

FEDERAL-STATE COOPERATIVE PROGRAM IN KANSAS,
SEMINAR PROCEEDINGS, JULY 1985

By Thomas L. Huntzinger

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1985

FOREWORD

The Kansas Water Office and the U.S. Geological Survey jointly sponsored a seminar on the Federal-State Cooperative Program in Water Resources at Lawrence, Kansas, on July 8-9, 1985. The Federal-State Cooperative Program is based on the concept that Federal, State and local governments have mutual interests in collecting and merging data on the nation's water resources and provides for Congressional appropriations to be used on a 50-50 cost-sharing basis with State and local agencies. The Cooperative Program consists of the Hydrologic Data Collection Program and Interpretive Investigations.

In 1895, Kansas became the first state to have a cooperative water-resource investigation with the U.S. Geological Survey. Since that time, many State and local agencies in Kansas have participated in the Cooperative Program, and it has experienced considerable growth in size and importance. Hence, the purpose of this seminar was to provide an opportunity for all Federal-State Cooperative Program participants in Kansas to see the broad perspective of current U.S. Geological Survey Federal-State Cooperative Projects and to discuss future plans and needs, in regard to the Federal-State Cooperative Program.

Joseph H. Harkins
Director
Kansas Water Office



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Seminar attendees take time for informal discussions.

Joe Rosenshein describes the Federal-State Cooperative Program.



FEDERAL-STATE COOPERATIVE PROGRAM IN KANSAS,

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ABSTRACT

During the past few years, water-resource management in Kansas has undergone reorientation with the creation of the Kansas Water Authority and the Kansas Water Office. New thrusts toward long-term goals based on the Kansas State Water Plan demand strong communication and coordination between all water-related agencies within the State. The seminar discussed in this report was an initial step by the Kansas Water Office to assure the continued presence of a technical-coordination process and to provide an opportunity for the U.S. Geological Survey to summarize their technical-information activities in Kansas for the benefit of State and Federal water agencies within the State. The seminar was held on July 8 and 9, 1985, in Lawrence, Kansas.

The agenda included a summary of the data-collection activities and short synopses of projects completed within the past year and those currently underway. The data-program discussions described the information obtained at the surface-water, ground-water, water-quality, and sediment sites in Kansas. Interpretive projects summarized included studies in ground-water modeling, areal hydrologic analysis, regional analysis of floods, low-flow, high-flow, and flow-volume characteristics, water quality of ground water and lakes, and traveltime and transit-loss analysis. Project work included in the summaries was part of the Federal-State Cooperative Program and the U.S. Geological Survey's National Thrust Programs in Kansas.

INTRODUCTION

During the past few years, water-resource management in Kansas has undergone reorientation with the creation of the Kansas Water Authority and the Kansas Water Office. New thrusts in addressing water problems in Kansas are beginning to emerge through State agencies that are based on the Kansas State Water Plan. These trends toward specific long-term goals in water management demand a strong communication and coordination effort between the technical-information agencies and the planning, administrative, and enforcement agencies within the State. State agencies that have direct responsibility for specific aspects of water-resource interests in Kansas must maintain a consistent forum for information transfer. The seminar discussed in this report was an initial step by the Kansas Water Office to assure the continued presence of a technical-coordination process and provided an opportunity for the U.S. Geological Survey, the primary national information-gathering agency, to summarize their technical-information activities in Kansas for the benefit of State and Federal water agencies within the State.

Discussion topics presented at the seminar were intended to provide all cooperating agencies and interested individuals with an overview of the entire U.S. Geological Survey Federal-State Cooperative Program in Kansas.

Attendance and Agency Representation

The seminar was held on July 8 and 9, 1985, in Lawrence, Kansas. Those attending represented the range of State and Federal agencies involved in water resources in Kansas. Attendees and agencies they represent are listed in table 1.

