# WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI, FISCAL YEAR 1985

Compiled by Wanietia M. Kratzer and Katherine L. Jenkins

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U.S. GEOLOGICAL SURVEY

Open-File Report 85-188


Rolla, Missouri

1985

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

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## Message from the District Chief

Since the establishment of the Water Resources Division district office at Rolla, Missouri, in 1921, hydrologic data have been collected and many interpretive studies completed in cooperation with State, local, and other Federal agencies. I am gratified by these past accomplishments and proud to be a part of the current activities of the Missouri program.

During recent years major changes have been made in the way hydrologic data are collected and processed by the Missouri District. These changes resulted from the addition of a large minicomputer system during 1983 and the installation of data-collection platforms that use a satellite-relay system at many streamflow-gaging sites. With this new mode of operation, much of the data will be processed, stored, and available for use on a near real-time basis. Changes in hydrologic data collection and analysis procedures are expected to continue.

The number of interpretive reports produced by the District during the past year increased approximately 25 percent. With the continued balance between interpretive work and hydrologic surveillance, the increase in the number of reports is expected to continue. One of our goals is to maintain and enhance the District's record of timely report products.

The future programs of the District will emphasize the major water problems in areas of hazardous waste, mining, water quality, and general water conditions. The District will continue to provide information to help solve the many water problems confronting Missouri, and I look forward to continued cooperation with State, local, and other Federal agencies in solving these problems.

Daniel P. Bauer
District Chief
U.S. Geological Survey
Water Resources Division
Rolla, Missouri 65401

## Water Resources Division

### Basic Mission and Program

The mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States.

This is accomplished, in large part, through cooperation with other Federal and non-Federal agencies, by:

- Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- Conducting analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water.

- Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems sufficiently well to quantitatively predict their response to stress, either natural or manmade.

- Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

- Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground waters.

- Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the Department of State.

## CONVERSION FACTORS

For readers who prefer to use metric units, conversion factors for terms used in this report are listed below:

| Multiply | By | To obtain |
|---|---|---|
| inch | 25.40 | millimeter |
| mile | 1.609 | kilometer |
| square mile | 2.590 | square kilometer |
| acre | 0.4047 | hectare |
| cubic foot per second | 0.02832 | cubic meter per second |
| gallon per minute | 0.06308 | liter per second |

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# WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN MISSOURI FISCAL YEAR 1985

By

Wanietia M. Kratzer and Katherine L. Jenkins

## ABSTRACT

Water-resources activities of the U.S. Geological Survey in Missouri consist of collecting hydrologic data and making interpretive studies. Hydrologic studies in Missouri are made through three basic types of projects: (1) hydrologic data-collection programs, (2) local or areal hydrologic investigations, and (3) statewide or regional studies. These projects are funded through joint-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds. These 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 hydrologic data-collection programs and local or areal hydrologic investigations in Missouri for fiscal year 1985 and provides a list of selected water-resources references for Missouri.

## INTRODUCTION

The U.S. Geological Survey was established by an act of Congress on March 3, 1879, to provide a permanent Federal agency to conduct the systematic and scientific classification of the public lands, and examination of the geologic structure, mineral resources, and products of national domain. An integral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

Since 1879, the research and fact-finding role of the U.S. Geological Survey has grown and been modified to meet the changing needs of the Nation it serves. As part of that evolution, the U.S. Geological Survey has become the Federal Government's largest earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists.

## MISSOURI DISTRICT

A District office of the U.S. Geological Survey was established in Rolla, Missouri, during 1921, when a cooperative program was begun with the Missouri Bureau of Geology and Mines (now the Missouri Department of Natural Resources, Division of Geology and Land Survey). The Missouri District, with field headquarters in Rolla, Independence, and Maryland Heights, and a project office in Independence (fig. 1), investigates the occurrence, quantity, quality, distribution, and movement of surface and ground waters in Missouri.

Hydrologic data-collection programs and interpretive studies in Missouri are conducted by two operating sections and three support units (fig. 2). The two operating sections are responsible for the implementation and execution of District projects assigned to project chiefs.

### Operating Sections

The Hydrologic Surveillance and Analysis Section designs, constructs, operates, and maintains all hydrologic-data networks in the State. The Section manages the collection and analysis of the hydrologic data for the State network, reviews and processes data for publication, prepares water-resources data for the annual water-data report, and provides quality control of results for field and office methods.

The Hydrologic Studies Section plans, executes, and reports on water-resources projects, including multidiscipline appraisal studies and conducts hydrologic and hydraulic investigations. These investigations include ground-water hydraulics and mathematical modeling of aquifer systems; environmental problems; hydraulics affected by manmade structures, as well as magnitude and frequency of floods and droughts; urban hydrology; analysis of the impact and assessment of hazardous waste and historical and ongoing mineral mining on the hydrologic system; and traveltime and dispersion studies.

### Support Units

The Reports Section maintains progress records of technical and hydrologic-data reports; reviews project annotated outlines; and edits, types, assembles, verifies, and prepares manuscripts and illustrations for publication. The Section advises and updates District personnel on current report-writing procedures.

The Computer Services Section manages and maintains the District's computer system, and coordinates processing, storage, and retrieval of data for the District and National computer files. The Section helps design, implement, and maintain the computer program software necessary for District operation.

The Administrative Services Section provides administrative support for the District, including programming, budgeting, accounting, management of personnel, property inventory, travel records, vehicle management, and related services.

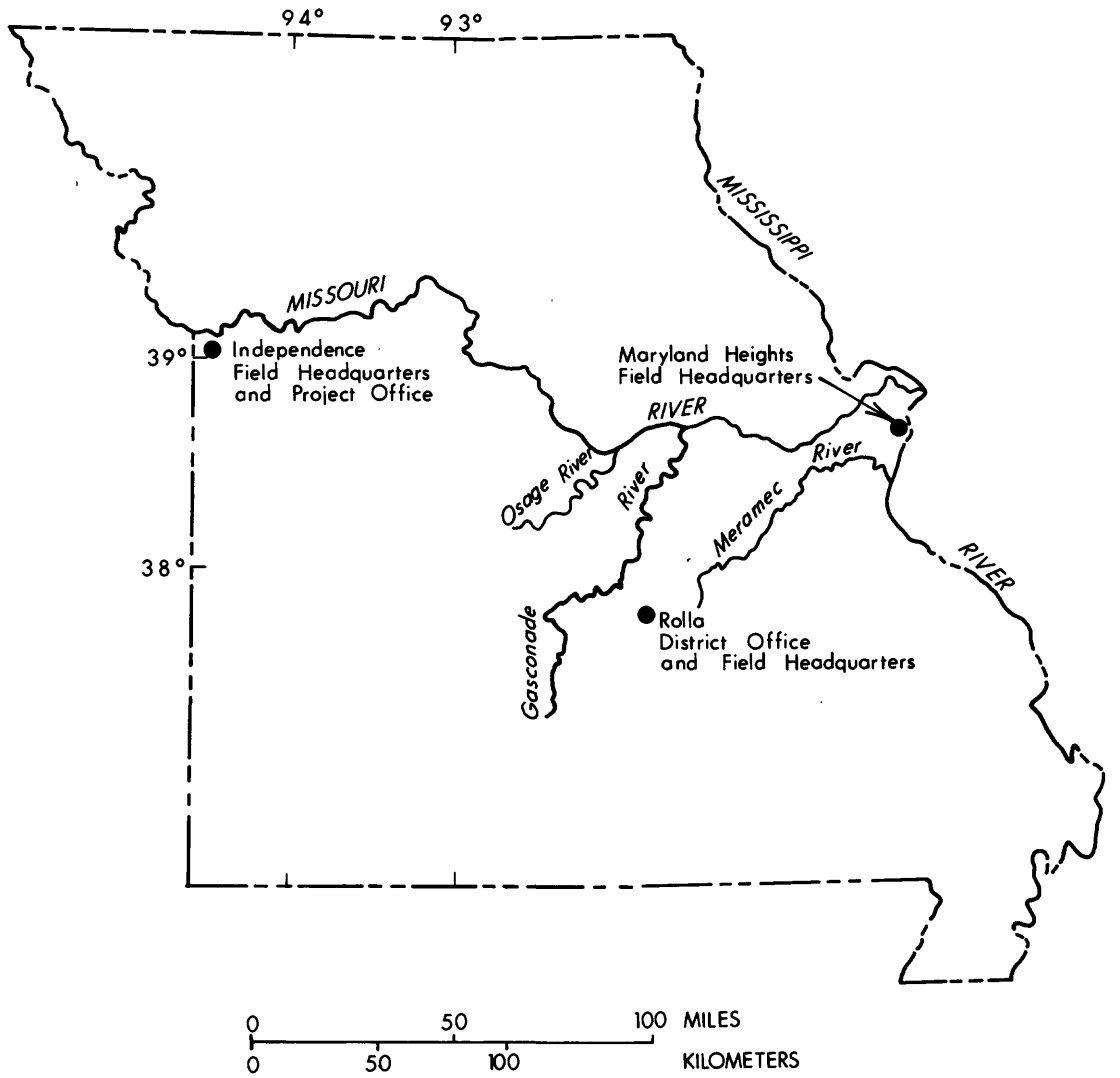
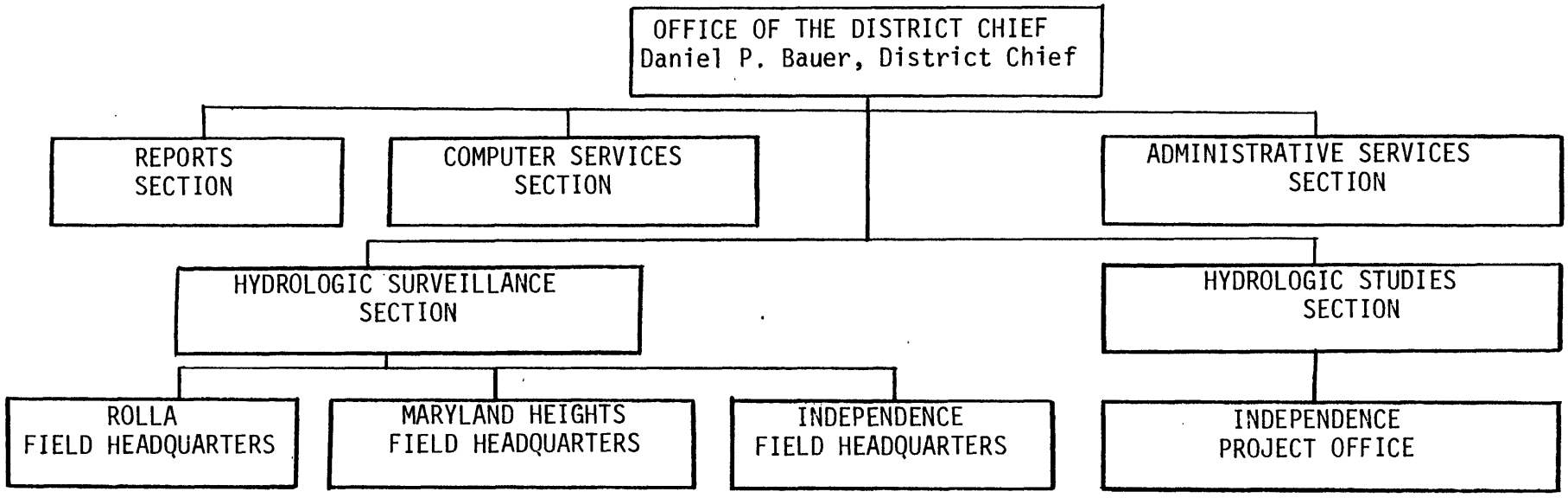



Figure 1.--Location of offices of the U.S. Geological Survey in Missouri.

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Room 223, Federal Building
301 West Lexington
Independence, Mo. 64050

Independence Project Office
D. W. Blevins, Hydrologist
(816) 254-5824
Room 219, Federal Building
301 West Lexington
Independence, Mo. 64050

Figure 2.--Missouri District organization and office addresses and telephone numbers.

## COOPERATION AND PROGRAM FUNDING

The Missouri District and agencies of the State of Missouri have had cooperative agreements for the systematic collection of streamflow records since 1921; about 80 percent of the hydrologic data collected by the U.S. Geological Survey in Missouri is in cooperation with local, State, or other Federal agencies.

Collection of surface-water data was begun at a few selected sites during 1903; collection of ground-water data in cooperation with the Missouri Division of Geology and Land Survey was begun during 1963; and water-quality data collection was begun during 1962 in cooperation with the Missouri Water Pollution Control Board (now a part of the Missouri Division of Environmental Quality). Surface-water data primarily are collected cooperatively with other Federal agencies, whereas the ground-water and water-quality data primarily are collected in cooperation with the Missouri Department of Natural Resources. These types of data are needed for the continuing determination and evaluation of the quantity, quality, and use of Missouri's water resource.

Moneys for program operation of the U.S. Geological Survey in Missouri come from joint-funding agreements with local and State agencies, transfer of funds from other Federal agencies, and direct Federal funds. Distribution of funding for program operation during fiscal year 1985 is shown in figure 3.

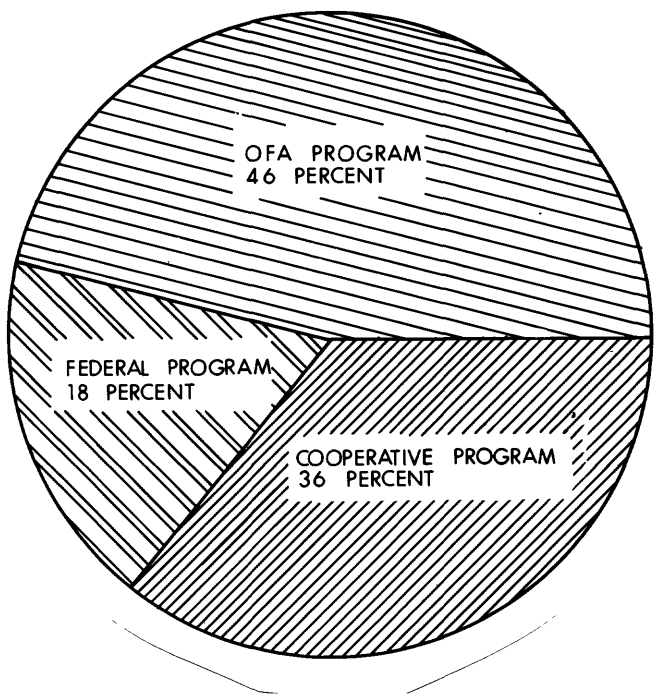


Figure 3.--Distribution of funding for water-resources programs of the U.S. Geological Survey in Missouri, fiscal year 1985.

Agencies cooperating with the U.S. Geological Survey in Missouri during the 1985 fiscal year are:

Local and State agencies

City Utilities of Springfield
Department of Natural Resources
  Division of Environmental Quality
    Land Reclamation Commission
    Water Pollution Control Program
  Division of Geology and Land Survey
Highway and Transportation Commission
Little River Drainage District

Federal agencies

Environmental Protection Agency
Federal Energy Regulatory Commission
  Union Electric Co. of Missouri
National Park Service
National Weather Service
U.S. Department of the Army, Corps of Engineers
  Kansas City District
  Little Rock District
  Rock Island District
  St. Louis District
  Tulsa District

## WATER CONDITIONS

Sufficient water for present demands is available in many parts of Missouri during most years. Annual precipitation ranges from 34 inches in the northwest to 46 inches in the southeast, according to the National Weather Service[1] (fig. 4), but in some years precipitation has been as much as 15 inches less than normal.

Surface-water supplies generally are adequate for most uses (fig. 5). However, variation in availability occurs within and among the State's three major physiographic regions: The Plains, the Ozarks, and the Southeast Lowlands (fig. 6). Some small communities in the Plains region, for example, can have water-supply shortages during droughts because many of the public-water supply districts located there serve large areas and cannot meet increased demands during extreme low-flow periods. Ozarks region streams generally have the best-sustained low flows because of the contribution of ground water from extensive solution cavities in the carbonate aquifers; however, in certain stream reaches water can be lost to these aquifers. Low flows in the Southeast Lowlands region are second in magnitude to those of the Ozarks region and are sustained by ground-water contributions from the extensive alluvial deposits.

More communities depend on ground water rather than on surface water, but larger quantities of surface water are withdrawn because most of Missouri's large cities have surface-water supplies. The southeastern two-thirds of the State is underlain by freshwater aquifers (Harris, 1979[2]), and large quantities of saline ground water are available in the northwestern one-third of Missouri (fig. 7); however, without desalination, this water is unsuitable for most purposes. In local areas of the State, the increased use of ground water for farmland irrigation has lowered ground-water levels.

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[1]National Weather Service, 1976, Climatological Data, Missouri: Asheville, N.C., Department of Commerce, National Oceanic and Atmoshperic Administration.

[2]Harris, Barbara, 1979, Water in Missouri: Missouri Department of Natural Resources, Division of Geology and Land Survey Educational Series 5, 28 p.

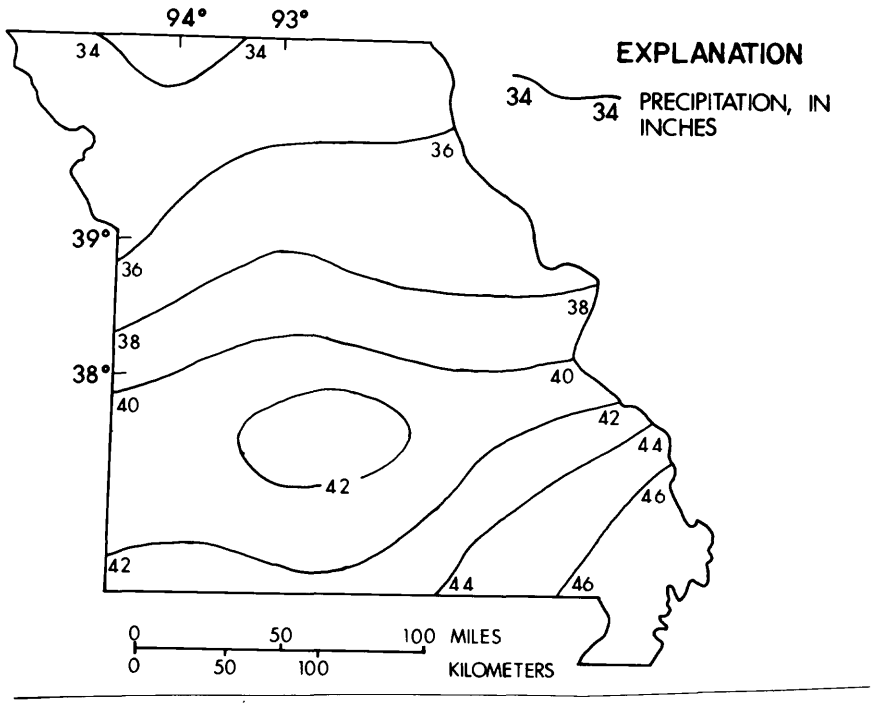



Figure 4.--Mean annual precipitation, in inches.

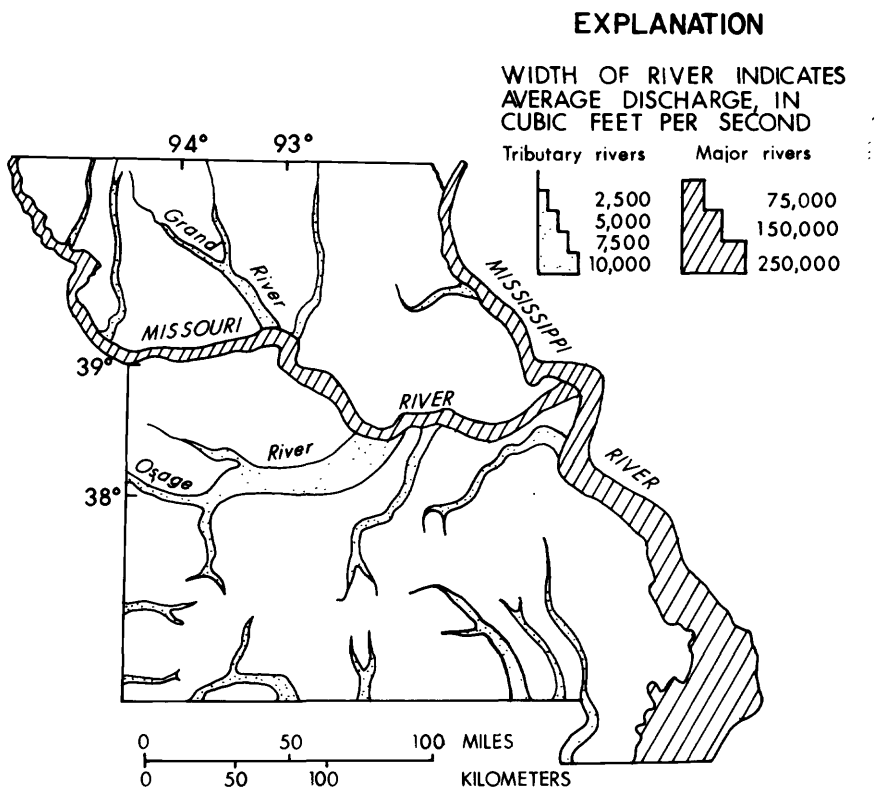



Figure 5.--Average discharge of the principal rivers.

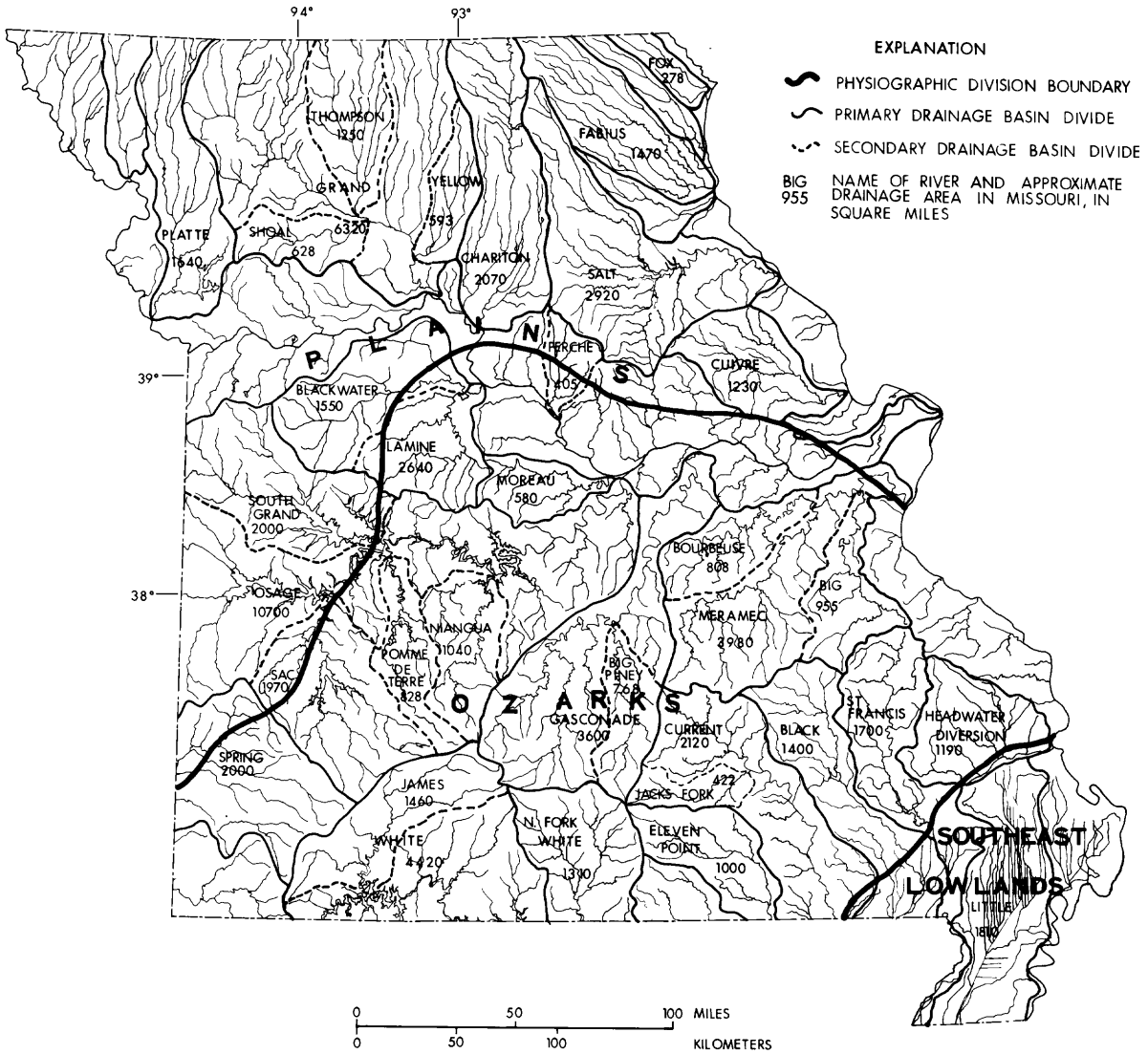



Figure 6.--Physiographic divisions and major drainage basins.