Table 1.--Attendees and agencies represented

| Attendee name | Agency |
|-------------------|---|
| Wayland Anderson | Kansas State Board of Agriculture, Division of Water Resources |
| James Bagley | Kansas State Board of Agriculture, Division of Water Resources |
| Ray Barnes | U.S. Army Corps of Engineers, Tulsa, Oklahoma |
| Rick Bean | Kansas Department of Health and Environment |
| Hugh Bevans | U.S. Geological Survey, Lawrence, Kansas |
| Jerry Buckheim | U.S. Bureau of Reclamation, Amarillo, Texas |
| Jerry Buehre | U.S. Army Corps of Engineers, Kansas City, Missouri |
| Jerry Carr | U.S. Geological Survey, Lawrence, Kansas |
| Al Clebsch | U.S. Geological Survey, Lakewood, Colorado |
| Ralph Clement | U.S. Geological Survey, Lawrence, Kansas |
| Jane Denne | Kansas Geological Survey |
| Clark Duffy | Kansas Water Office |
| Darrel Eklund | Kansas Water Office |
| Claude Geiger | U.S. Geological Survey, Lawrence, Kansas |
| Jay Gillespie | U.S. Geological Survey, Lawrence, Kansas |
| William Hambleton | Kansas Geological Survey |
| Cristi Hansen | U.S. Geological Survey, Lawrence, Kansas |
| Joseph Harkins | Kansas Water Office |
| Robert Hart | U.S. Geological Survey, Lawrence, Kansas |
| Manoutch Heidari | Kansas Geological Survey |
| Ralph Hight | U.S. Army Corps of Engineers, Tulsa, Oklahoma |
| Thomas Huntzinger | U.S. Geological Survey, Lawrence, Kansas |
| Kenneth Hurst | Kansas Department of Transportation |
| Daljit Jawa | Kansas Water Office |
| Joan Kenny | U.S. Geological Survey, Lawrence, Kansas |

Table 1.-- Attendees and agencies represented--Continued

| Attendee name | Agency |
|--------------------|--|
| Hal Langford | U.S. Geological Survey, Reston, Virginia |
| Keith LeGer | Kansas Department of Transportation |
| Norman Lister | U.S. Soil Conservation Service |
| Tom Lowe | Kansas Water Office |
| Tom McClain | Kansas Geological Survey |
| Hal McGovern | U.S. Geological Survey, Lawrence, Kansas |
| Jesse McNellis | U.S. Geological Survey, Lawrence, Kansas |
| Kyle Medina | U.S. Geological Survey, Lawrence, Kansas |
| Dick Pelton | City of Topeka |
| Laura Perkins | U.S. Geological Survey, Lawrence, Kansas |
| Mike Pope | U.S. Geological Survey, Lawrence, Kansas |
| James Power | Kansas Department of Health and Environment |
| Dennis Remboldt | Federal Highway Administration |
| Joe Rosenshein | U.S. Geological Survey, Lawrence, Kansas |
| Ervin Sanders | U.S. Army Corps of Engineers, Kansas City, Missouri |
| James Schoof | Kansas Corporation Commission |
| Floyd Smith | Kansas State University, Water Resources Research Institute |
| Don Snethen | Kansas Department of Health and Environment |
| Marios Sophocleous | Kansas Geological Survey |
| Tim Spruill | U.S. Geological Survey, Lawrence, Kansas |
| John Stamer | U.S. Geological Survey, Lawrence, Kansas |
| Tom Stiles | Kansas Water Office |
| Marvin Stevens | U.S. Geological Survey, Garden City, Kansas |
| Lloyd Stullken | U.S. Geological Survey, Garden City, Kansas |
| Robert Swain | U.S. Bureau of Reclamation, Denver, Colorado |
| Yun-Sheng Yu | University of Kansas, Water Resources Research Institute |

Summary of Seminar Agenda

The agenda was dominated by short synopses of selected projects within the cooperative program. Introductory presentations preceded each session to provide background information on the U.S. Geological Survey's operation as it related to the technical discussions.

The seminar agenda is shown in table 2.