Generally, water-quality in Missouri streams and aquifers is adequate for most uses (Missouri Division of Geology and Land Survey, 1967[3]). However, there are some pollution issues in Missouri, including: erosion into streams, which is among the greatest in the United States; carbonate rocks in the Ozarks region that contain solution-enlarged cracks and crevices allowing pollutants, such as sewage-lagoon effluent, to directly enter the shallow ground-water system; dioxin is present in the soil and streambed sediment in several stream basins and may be moving through the hydrologic system in association with sediment particles; and many obsolete sewage-treatment plants in the State are adversely affecting the water quality of streams.

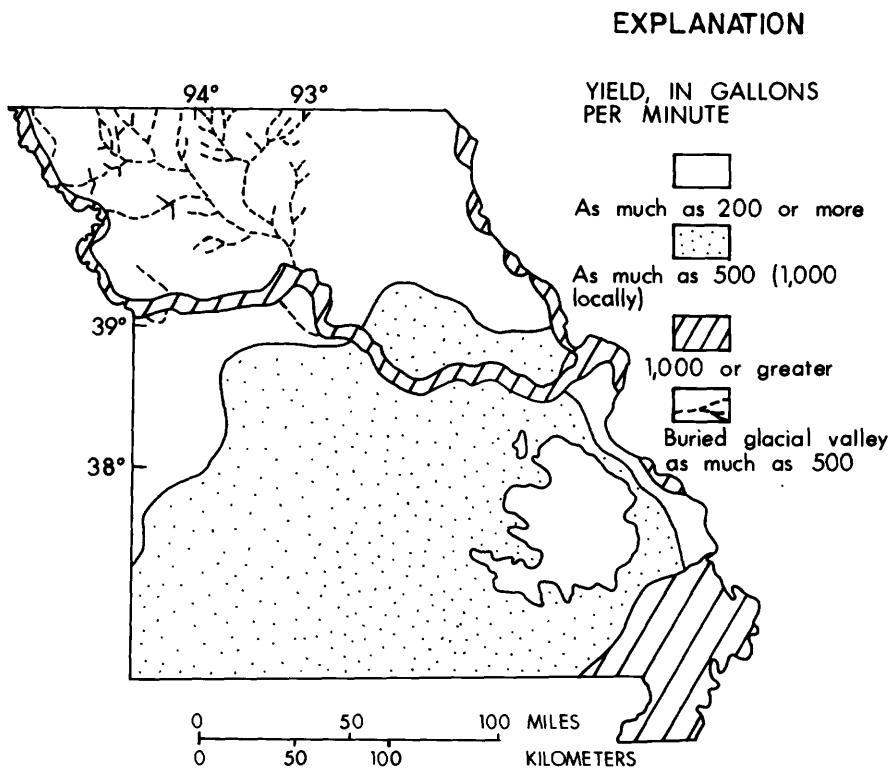



Figure 7.--Availability of ground water.

[3]Missouri Division of Geology and Land Survey, 1967, Water resources, in Mineral and Water Resources of Missouri: Rolla, Mo., Missouri Division of Geology and Land Survey, ser. 2, v. 43, p. 254.

## NATIONAL HYDROLOGIC-DATA NETWORKS AND PROGRAMS

A significant quantity of stream water-quality data is collected in Missouri as part of the National Stream Quality Accounting Network (NASQAN). NASQAN is a data-collecting effort for obtaining consistent regional and nationwide overviews of the quality of streams. The primary objectives of the network are to (1) account for the quantity and quality of water moving within and from major river basins in the United States, (2) depict areal variability, (3) detect changes in stream quality, and (4) provide data for future assessments of changes in stream quality. Fourteen NASQAN stations are included in the Missouri District's hydrologic data-collection program.

The National Water-Use Information Program of the U.S. Geological Survey is a Federal-State cooperative program designed to collect, store, and disseminate water-use information both nationally and locally. The program was begun during 1978 to meet the need for a single source of uniform information on water use. The water-use information from this program complements long-term U.S. Geological Survey data on the availability and quality of the Nation's water resources. Information on the National Water-Use Information Program and its data bases can be obtained from:

Program Manager
National Water-Use Information Program
U.S. Geological Survey
440 National Center
Reston, Virginia 22092

As part of the U.S. Geological Survey's program of releasing water data to the public, a large-scale computerized system is used for the storage and retrieval of water data. At the present time (1985), all U.S. Geological Survey water-resources data are maintained on the National Water Data Storage and Retrieval System (WATSTORE) at the central computer facilities in Reston, Virginia. In addition, much of these data are stored and available on local District minicomputer files using the recently implemented Distributed Information System (DIS). The new DIS configuration provides easier dissemination and access of data that pertain to a given State. These data are available for water planning and management in machine-readable form, computer-printed tables or graphs, statistical analyses, and digital plots. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained from the District office in Rolla.

A Master Water Data Index (MWDI) was developed by the Office of Water Data Coordination (OWDC) and is managed by the National Water Data Exchange (NAWDEX) Program Office to assist users of water data to identify, locate, and acquire needed data. The U.S. Geological Survey through OWDC coordinates the water-data-acquisition activities of the U.S. Geological Survey and other Federal agencies. This information is made available to all users of water data by means of a national network of assistance centers. In Missouri, NAWDEX services can be obtained from the District Chief, Rolla, Missouri.

The U.S. Geological Survey outlines flood-prone areas on topographic maps as part of a nationwide Federal program for managing flood losses. Studies of the frequency and extent of flooding in Missouri have resulted in delineation of the 100-year flood boundary on selected topographic quadrangle maps (fig. 8). These maps are available on request from the Missouri District office in Rolla.

## HYDROLOGIC DATA-COLLECTION PROGRAMS

Hydrologic data-collection stations are maintained by the U.S. Geological Survey throughout Missouri to obtain records of stream discharge or stage, lake and reservoir storage, spring discharge, ground-water levels, and the quality of surface and ground water. Major drainage basins in Missouri and approximate areas in square miles are shown in figure 6. Daily discharge and surface-water quality data-collection stations in operation during fiscal year 1985 are listed in downstream order in table 1, which also includes the cooperating agency and type of data collected. In addition to these stations the Missouri District, in cooperation with the Missouri Division of Geology and Land Survey, collects data from 137 low-flow partial-record sites, 24 peak-flow partial-record sites, and approximately 200 observation wells throughout the State.

Hydrologic data collected in Missouri as part of the data-collection network are published annually in a report entitled "Water Resources Data for Missouri, Water Year 19__" (the water year is from October 1 of each year to September 30 of the following year). These data represent the majority of water resources data collected in Missouri in cooperation with local, State, and other Federal agencies. Reports for each year are released the following year. Water-data reports are available for inspection at the U.S. Geological Survey in Rolla, Missouri; or may be purchased from the U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia 22161.

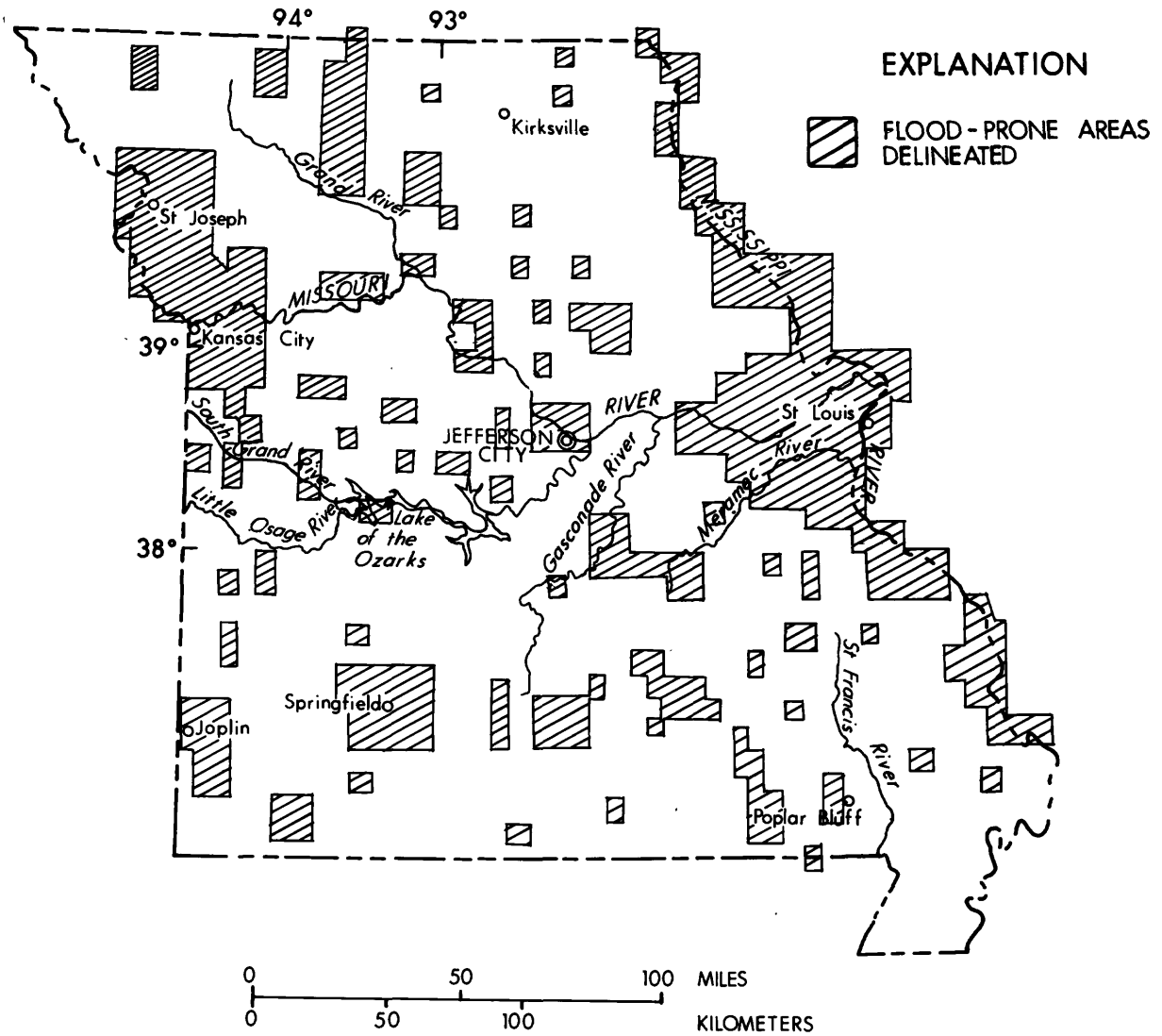



Figure 8.--Flood-prone area maps completed in Missouri.