Table 2.--Seminar agenda--Continued

| Time | Activity | Speaker |
|---------------------------------|---|--|
| <u>July 8, 1985</u> --Continued | | |
| 4:25-4:40 Continued | Federal-State Cooperative interpretive projects and research | Clark Duffy, Moderator Kansas Water Office |
| <u>July 9, 1985</u> | | |
| 9:00-9:20 | U.S. Geological Survey, general project acti- vities | Jerry Carr, Kansas District U.S. Geological Survey |
| 9:20-10:00 | Summary of cooperative projects completed since July 1984 | Project Staff U.S. Geological Survey |
| 10:00-10:30 | Coffee break | |
| 10:45-11:30 | Summary of completed pro- jects, completed | Project Staff U.S. Geological Survey |
| 11:30-12:00 | Summary of selected current projects from following general categories: Surface-water hydrology Surface-water quality | |
| 12:00-1:30 | Luncheon - Address: Federal Thrust Programs and Research | Hal Langford, Assoc. Chief Hydrologist, U.S. Geological Survey |
| 1:30-2:45 | Summary of selected current projects from the follow- ing general categories, continued Ground-water quality Ground-water hydrology Ground-water/surface- water interactions Areal hydrologic analyses Water use | Project Staff U.S. Geological Survey |

Table 2.--Seminar agenda--Continued

| Time | Activity | Speaker |
|---------------------------------|---|---|
| <u>July 9, 1985</u> --Continued | | |
| 2:45-3:00 | Coffee break | |
| 3:00-3:30 | Open discussion on future Federal-State cooperative project needs | |
| 3:30-4:00 | U.S. Geological Survey thrust projects and projects with other Federal agencies conducted in Kansas | John Stamer U.S. Geological Survey |
| 4:00-4:15 | Data network evaluation | Claude Geiger |
| | Networks for regional streamflow characteristics | Kyle Medina U.S. Geological Survey |
| 4:15-4:30 | Potential directions of the U.S. Geological Survey and the cooperative programs in the future - open discussion | Hal Langford Al Clebsch Joe Rosenshein Joe Harkins |

FEDERAL-STATE COOPERATIVE PROGRAM IN KANSAS

The definition of a cooperative program in Kansas is, as paraphrased from the national definition:

"A partnership for water-resources information between the U.S. Geological Survey and State and local agencies."

Most State agencies administer the cooperative program through contracts, but the spirit of the contractual agreement for the program provides more than contractual services because of the broad and long-term interest that the U.S. Geological Survey has in water resources and hydrology. A thorough description of the cooperative program is included in "The U.S. Geological Survey Federal-State Cooperative Water Resources Program" (Gilbert and Buchanan, 1981).

It is of particular interest for Kansas to note the early history of the cooperative program because the first such program in the Nation was in western Kansas in 1895, according to historic references (Gilbert and Buchanan, 1981). A quick look at the current streamflow-gaging station records indicates stations on four rivers that have data since 1895--the Medicine Lodge, the Smoky Hill, the Neosho, and the Verdigris.

The current cooperative program from the Survey's perspective is designed to:

- * assure the program addresses State and local interests;
- * assure the program addresses Federal interests;
- * provide an objective and credible analysis of locally visible and sometimes sensitive issues;
- * provide a technically consistent approach and, therefore, regionally comparable results; and
- * provide continuity in a state's basic water-resources information program.

There are specific characteristics of the cooperative program in Kansas that are not necessarily unique in the Nation. The most important characteristics are:

- * objectives negotiated through project proposals;
- * project obligations are made through a joint-funding agreement;
- * State and local funds are matched with Federal funds;
- * direct credit is given for State and local agency efforts by matching them with Federal funds; and
- * all technical resources of the Federal agency and its credibility are made available to State and local agencies.

The cooperative program in Kansas is competing with other states for Federal matching money. The technical basis for determining the distribution of funds to each state is a list of national priority issues that is updated each fiscal year. Proposed programs in Kansas that address national priority issues are more likely to receive Federal matching funds. The national priority issues for 1986 are:

- * ground-water contamination;
- * stream quality;
- * water supply and demand;
- * hydrologic hazards;
- * hydrologic effects of energy and mineral activity;
- * wetlands, lakes, and estuaries; and
- * acid rain.

The top four national priority issues apply to the Nation, and the remainder are of national concern, but the problems may be of a regional nature.