Table 1.--Daily discharge and surface-water quality stations in operation during fiscal year 1985

| Station number | Station name | Cooperation[1] | Type of[1] data |
|---|---|---|---|
| 05490600 | Des Moines River at St. Francisville | USGS, CE RI | CST |
| 05495000 | Fox River at Wayland | CE RI | D |
| 05496000 | Wyaconda River above Canton | CE RI | D |
| 05497000 | North Fabius River at Monticello | CE RI | D |
| 05498000 | Middle Fabius River near Monticello | CE RI | DST |
| 05500000 | South Fabius River near Taylor | CE RI, DEQ | DC |
| 05501000 | North River at Palmyra | CE RI | D |
| 05501600 | Mississippi River at Hannibal | DEQ | C |
| 05502000 | Bear Creek at Hannibal | CE RI | D |
| 05502300 | Salt River at Hagers Grove | CE STL | D |
| 05503500 | North Fork Salt River near Hunnewell | CE STL | DST |
| 05503800 | Crooked Creek near Paris | CE STL | D |
| 05505000 | South Fork Salt River at Santa Fe | CE STL | D |
| 05506500 | Middle Fork Salt River at Paris | CE STL | DST |
| 05506800 | Elk Fork Salt River near Madison | CE STL | D |
| 05507600 | Lick Creek at Perry | CE STL | D |
| 05507800 | Salt River near Center | CE STL | D |
| 05508000 | Salt River near New London | CE STL, USGS, DEQ | DCST |
| 05508800 | Spencer Creek near Frankford | CE STL | D |
| 05509300 | Salt River near Ashburn | CE STL | LS |
| 05514500 | Cuivre River near Troy | CE STL, DEQ | C |
| 05587500 | Mississippi River at Alton, Ill. | CE STL, USGS | ST |
| 05587550 | Mississippi River below Alton, Ill. | USGS | C |
| 06813000 | Tarkio River at Fairfax | DGLS | D |
| 06817700 | Nodaway River near Graham | CE KC | D |
| 06817800 | Nodaway River near Oregon | DEQ | C |
| 06818000 | Missouri River at St. Joseph | CE KC, USGS, DEQ | DC |
| 06819500 | One Hundred and Two River at Maryville | DGLS | D |
| 06820500 | Platte River near Agency | CE KC | D |
| 06821140 | Smithville Reservoir near Smithville | CE KC | R |
| 06821150 | Little Platte River at Smithville | CE KC | D |
| 06821190 | Platte River at Sharps Station | CE KC, USGS | DC |
| 06893000 | Missouri River at Kansas City | CE KC | D |
| 06893500 | Blue River near Kansas City | CE KC | D |

[1]See footnote at end of table for explanation of abbreviations.

Table 1.--Daily discharge and surface-water quality station in operation during fiscal year 1985--Continued

| Station number | Station name | Cooperation[1] | Type of data[1] |
|---|---|---|---|
| 06893590 | Blue River at 12th Street in Kansas City | CE KC | St |
| 06893793 | Little Blue River below Longview damsite in Kansas City | CE KC | D |
| 06893890 | East Fork Little Blue River near Blue Springs | CE KC | D |
| 06894000 | Little Blue River near Lake City | CE KC | D |
| 06895500 | Missouri River at Waverly | CE KC | D |
| 06897500 | Grand River near Gallatin | CE KC | D |
| 06899500 | Thompson River at Trenton | CE KC | D |
| 06899620 | Thompson River near Chillicothe | DEQ | C |
| 06900000 | Medicine Creek near Galt | DGLS | D |
| 06902000 | Grand River near Sumner | CE KC, USGS, DEQ | DC |
| 06904050 | Chariton River at Livonia | CE KC | D |
| 06904500 | Chariton River at Novinger | CE KC | D |
| 06905500 | Chariton River near Prairie Hill | CE KC, USGS | DC |
| 06906000 | Mussel Fork near Musselfork | CE KC | D |
| 06906190 | Long Branch Lake near Macon | CE KC | R |
| 06906200 | East Fork Little Chariton River near Macon | CE KC | D |
| 06906300 | East Fork Little Chariton River near Huntsville | CE KC, DEQ | DC |
| 06906470 | Middle Fork Chariton River below Salisbury | DEQ | C |
| 06906500 | Missouri River at Glasgow | CE KC | St |
| 06908000 | Blackwater River at Blue Lick | CE KC | D |
| 06908800 | Lamine River near Blackwater | USGS, DEQ | C |
| 06909000 | Missouri River at Boonville | CE KC | D |
| 06910414 | Cedar Creek near Ashland | DEQ | C |
| 06910450 | Missouri River at Jefferson City | UE | St |
| 06918070 | Osage River above Schell City | CE KC, USGS | DC |
| 06918440 | Sac River near Dadeville | CE KC, DEQ | DC |
| 06918460 | Turnback Creek above Greenfield | CE KC | D |
| 06918600 | Little Sac River near Walnut Grove | DEQ | C |
| 06918740 | Little Sac River near Morrisville | CE KC | D |
| 06918990 | Stockton Lake near Stockton | CE KC | R |
| 06919000 | Sac River near Stockton | CE KC | D |
| 06919020 | Sac River below Stockton | CE KC | D |
| 06919500 | Cedar Creek near Pleasant View | CE KC | D |
| 06919900 | Sac River near Caplinger Mills | CE KC | D |
| 06920500 | Osage River at Osceola | CE KC | St |

Table 1.--Daily discharge and surface-water quality station in operation during fiscal year 1985--Continued

| Station number | Station name | Cooperation[1] | Type of data[1] |
|---|---|---|---|
| 06921070 | Pomme de Terre River near Polk | CE KC, DGLS, DEQ | DC |
| 06921200 | Lindley Creek near Polk | CE KC | D |
| 06921325 | Pomme de Terre Lake near Hermitage | CE KC | R |
| 06921350 | Pomme de Terre River near Hermitage | CE KC | D |
| 06921590 | South Grand River at Archie | CE KC | D |
| 06921600 | South Grand River at Urich | DEQ | C |
| 06921770 | South Grand River near Clinton | CE KC | D |
| 06922180 | Tebo Creek near Calhoun | CE KC | C |
| 06922440 | Harry S. Truman Lake at Warsaw | CE KC | R |
| 06922450 | Osage River below Harry S. Truman Dam | CE KC | D |
| 06922500 | Osage River at Warsaw | CE KC | St |
| 06922550 | Osage River below Warsaw | CE KC | St |
| 06922560 | Lake of the Ozarks at Oar House Marina | CE KC | St |
| 06922650 | Lake of the Ozarks at Turkey Creek Cove | CE KC | St |
| 06922790 | Lake of the Ozarks above Buffalo Creek | CE KC | St |
| 06922900 | Lake of the Ozarks at Rainy Creek | CE KC | St |
| 06923500 | Bennett Spring at Bennett Springs | DGLS | D |
| 06923700 | Niangua River at Bennett Springs | DEQ | C |
| 06925500 | Lake of the Ozarks near Bagnell | DGLS | R |
| 06926000 | Osage River near Bagnell | UE | D |
| 06926500 | Osage River near St. Thomas | UE | D |
| 06926510 | Osage River below St. Thomas | USGS | C |
| 06928600 | Gasconade River near Hooker | DEQ | C |
| 06930450 | Big Piney River at Devils Elbow | DEQ | C |
| 06930800 | Gasconade River above Jerome | USGS | C |
| 06932000 | Little Piney Creek at Newburg | DGLS | D |
| 06933500 | Gasconade River at Jerome | DGLS | D |
| 06934500 | Missouri River at Hermann | CE KC, USGS, DEQ | DCT |
| 06935965 | Missouri River at St. Charles | CE STL | St |
| 07010000 | Mississippi River at St. Louis | CE STL, USGS | DST |
| 07010500 | Maramec Spring near St. James | DGLS | D |
| 07013000 | Meramec River near Steelville | CE STL | D |
| 07013050 | Crooked Creek near Dillard | DEQ | C |
| 07014500 | Meramec River near Sullivan | CE STL, DEQ | DC |
| 07015720 | Bourbeuse River near Highgate | CE STL | D |
| 07016400 | Bourbeuse River above Union | DEQ | C |
| 07016500 | Bourbeuse River at Union | CE STL | D |
| 07017020 | Meramec River at Pacific | CE STL | St |
| 07017200 | Big River at Irondale | CE STL | D |
| 07018100 | Big River near Richwoods | CE STL, DEQ | DC |

Table 1.--Daily discharge and surface-water quality station in operation during fiscal year 1985--Continued

| Station number | Station name | Cooperation[1] | Type of[1] data |
|---|---|---|---|
| 07018500 | Big River near Byrnesville | CE STL | D |
| 07019000 | Meramec River near Eureka | CE STL, USGS | DCST |
| 07019280 | Meramec River at Paulina Hills | DEQ | C |
| 07019300 | Meramec River at Arnold | CE STL | St |
| 07020500 | Mississippi River at Chester, Ill. | CE STL | DST |
| 07021000 | Castor River at Zalma | DGLS | D |
| 07022000 | Mississippi River at Thebes, Ill. | CE STL, USGS | DCST |
| 07034000 | St. Francis River near Roselle | CE STL | D |
| 07035000 | Little St. Francis River near Fredericktown | CE STL | D |
| 07036100 | St. Francis River near Saco | CE STL, DEQ | DC |
| 07036940 | Big Creek at Chloride | DEQ | C |
| 07037000 | Big Creek at Des Arc | CE STL | D |
| 07037500 | St. Francis River near Patterson | CE STL | D |
| 07039000 | Wappapello Lake at Wappapello | CE STL | R |
| 07039500 | St. Francis River at Wappapello | CE STL | D |
| 07042500 | Little River ditch 251 near Lilbourn | DGLS | D |
| 07043500 | Little River ditch 1 near Morehouse | DGLS | D |
| 07046001 | Little River ditches near Kennett | DEQ | C |
| 07050580 | James River near Strafford | CE LR | D |
| 07050700 | James River near Springfield | CU | D |
| 07051600 | James River near Wilsons Creek | DEQ | C |
| 07052250 | James River near Boaz | DEQ | C |
| 07052500 | James River at Galena | CE LR | D |
| 07053400 | Table Rock Lake near Branson | CE LR | R |
| 07053500 | White River near Branson | RECORDS FURNISHED BY CORPS OF ENGINEERS | D |
| 07053600 | Lake Taneycomo at School of the Ozarks | CE LR | StCT |
| 07053700 | Lake Taneycomo at Branson | DEQ | C |
| 07053820 | Lake Taneycomo at Powersite Dam | CE LR | St |
| 07057500 | North Fork River near Tecumseh | CE LR, DEQ | DC |
| 07058000 | Bryant Creek near Tecumseh | CE LR | D |
| 07061300 | East Fork Black River at Lesterville | DGLS | D |
| 07061500 | Black River near Annapolis | CE LR | D |
| 07062000 | Clearwater Lake near Piedmont | CE LR | R |
| 07062500 | Black River at Leeper | CE LR | D |
| 07063000 | Black River at Poplar Bluff | CE LR, DEQ | DC |

Table 1.--Daily discharge and surface-water quality station in operation during fiscal year 1985--Continued

| Station number | Station name | Cooperation[1] | Type of[1] data |
|---|---|---|---|
| 07064400 | Montauk Springs at Montauk | NPS | C |
| 07064440 | Current River below Montauk State Park | NPS | C |
| 07064530 | Welch Spring near Akers | NPS | C |
| 07064555 | Pulltite Spring near Round Spring | NPS | C |
| 07065000 | Round Spring at Round Spring | NPS | C |
| 07065500 | Alley Spring at Alley | NPS | C |
| 07066000 | Jacks Fork at Eminence | DGLS | D |
| 07066110 | Jacks Fork above Two Rivers | NPS | C |
| 07066510 | Current River above Powder Mill | NPS | C |
| 07066550 | Blue Spring near Eminence | NPS | C |
| 07067000 | Current River at Van Buren | DGLS, CE LR | D |
| 07067500 | Big Spring near Van Buren | DGLS, NPS | DC |
| 07067800 | Current River below Hawes Campground | NPS | C |
| 07068000 | Current River at Doniphan | CE LR, DEQ | DC |
| 07068510 | Little Black River below Fairdealing | SCS | DCST |
| 07068600 | Little Black River at Success, Ark. | SCS | DCST |
| 07071000 | Greer Spring at Greer | RECORDS FURNISHED BY U.S. FOREST SERVICE | D |
| 07071500 | Eleven Point River near Bardley | DGLS, CE LR, DEQ | DC |
| 07186000 | Spring River near Waco | CE TU | D |
| 07186400 | Center Creek near Carterville | DGLS, DEQ | DC |
| 07186480 | Center Creek near Smithfield | DEQ | C |
| 07187000 | Shoal Creek above Joplin | CE TU | D |
| 07189000 | Elk River at Tiff City | DEQ | C |