A discussion of the trends in the size of the cooperative program is important because it represents the amount of opportunity that Kansas has taken to acquire hydrologic information. Based on U.S. Geological Survey water-resource funding in Kansas since 1980, the total program has varied from about \$3.5 million during 1980 to about \$2.5 million during 1984 (fig. 1). The Federal-State cooperative program has varied from about \$2.2 million during 1980 to about \$1.7 million during 1984. The U.S. Geological Survey's Federal program and the other Federal-agency programs have remained about the same through 1980-84. An indication of the distribution of program dollars for 1984 is shown in figure 2.

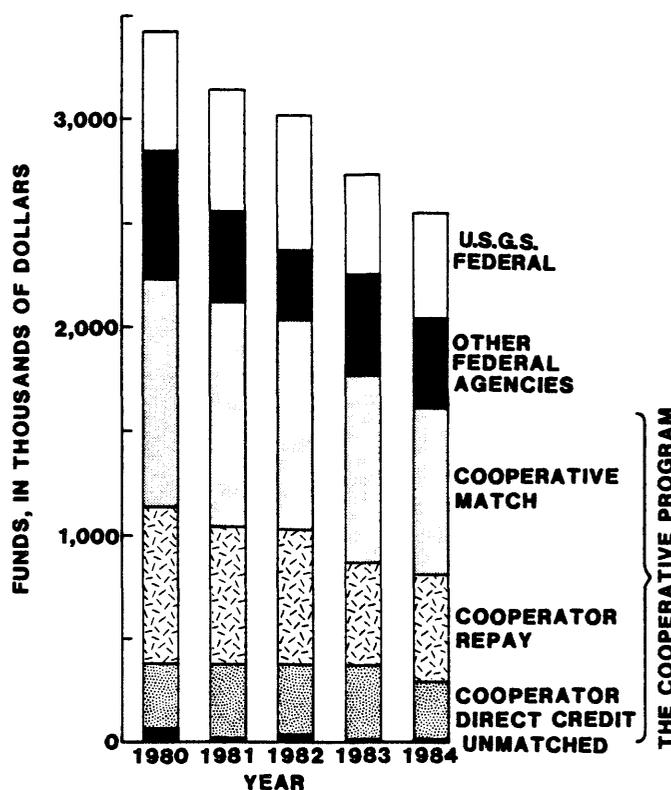


Figure 1.--Trends of U.S. Geological Survey program in Kansas.

The upper diagram in figure 2 represents the 1984 data program:

- * after the U.S. Geological Survey, the largest contributors to the data program were other Federal agencies, in this case the U.S. Army Corps of Engineers;
- * the largest State contributor was the Kansas Water Office, with the Kansas State Board of Agriculture and the Department of Health and Environment following it in cooperative-program size.

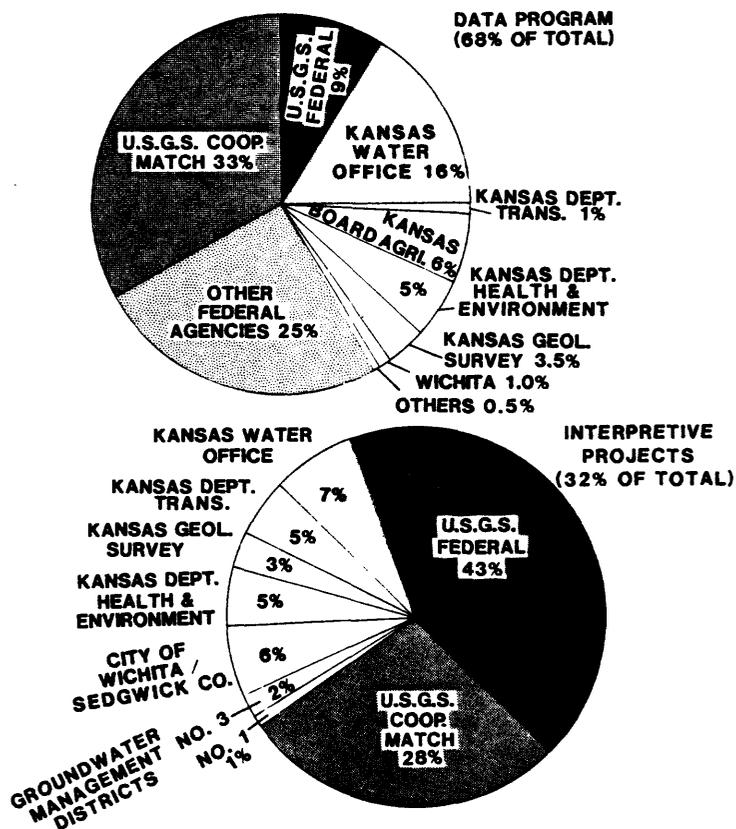


Figure 2.--Distribution of U.S. Geological Survey program dollars for fiscal year 1984.

The lower diagram in figure 2 represents 1984 interpretive projects:

- * the Kansas Water Office was the largest contributor to interpretive projects during 1984, with the City of Wichita/Sedgwick County following it in program size.
- * So far during fiscal year 1985, indications are that the Department of Health and Environment will be the largest State contributor.

An understanding of the organization of U.S. Geological Survey water-resources operations in Kansas for implementing the cooperative program provides insight into the capabilities of the Survey staff in Kansas. U.S. Geological Survey water-resource operational groups are diagrammed in figure 3. The existence of a separate ground-water specialist position is a reflection of the importance of ground water in Kansas. Specialist positions in water quality and surface water are assumed by project-office chiefs. Cooperators are advised to contact these individuals for information and assistance.

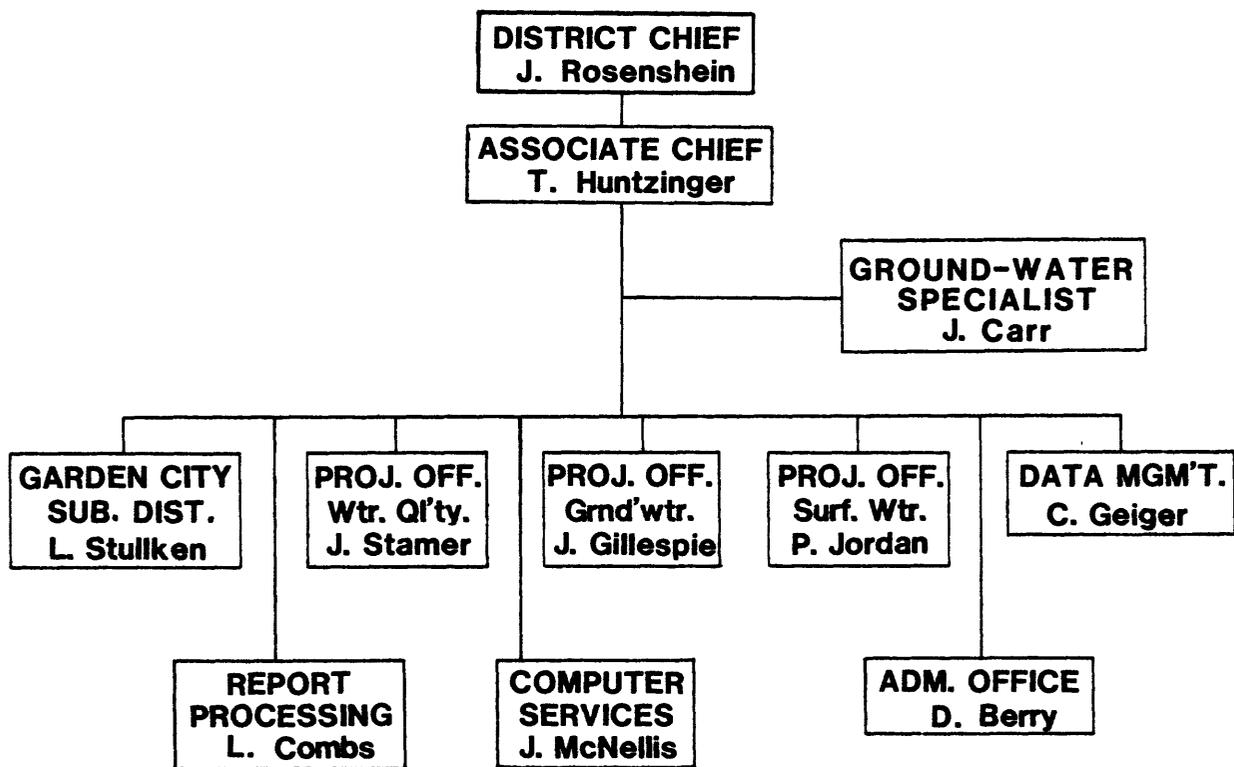


Figure 3.--U.S. Geological Survey water-resources operational groups in Kansas.