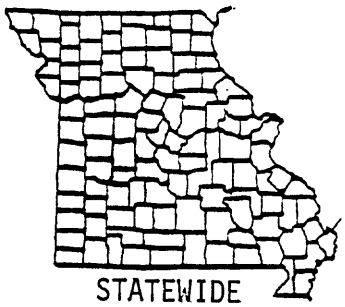
[1]Explanation of abbreviations:

Cooperation

| | |
|---|---|
| CE KC | Corps of Engineers, Kansas City |
| CE LR | Corps of Engineers, Little Rock |
| CE RI | Corps of Engineers, Rock Island |
| CE STL | Corps of Engineers, St. Louis |
| CE TU | Corps of Engineers, Tulsa |
| CU | City Utilities, Springfield |
| DEQ | Division of Environmental Quality |
| DGLS | Division of Geology and Land Survey |
| UE | Union Electric |
| NPS | National Park Service |
| SCS | Soil Conservation Service |
| USGS | U.S. Geological Survey |

Type of data

C - Chemical
D - Discharge--continuous record of stage and discharge
R - Reservoir content
S - Sediment
St - Stage only
T - Temperature




PROJECT TITLE: Collection of Surface-Water Data MO 00-001

COOPERATORS: City Utilities of Springfield
Division of Geology and Land Survey
Highway and Transportation Commission
Little River Drainage District
Missouri Park Board
Union Electric Co. of Missouri
U.S. Army, Corps of Engineers

LOCATION: Statewide PROJECT CHIEF: L. A. Waite

## NEED FOR STUDY

Surface-water information is needed for surveillance, planning, design, hazard warning, and operation and management in water-related fields, such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, and waste disposal.

## OBJECTIVES

(1) To collect surface-water data sufficient to satisfy needs for current-purpose uses, such as assessment of water resources; operation of reservoirs or industries; forecasting; disposal of wastes, both common and nuclear; pollution controls; discharge data to accompany water-quality measurements; compact and legal requirements; and research of special studies. (2) To collect data necessary for analytical studies and define the trends and statistical properties of streamflow.

## APPROACH

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

Project MO-001--Continued

## ACTIVITIES DURING FISCAL YEAR 1984

The 1983 annual water-data report was completed and submitted to the U.S. Government Printing Office during September 1984; printed copies were distributed to cooperators and other Federal agencies.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Data collection will continue, and a date of May 1985 for completion of the 1984 water-data report is anticipated.

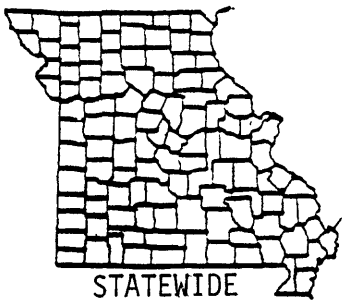
## REPORTS

Becker, L. D., and Alexander, T. W., 1983, Floods in Kansas City, Missouri and vicinity, August 12-13, 1982: U.S. Geological Survey Water-Resources Investigations Report 83-4141, 35 p.

Waite, L. A., 1985, Hatten, D. O., and Cross, P. W., 1984, Water resources data for Missouri, water year 1983: U.S. Geological Survey Water-Data Report MO 83-1, 298 p. (published annually).

Waite, L. A., and Alexander, T. W., 1984, Floods of December 1982 in southeastern Missouri: U.S. Geological Survey Hydrologic Investigations Atlas HA-689 (in press).

Waite, L. A.,1984, Data and funding of the stream-gaging program in Missouri: U.S. Geological Survey Open-File Report 84-868, 32 p.




PROJECT TITLE: Collection of Ground-Water Data MO 00-002

COOPERATOR: Department of Natural Resources
Division of Geology and Land Survey

LOCATION: Statewide PROJECT CHIEF: L. F. Emmett

## PROBLEM

Ground-water information is 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 resources.

## OBJECTIVES

(1) To collect sufficient data to provide a 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 soon enough to allow proper planning and management. (2) To provide a data base against which the short-term records acquired in areal studies can be analyzed.

## APPROACH

Evaluation of regional geology allows broad, general definition of aquifer systems and their boundary conditions. Within this framework, data will be collected to help define stresses on the system and the hydrologic properties of the aquifers. The data-collection network will be refined as records accumulate and detailed areal studies of the groundwater system more closely define the aquifers, their properties, and the stresses to which they are subjected.

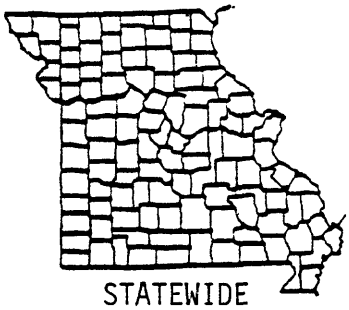
Project MO 00-002--Continued

## ACTIVITIES DURING FISCAL YEAR 1984

Water-levels were measured in 211 wells during April 1984 at three areas where ground water is used for supplemental irrigation of crops. Seventy-seven water-level measurements were made in the Audrain County area, 93 measurements were made in the Barton, Vernon, and Bates Counties area, and 41 measurements were made in southeast Missouri.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Make water-level measurements in all network wells during October 1984 after the irrigation season is over, and make water-level measurements again during April before the beginning of the 1985 irrigation season.



STATEWIDE

PROJECT TITLE: Collection of Quality-Water Data MO 00-003

COOPERATORS: Department of Natural Resources
Division of Environmental Quality
National Park Service
U.S. Army, Corps of Engineers

LOCATION: Statewide PROJECT CHIEF: J. V. Davis

## PROBLEM

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

## APPROACH

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

## ACTIVITIES DURING FISCAL YEAR 1984

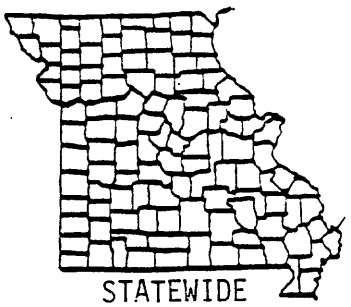
The Missouri quality-water network included 14 National Stream Quality Accounting Network (NASQAN) stations; 10 were sampled bimonthly, 4 were sampled quarterly, and 1 was also sampled daily for temperature and specific conductance. Missouri Division of Environmental Quality stations included 33 monthly sampling sites, 3 bimonthly sampling sites, and 3 sites where samples were collected 8 times. Samples were collected monthly at 1 site for the Corps of Engineers and biannually at 11 sites for the National Park Service. Minimonitors, which measure temperature and dissolved oxygen, were operated at three stations, one for the Corps of Engineers, and two for the Missouri Division of Environmental Quality.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

NASQAN samples will be collected at 10 sites bimonthly, 4 sites quarterly, and at 1 site daily for temperature and specific conductance. Stations operated in cooperation with 1985: the Missouri Division of Environmental Quality will include 33 monthly sampling sites, 3 bimonthly sampling sites, and 3 sampling sites where samples will be collected 8 times. Samples will be collected monthly at 1 site for the Corps of Engineers and biannually at 11 sites for the National Park Service. Three minimonitors that measure temperature and dissolved oxygen and two continuous-temperature recorders will be operated.

## REPORT

Waite, L. A., Hatten, D. O., and Cross, P. W., 1984, Water resources data for Missouri, water year 1983: U.S. Geological Survey Water-Data Report MO 83-1, 288 p. (published annually).




PROJECT TITLE: Sediment Stations MO 00-004

COOPERATOR: U.S. Army, Corps of Engineers

LOCATION: Statewide PROJECT CHIEF: W. R. Berkas

## PROBLEM

Water-resources planning and water-quality assessment require a nationwide base level of relatively standardized information. Sediment concentrations and discharges in Missouri's rivers and streams need to be defined and monitored.

## OBJECTIVES

Provide sediment data for use in broad State and Federal 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.

## ACTIVITIES DURING FISCAL YEAR 1984

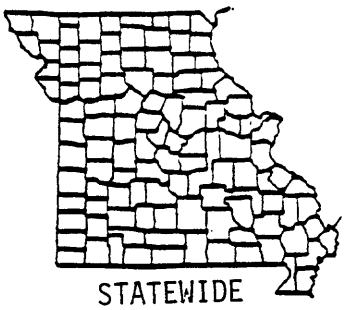
Continue the operation of 10 sediment-sampling stations and publish the records in "Water Resources Data for Missouri", published annually.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Continue collecting daily sediment data at 10 sediment-sampling stations.

## REPORT

Waite, L. A., Hatten, D. O., and Cross, P. W., 1984, Water resources data for Missouri, water year 1983: U.S. Geological Survey Water-Data Report MO 83-1, 288 p. (published annually).



STATEWIDE

PROJECT TITLE: A Water-Use Data-Collection and Reporting Program for Missouri MO 00-007

COOPERATOR: Department of Natural Resources
Division of Geology and Land Survey

LOCATION: Statewide PROJECT CHIEF: John Skelton

## PROBLEM

As population increases in an area and industry expands to meet the needs of that population, demand for and use of water will increase. This places a two-fold stress on the water supply. The increased demand may decrease availability, and increased use may degrade the quality. Therefore, any water-resource assessment must take water use into account.

## OBJECTIVES

To establish a program to systematically collect data to estimate the withdrawal and return of water for all types of water uses. The program will provide a broad data base from which many types of analyses can be made. In addition to obtaining a greater knowledge of the overall hydrologic effects of increased withdrawals from the water system, data obtained through the program will be added to the national water-use data base to assist in the national water- resources assessment.

## APPROACH

Water-use data will be collected by categories on a statewide basis. Existing data will be compiled from State files, stored in the U.S. Geological Survey Prime computer system and entered into the U.S. Geological Survey aggregated data base. Data-collection methods and sampling strategies will be devised to acquire additional data. A report will be planned to describe data-collection methods and sampling strategies. Statistical summaries will be included in the annual water-data reports.

Project MO-007--Continued

## ACTIVITIES DURING FISCAL YEAR 1984

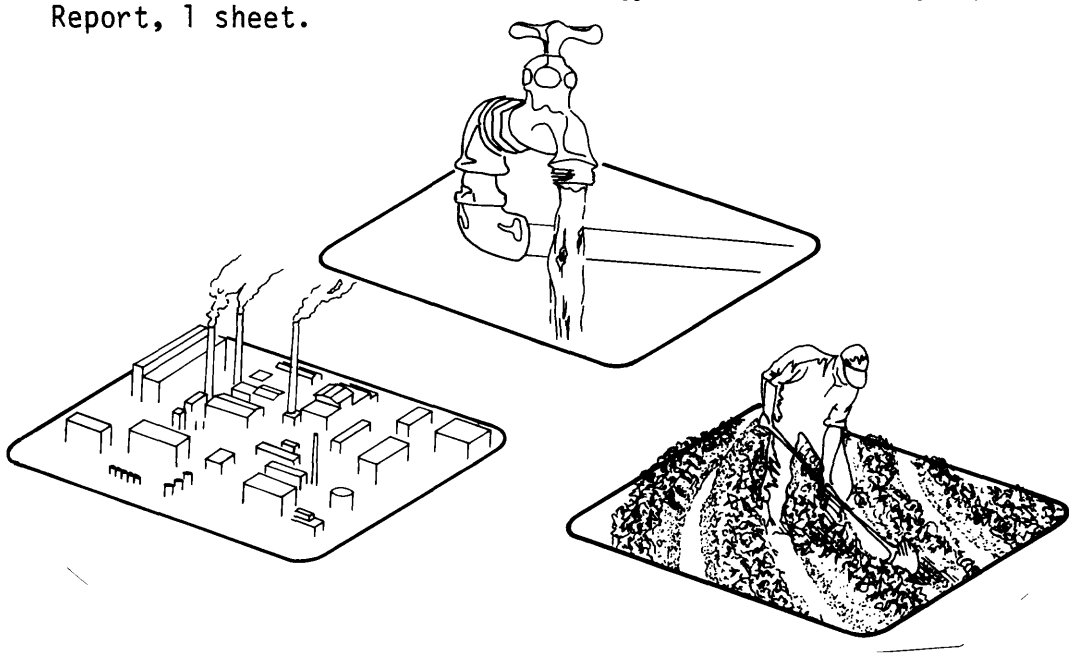
Personnel from the University of Missouri-Rolla and Columbia and from several agencies of the U.S. Department of Agriculture were consulted to evaluate remote-sensing techniques, aerial photography, and other data-collection methods to estimate irrigation water use in Missouri. It was determined that remote-sensing techniques are not cost effective with current technology. Beginning during 1984, accurate crop and irrigation data can be obtained from the U.S. Department of Agriculture from reports submitted by farmers. The U.S. Geological Survey water-use software package was integrated into the Prime computer system and some 1980-81 water-use data were entered. The Missouri Division of Geology and Land Survey distributed water-use data reporting forms through the U.S. Department of Agriculture and the University of Missouri Extension Service offices in each county in Missouri and compiled data from the completed forms.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Data for 1981-83 will be assembled and entered into the data base. The Missouri Division of Geology and Land Survey and the U.S. Geological Survey will continue to collect data for most water-use categories. An effort will be made to link computerized data bases to other State and Federal systems. Procedures will be developed for statistical analyses of data for all categories. An outline and work plan will be developed for a report describing data-collection and statistical-sampling techniques.

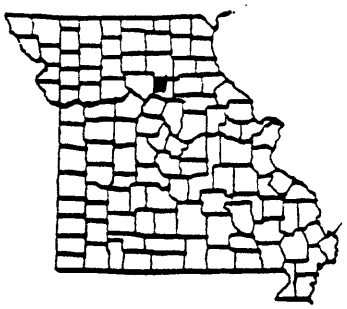
## REPORT

Marikos, Mark, and Skelton, John, 1982, Estimated water use in Missouri, 1980: Missouri Division of Geology and Land Survey Open-File Map Report, 1 sheet.



## AREAL HYDROLOGIC INVESTIGATIONS

Interpretive investigations in Missouri include local, county, and statewide studies. Some of the anticipated uses of the results of these investigations include: determining runoff characteristics, water quality, water temperatures, and sediment loads of Missouri streams; defining floodflows at ungaged rural areas of Missouri; appraisal of the water-resources to determine the availability and quality of water for irrigation; identifying and monitoring of surface- and ground-water affected by acid-mine drainage; and determining the effects of hazardous waste disposal on ground and surface waters in Missouri.



PROJECT TITLE: Hydrogeochemical Effects of Strip Mining Coal in the Prairie Hill Area, North-Central Missouri MO 80-045

COOPERATOR: Federal Program

LOCATION: North-central Missouri PROJECT CHIEF: D. C. Hall

### PROBLEM

Information about the chemical reactions that occur as water moves through spoil piles and natural rocks is insufficient to predict the effects of coal mining on the geochemistry of ground water. A prerequisite to determining the reactions and resulting water quality is an accurate description of the mineralogy of natural rocks and an understanding of the three-dimensional flow and water-quality system in natural rocks and spoil.

### OBJECTIVE

Develop the capability to predict water-quality changes resulting from strip mining of high-sulfur bituminous coal in a humid climate.

## APPROACH

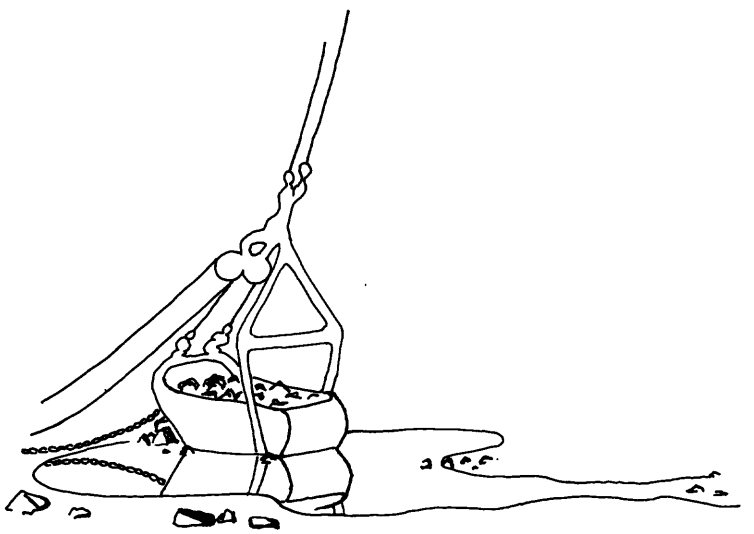
The investigation will include a well inventory and drilling and testing of wells needed to help develop a conceptual model of the ground-water flow system and water-quality variations within the flow system. Water-level measurements and water-quality analyses will be made and core samples collected. Results will be used in constructing a geochemical model of the ground water. Water-quality and gain-loss data will be used to assess the impact of earlier strip mining on water quality in the East Fork Little Chariton River.

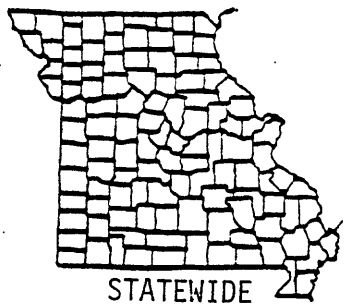
## ACTIVITIES DURING FISCAL YEAR 1984

A report describing the hydrology and geochemistry of coal strip-mine spoil in the Macon-Huntsville area, north-central Missouri, was completed and submitted for colleague review. Samples of unleached spoil were collected from nine sites. Water-quality samples were collected at seven sites for analyses including sulfide and tritium. A preliminary draft of a report describing the effects of strip mining on water quality in the Macon-Huntsville area was submitted for District review, and a hydrologic-data report was begun.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Complete and publish reports that are now in preparation.






PROJECT TITLE: Missouri Small-Streams Analysis MO 81-046

COOPERATOR: Missouri Highway and Transportation Commission

LOCATION: Statewide PROJECT CHIEF: L. D. Becker

## PROBLEM

Streamflow information has been collected on small rural streams in Missouri since 1948 and on small urban streams since 1976. A recent (1980) evaluation of the rural streamflow data indicates that further data collection will not improve statistical relationships that are used to estimate floodflows. As a result, efforts are directed toward determining better flood-estimating tools and more definitive basin parameters. Requirements necessary for rainfall-runoff modeling have been met in the urban data-collection part of the program. Data evaluation and analysis using rainfall-runoff modeling techniques are underway.

## OBJECTIVE

Provide improved urban flood-estimating relationships using statistical or other estimating approaches.

## APPROACH

Urban data from 10 sites are being evaluated and used to calibrate a rainfall-runoff model. Long-term peak-flow data, generated using the calibrated model at each site, will be used to develop relationships defining floodflows at ungaged urban areas of Missouri. The small rural streamflow network has been decreased to six streamflow-gaging stations to sample long-term trends. Streamflow characteristics for all rural basins (areas ranging from 0.1 to 21.3 square miles), together with their various physical or dimensionless basin characteristics, may be used to determine the most effective model and most descriptive basin characteristic for defining improved floodflow relationships at ungaged rural areas of Missouri.

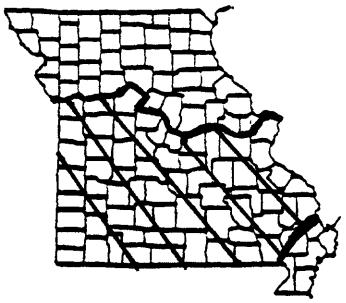
PROJECT MO 80-046--Continued

ACTIVITIES DURING FISCAL YEAR 1984

Evaluation of data continued for 10 urban sites. Transferability of flood-frequency information developed for St. Louis County to other urban settings in Missouri was tested. Model calibrations were made for eight sites and simulations of long-term flood data were accomplished for sites in Columbia and Independence. Data collection ceased at the end of water year 1984, final data analyses continued, and a final report was outlined.

PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Complete analyses of urban flood data. Continue with investigation of factors affecting magnitude and frequency of Missouri floods and study the effects of embankment storage of culverts in Missouri. Prepare final report, or reports, documenting findings of these studies.



PROJECT TITLE: Hydrogeology of the Paleozoic Aquifers in Southern Missouri MO 81-047

COOPERATOR: Federal program

LOCATION: Southern Missouri PROJECT CHIEF: L. F. Emmett

## PROBLEM

Increased use of ground water has led to conflicts among water users. In addition, a new awareness of the potential for contamination and water-quality deterioration is increasing the need to understand water-quality variations. Public demand eventually can be expected to result in methods to manage the resource to obtain maximum use with minimum deterioration. Successful management plans need to be based on factual data collated in a quantitative description of the flow system. Such an understanding does not now exist, but is a prerequisite to further progress in the development of the resource. The U.S. Geological Survey, as a part of the Regional Aquifer System Analysis program, has begun a hydrologic investigation of the regional-flow system in Kansas, Oklahoma, Nebraska, eastern Colorado, southern Missouri, and northern Arkansas. This study, known as the Central Midwest Regional Aquifer System Analysis, will evaluate the potential of water contained in the regional aquifer system for use and management.

## OBJECTIVES

To provide the regional aquifer study with concepts and data that will allow evaluation of the aquifers' water-supply potential and to evaluate the aquifers' response to projected development methods. More specifically, the study is designed to: (1) describe the geologic, hydrologic, and water-quality characteristics, and the hydrologic boundaries of the aquifers; (2) develop a regional data base on water use, and hydrologic and geologic characteristics; (3) describe the past, present, and future problems associated with water use; and (4) evaluate the aquifers' responses to possible future changes in land use and pumpage.

## APPROACH

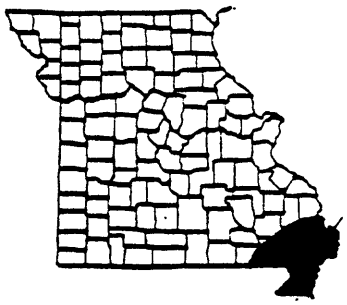
From existing data construct preliminary digital model of southern Missouri to test the conceptual model and to determine sensitivity of system to transmissivity, storage, vertical permeability, and boundaries. Use model to select areas for supplemental hydrogeologic data collection. Attempt to delimit recharge areas using geologic concepts and streamflow data. Use hydrograph-separation techniques and ground-water levels to estimate discharge to streams. Refine digital model of the aquifer using revised estimates of recharge, discharge, and water use. Determine location and movement of fresh-saltwater transition zone in response to pumpage. If practical, use computer-simulation techniques to predict saltwater movement in response to pumpage.

## ACTIVITIES DURING FISCAL YEAR 1984

Data were compiled for seven hydrogeologic layers in the Ozark Plateaus Province. The seven layers consist of three aquifers and four confining units. Hydrologic Investigations Atlases describe each layer, and were reviewed in the District and forwarded for colleague review. In addition an eighth Hydrologic Investigations Atlas gives a summary of the seven layers and is ready for colleague review.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

After colleague review submit Hydrologic Investigations Atlases for Director's approval. Construct and analyze flow model of the Ozark subregion. Prepare Professional Paper chapter, which will be a description of the hydrogeology of the Ozark Plateaus Province.



PROJECT TITLE: Hydrogeology of Southeastern Missouri MO 82-052

COOPERATION: Federal Program

LOCATION: Southeastern Missouri PROJECT CHIEF: T. O. Mesko

## PROBLEM OR NEED FOR STUDY

Alluvial, Tertiary, Cretaceous, and Paleozoic aquifers are the principal sources of domestic, municipal, industrial, and agricultural water supplies in the Mississippi embayment area of southeastern Missouri. A quantitative analysis of the flow system, quality, and use of the ground-water resources is needed to manage the resources effectively.

## OBJECTIVES

To provide the West Gulf Coast Regional Aquifer Systems Analysis study with concepts and data that will allow evaluation of the aquifers' water-supply potential and their response to projected development methods. The study is designed to describe the geologic, hydrologic, and water-quality characteristics of the aquifers; develop a regional data base on water use, geologic, hydrologic, and water-quality information; and determine the recharge from the Ozark Plateaus to the aquifers in the Mississippi embayment.

## APPROACH

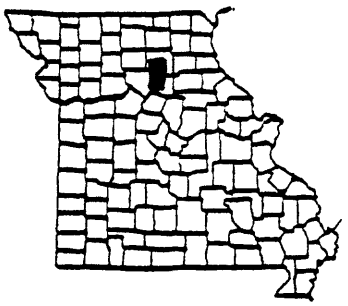
Compile and analyze existing geologic, hydrologic, and water-use data. Inventory wells tapping aquifers of Tertiary, Cretaceous, and Paleozoic ages for additional data collection. Make on-site measurements and analyze water samples for 50 to 75 wells for major inorganic constituents, and selected radioelements and isotopes. Perform hydraulic testing, geophysical logging, and water-quality sampling in selected wells to determine vertical differences. Prepare geologic potentiometric-surface, and water-quality maps. A ground-water model will be completed relating the Paleozoic- and Cretaceous-age aquifers to overlying aquifers.

## ACTIVITIES DURING FISCAL YEAR 1984

A Miscellaneous Investigations map series was completed and reviewed in the District. The three-sheet map series describes and correlates the subsurface geology and stratigraphy of southeastern Missouri using nomenclature that is consistent with Tennessee and Arkansas. Potentiometric and water-use data were compiled, and maps and graphs were drawn for the various aquifers. Wells tapping aquifers of Tertiary and Cretaceous ages were sampled and the age of the water will be calculated.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Continue water-quality sampling from the Tertiary-age and younger aquifers and calculate the age of water from wells tapping these aquifers. Complete a Hydrologic Investigations Atlas that will include historical and current water-level and water-use data for the various aquifers. Prepare cross section to show confining beds and aquifers in southeastern Missouri.



PROJECT TITLE: Effects of Abandoned Surface and Underground Coal Mines on Water Quality in the Claybank Creek Planning Unit, North-Central Missouri MO 83-056

COOPERATOR: Department of Natural Resources
Land Reclamation Commission

LOCATION: North-central Missouri PROJECT CHIEF: D. W. Blevins

## PROBLEM

Past underground and surface mining disturbed approximately 4,500 acres of the Claybank Creek basin. Thomas Hill Reservoir, which is at the mouth of the basin, receives large quantities of suspended sediment from runoff and acid-mine drainage from abandoned mines, gob piles, and spoil piles. The relative contribution of each mined area to the deterioration of water quality is unknown. The identification, quantification, and description of these contributions are needed to begin remedial action.

## OBJECTIVE

To identify and monitor all significant sources of acid surface and ground water in the Claybank Creek area. Water from each mine will be evaluated to determine its relative contribution to the total acid-mine drainage problem in the Claybank Creek basin.

## APPROACH

This study will include a reconnaissance to locate water-quality changes in Claybank Creek, Thomas Hill Reservoir, and the underlying mines and ground-water system. This will be accomplished from literature review, aerial photography, seepage surveys, water-impoundment surveys, and an inventory of existing wells and mine shafts. The reconnaissance data will be used to select critical sites to monitor the hydrologic system of Claybank Creek and Thomas Hill Reservoir. Properties and constituents to be monitored include: streamflow, rainfall, ground-water levels, specific conductance, pH, alkalinity, acidity, sulfate, total and dissolved iron, total and dissolved manganese, dissolved-solids concentration, and suspended sediment.

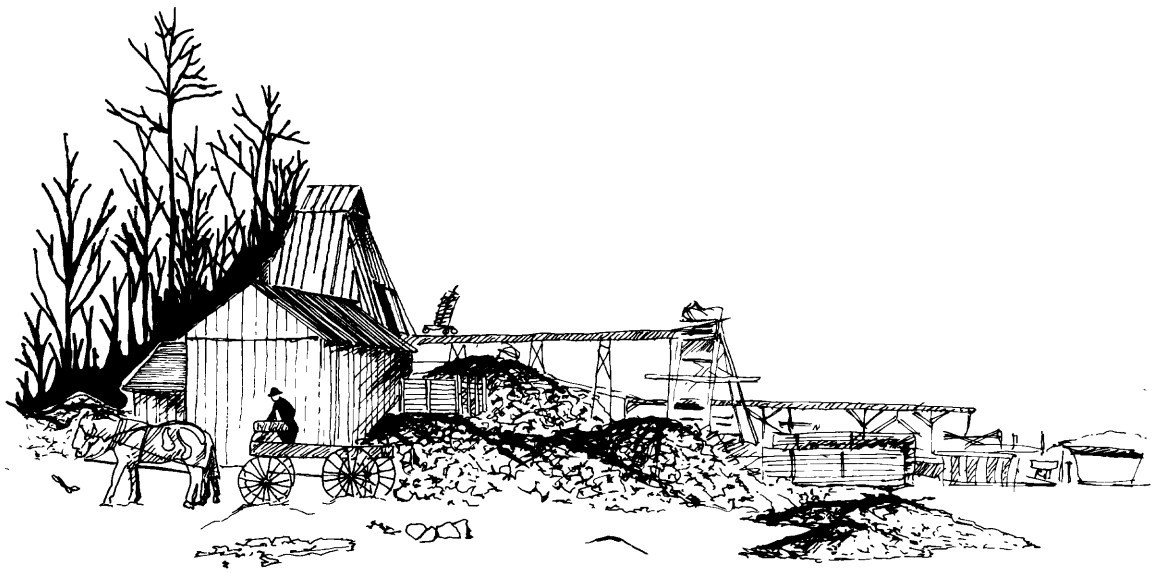
Project MO 83-056--Continued

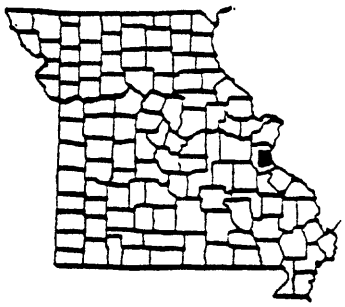
ACTIVITIES DURING FISCAL YEAR 1984

All major sources of mine drainage and selected sites in receiving streams were sampled during high and low base flow. Two major sources of mine drainage were continuously monitored for pH, specific conductance, and discharge for 6 months. Runoff samples were collected at two sites. The first draft of a report describing location, effects, and chemistry of mine drainage in the Claybank Creek basin was completed.

PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Submit report for colleague review and Director's approval for open-file release pending publication as a U.S. Geological Survey Water-Supply Paper.





PROJECT TITLE: Hydrology of the Sugar, Romaine, and Rock Creek basins, south of St. Louis, Missouri MO 83-057

COOPERATOR: U.S. Environmental Protection Agency

LOCATION: Jefferson County, Missouri PROJECT CHIEF: M. J. Kleeschulte

## PROBLEM

The U.S. Environmental Protection Agency has confirmed the presence of dioxin at several locations in Romaine and Rock Creek basins, and the soils and streambed material are contaminated with dioxin in the Romaine Creek basin. The area is a karst limestone terrane. The upstream reach of Romaine Creek loses water through permeable soil into solution-affected limestone. The adjoining Sugar Creek basin is hydrologically connected with Romaine Creek.

## OBJECTIVE

To determine water movement, sediment characteristics, and geology of the Sugar, Romaine, and Rock Creek basins.

## APPROACH

Available information will be compiled for the area. A detailed description of the geology, including surficial material, will be prepared by the Missouri Division of Geology and Land Survey. Wells will be inventoried and a potentiometric-surface map prepared. Seepage runs will be made to identify gaining and losing reaches of streams. These will be complemented by dye-tracer studies by Missouri Department of Natural Resources, Division of Geology and Land Survey to determine the destiny of water lost from streams. Suspended-sediment samples will be collected during base-flow and high-flow conditions at two sites on Romaine Creek and analyzed for sediment concentration, particle size, and dioxin concentration.

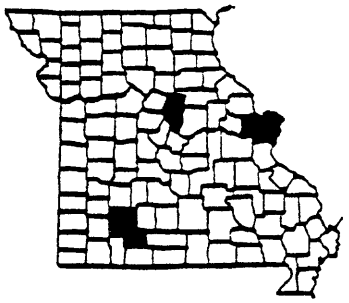
Project MO 83-057--Continued

ACTIVITIES DURING FISCAL YEAR 1984

The final report was submitted for Director's approval for publication as Missouri Division of Geology and Land Survey Open-File Report.

PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Report received Director's approval and will be published by the Missouri Division of Geology and Land Survey in their open-file series.



PROJECT TITLE: Waste-Load Assimilative Capacity Determination for Streams in Missouri MO 83-058

COOPERATOR: Department of Natural Resources
Division of Environmental Quality

LOCATION: Multicounty PROJECT CHIEF: W. R. Berkas

## PROBLEM

A few streams receiving wastewater effluent do not meet the water-quality standards for the classifications set by the Missouri Department of Natural Resources.

## OBJECTIVES

(1) Collect water-quality data in each stream for comparison with the Missouri water-quality standards; (2) calibrate and verify a one-dimensional, steady-state, water-quality model in the study reach of each stream; and (3) evaluate wastewater-managememt alternatives by simulating water-quality conditions of each stream during various wastewater discharges to determine the minimum level of treatment that would be required to protect stream water quality.

## APPROACH

(1) Determine the time-of-travel characteristics and reaeration rates ($K_2$) of the selected treams; (2) determine diurnal variations in carbonaceous biochemical-oxygen demand (CBOD), dissolved oxygen (DO), water temperature, pH, specific conductance, selected nitrogen species, and orthophosphorous during steady-state low-flow stream conditions; (3) determine average streambed-oxygen demand (SOD) in the study reaches; (4) calculate the un-ionized ammonia concentration in the study reach; and (5) calibrate one or more one-dimensional steady-state water models for the study reaches. These data will be used to calibrate one or more one-dimensional steady-state water models. A reareation study also will be made to obtain $K_2$ values for the model. The model will then be used to provide estimates of the concentrations of selected nitrogen species, orthophosphorous, DO, and CBOD at selected locations of the stream for various assumed values of waste discharges.

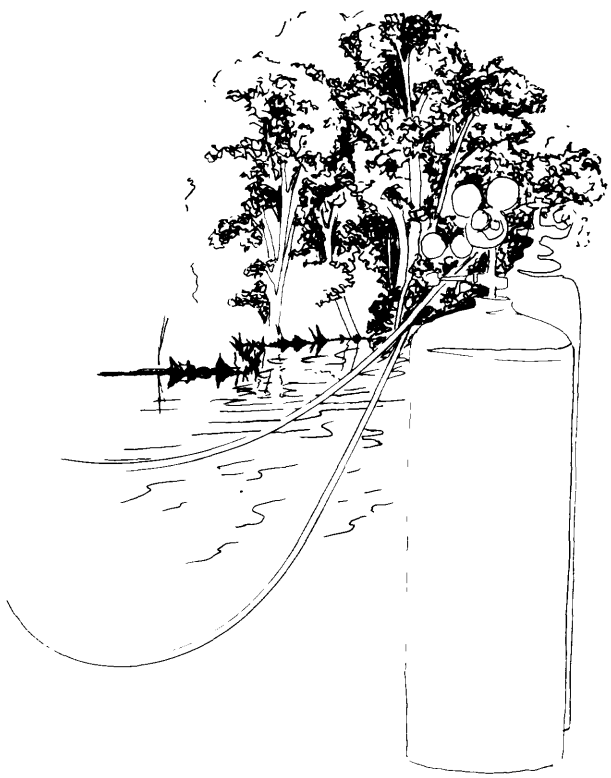
Project MO 83-058--Continued

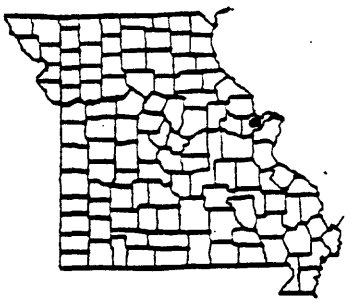
ACTIVITIES DURING FISCAL YEAR 1984

Traveltime, reaeration, streambed-oxygen demand, and water-quality data were collected on Peruque Creek, Perche Creek, and the James River. Data for Dardenne Creek were analyzed and a report was prepared and submitted for colleague review.

PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Publish the report describing water-quality assessment and wastewater-management alternatives in the Dardenne Creek basin. Reports for Peruque Creek, James River, and Perche Creek will be prepared.





PROJECT TITLE: Potential Effects of Hazardous Wastes on the Hydrologic System in the Weldon Spring Area, St. Charles County, Missouri MO 84-059

COOPERATOR: Federal Program

LOCATION: St. Charles County, eastern Missouri

PROJECT CHIEF: L. F. Emmett

## PROBLEM

The Weldon Spring Chemical Plant was used by the Atomic Energy Commission from 1957 to 1966 to process uranium and thorium. Residues from the operation were disposed of in four pits having a combined volume of 220,000 cubic yards. An abandoned limestone quarry about 3 miles southwest of the pits was used for the burial of contaminated solids and radioactive residues from various processing sites. Disposal of these radioactive wastes in an area underlain by carbonate rocks has created the potential for contamination of the ground and surface water.

## OBJECTIVES

Determine the extent and magnitude of contamination of the ground and surface water from the pits and quarry; (2) describe the ground-water flow system in the study area, including the hydrologic boundaries; (3) describe the hydrogeologic characteristics of the aquifers underlying the area; (4) determine the surface-ground water relationship; and (5) describe chemical quality of the ground and surface water.

## APPROACH

The first year of the 3-year project will include the compilation and analysis of available hydrologic information, collection of synoptic field data, and the preparation of a planning report that will summarize available hydrologic data and indicate where additional data are needed. Work during the last 2 years of the project will consist of test-hole drilling, aquifer testing, water-level measurements in wells, collection of water samples for chemical analysis, and preparation of a final report.

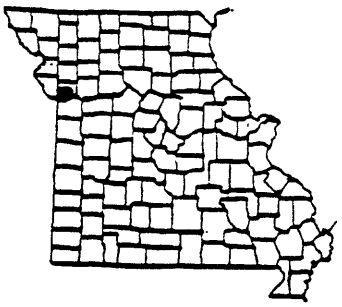
Project MO 84-059--Continued

## ACTIVITIES DURING FISCAL YEAR 1984

A detailed well inventory was made and potentiometric-surface maps were prepared from data collected during the inventory. Ten water samples were collected for chemical and radiochemical analysis. Available hydrogeologic data were collected and preparation of the planning report was begun.

## PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Complete the planning report that will propose data-collection activities needed to define areas of ground-water contamination. These activities will include installation of test wells for monitoring water-levels and water quality, aquifer testing, and collection of water samples for chemical analysis.



PROJECT TITLE: Water Quality in the Missouri River Alluvial Aquifer near Kansas City and Independence, Missouri MO 85-060

COOPERATOR: Missouri Division of Geology and Land Survey

LOCATION: Kansas City and Independence, Missouri

PROJECT CHIEF: J. L. Imes

## PROBLEM

Industrial, commercial, and residential expansion adjacent to the Missouri River alluvial aquifer near Kansas City and Independence, Missouri, has significantly increased the volume of waste products in this area. Many of these wastes are entering the alluvial aquifer. The ground-water resources of this aquifer, the largest source of fresh ground water in the area, need to be assessed so that the impact of waste products on water quality can be investigated.

## OBJECTIVES

(1) To determine the quality of water in the Missouri River alluvial aquifer and possibilities of contamination from existing and abandoned waste-disposal sites; (2) to collect data describing water use from the alluvial aquifer and discharge of contaminated water into or at the surface of the aquifer; (3) to determine the hydrologic characteristics and direction and magnitude of ground-water flow in the aquifer and the interaction of water in the aquifer with the Missouri River.

## APPROACH

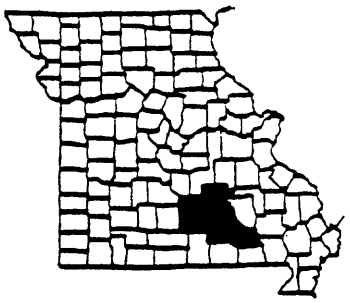
Phase 1: Search of literature and existing data bases for information on geology, hydrology, background levels and distribution of inorganic chemical species, and locations of past and present (1984) industrial and municipal wastedisposal sites; and construction of hydrologic and geologicsection maps.

Phase 2: Drilling and sampling program to determine rate and direction of ground-water flow and present chemical quality. Monitor wells will be established to assess future impact of waste disposal and determine the response of alluvial ground-water level to river stage.

Project MO 85-060--Continued

PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

Make literature search and collect available water use, water quality, hydrologic, and geologic data. Inventory existing wells and measure water levels. Construct potentiometric-surface and geologic maps. Inventory and investigate current and abandoned waste sites.



PROJECT TITLE: Flood Characteristics and Flood-Hazard Delineation in the Ozark National Scenic Riverways, Southeastern Missouri MO 84-061

COOPERATOR: National Park Service

LOCATION: Southeastern Missouri PROJECT CHIEF: T. W. Alexander

## PROBLEM

Approximately 95 percent of the development within the Ozark National Scenic Riverways lies within the estimated 100-year flood plain. The safety of visitors who might be subjected to possible flooding hazards is a primary concern. A flood-hazard survey is needed to help manage the flood plains for visitor safety and property protection.

## OBJECTIVES

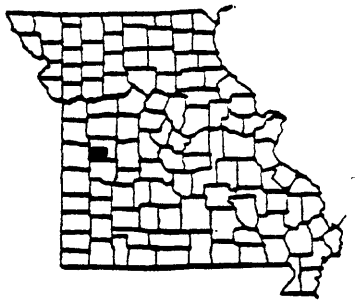
A determination of the 100- and 500-year flood elevations and an evaluation of critical factors, such as depth, velocity, rate of rise, and duration, will be made at four to six developed, extensively used areas along the Current River and Jacks Fork.

## APPROACH

Existing data will be compiled. Slope-conveyance or modified step-backwater methods will be used to generate the 100- and 500-year flood profile; therefore, field survey work (channel cross sections) will be needed at each development of interest. The four continuous-recording stations on the mainstems (Current River and Jacks Fork) and a watershed model will be used to help generate data needed at each location.

## PROPOSED ACTIVITIES FOR FISCAL YEAR 1985

This project was begun during July 1984. Proposed activities during fiscal year 1985 include: map computations of basin characteristics, survey the needed channel cross sections, and begin computation phases.



PROJECT TITLE: Hydrology of Abandoned Strip Mines and Effects of Reclamation at the Power Mine in Western Missouri MO 85-062

COOPERATOR: Missouri Department of Natural Resources
Land Reclamation Commission

LOCATION: Western Missouri PROJECT CHIEF: D. W. Blevins

## PROBLEM

Approximately 2,750 acres of abandoned strip mines in western Missouri are characterized by barren spoil and acid water. The Missouri Land Reclamation Commission is considering revegetating the area, but there is insufficient information about the factors that control water quality to determine whether revegetation efforts will improve the acid condition of the lakes and streams in the area.

## OBJECTIVES

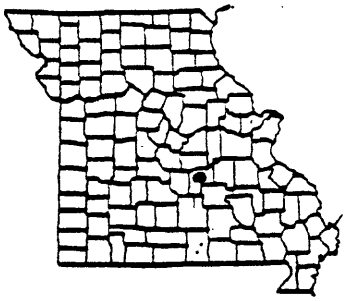
To determine the movement and quality of ground and surface waters; determine the interchange between the ground- and surface-water systems; and determine the effects of revegetation activities on the quantity and quality of surface discharge from the strip-mined area.

## APPROACH

Existing information will be compiled with reconnaissance data to develop a conceptual hydrologic model of the basin. Continuous rainfall-runoff and surface-water-quality data will be collected to determine runoff quality and the origin of acid water in the lakes. Ground-water and spoil samples (including isotope data) will be collected to determine the geochemistry and contribution of ground water to acid lakes. Ground-water levels will be used to determine the direction of ground-water flow in the spoil. Watershed, ground-water, and water-quality computer models will be used to broaden the results and evaluate details of the hydrologic system where they are missing. Two long-term streamflow-gaging stations and two water-quality monitors will be operated to monitor the effects of revegetation on water quality.

PROPOSED ACTIVITIES DURING FISCAL YEAR 1985

This project was begun during October 1984. Proposed activities during fiscal year 1985 are: install two streamflow-gaging stations, two water-quality monitors, and one rain gage; collect ground-water, surface-water, and water-quality reconnaisance data; drill 20 test holes and collect spoil samples; monitor lake and ground-water levels; collect ground-water samples; and collect surface runoff samples.



PROJECT TITLE: A Comparison of Field and Laboratory Methods of Measuring Sediment Oxygen Demand MO 85-063

COOPERATOR: Missouri Division of Environmental Quality

LOCATION: Little Dry Fork, Phelps County, Missouri

PROJECT CHIEF: D. C. Hall

## PROBLEM

The Missouri District and the Missouri Department of Natural Resources have begun waste-load assimilation studies on streams throughout the State. Sediment oxygen demand is an important component in these evaluations, but no standardized method has been developed to measure this parameter.

## OBJECTIVES

Compare field and laboratory methods of measuring sediment oxygen demand and select a simple, reliable method for future use in the Missouri District.

## APPROACH

Sediment oxygen demand will be measured on undisturbed and disturbed samples in the field and on samples transported to the laboratory. Three sites will be selected on Little Dry Fork near the Rolla waste-treatment plant: upstream from the plant input, near the input, and downstream from the input. Results will be compared by statistical analysis.

## PROPOSED ACTIVITIES FOR FISCAL YEAR 1985

Collect and compare all data and write report.

## SOURCES OF WATER RESOURCES DIVISION PUBLICATIONS AND INFORMATION

Selected references on water resources in Missouri are listed on the following pages, and many of these references are available for inspection at:

U.S. Geological Survey, WRD
Missouri District
1400 Independence Road
Mail Stop 200
Rolla, Missouri 65401

and

Missouri Division of Geology and Land Survey
Fairgrounds Road
P. O. Box 250
Rolla, Missouri 65401

Current releases are described in a monthly pamphlet, "New Publications of the Geological Survey," which may be obtained from:

Branch of Distribution
U.S. Geological Survey
604 South Pickett Street
Alexandria, Virginia 22304

Professional Papers, Bulletins, Water-Supply Papers, Techniques of Water-Resources Investigations, Earthquake Information Bulletins, and popular leaflets, pamphlets, and booklets may be purchased from Branch of Distribution, Alexandria, Virginia (address above); additional information is given in "A Guide to Obtaining Information from the U.S. Geological Survey, 1982," Geological Survey Circular 777, which is available without cost from Branch of Distribution, Alexandria, Virginia.

Open-File and Water-Resources Investigations Reports for Missouri are available for inspection at the Missouri District office, and may be purchased from:

Open-File Services Section
U.S. Geological Survey
Box 25425, Denver Federal Center
Denver, Colorado 80225

Map information:

To order maps of areas east of the Mississippi River (including Minnesota, Puerto Rico, and The Virgin Islands) write:

Eastern Distribution Branch
U.S. Geological Survey
1200 South Eads Street
Arlington, Virginia 22202

To order maps of areas west of the Mississippi River (including Alaska, Hawaii, Louisiana, Guam, and Samoa) write:

Western Distribution Branch
U.S. Geological Survey
Box 25286
Denver Federal Center
Denver, Colorado 80225

For additional information write:

National Cartographic Information Center
Mid-Continent Mapping Center
1400 Independence Road
Mail Stop 231
Rolla, Missouri 65401

General information:

Public Inquiries Offices (PIOs) provide general information about the programs of the U.S. Geological Survey and its reports and maps. The PIOs answer inquiries made in person, by mail, or by telephone and refer requests for specific technical information to the appropriate people. Direct inquiries for Missouri to:

Public Inquiries Office
U.S. Geological Survey
1028 General Services Administration Building
19th and F Streets, NW
Washington, D.C. 20244

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