DATA-COLLECTION AND DISSEMINATION PROGRAM

The U.S. Geological Survey has, as a part of its traditional mission, a responsibility for collecting hydrologic data and making it readily available to the public. The Survey's Hydrologic Data Management Section in Kansas is responsible for data-collection and dissemination activities. Data collection is a multidisciplinary function that involves surface water, ground water, and water quality. Records of all data collected are maintained for dissemination and analysis. The number of data-collection sites in Kansas for 1970-84 is shown in figure 4. Data were collected at these sites by the U.S. Geological Survey and various cooperators for many purposes, the most significant of which were as follows:

- * to document regional and long-term hydrologic characteristics;
- * to support short-term and problem-related hydrologic studies; and
- * to provide current purpose and real-time management information.

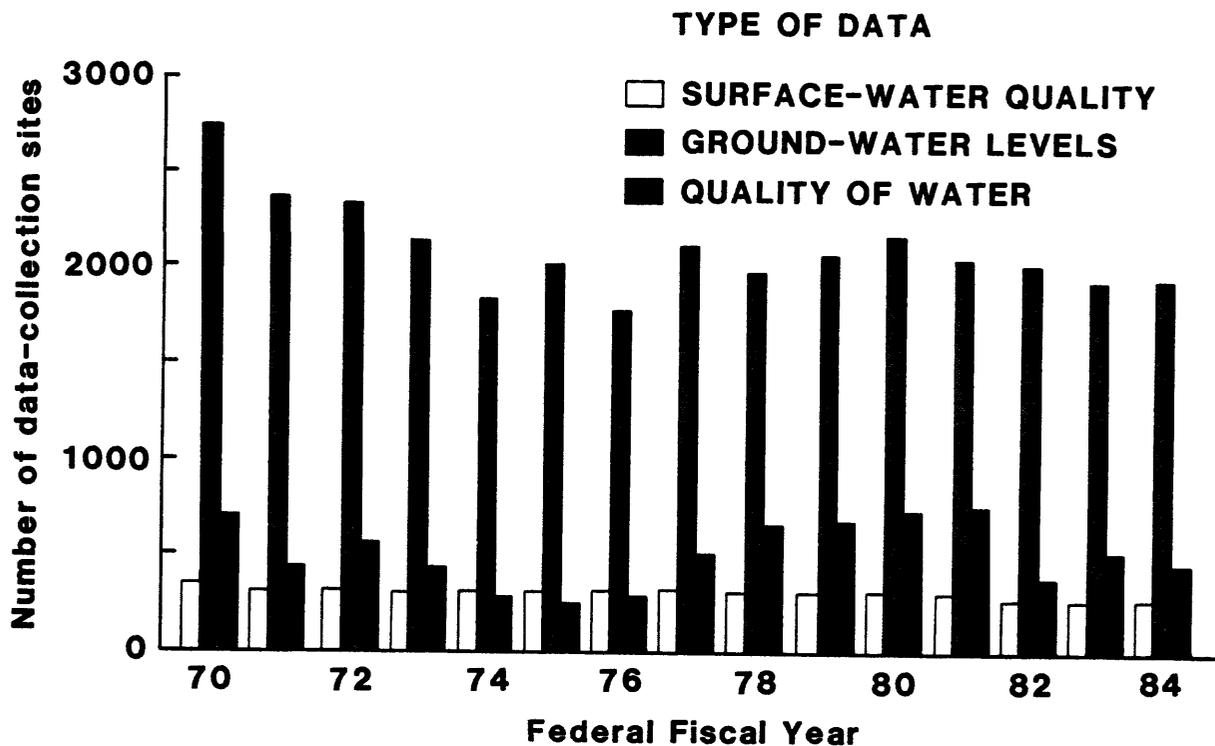


Figure 4.--Number of data-collection sites by type of data, 1970-84.

Surface-Water-Quantity Data

The collection of surface-water-quantity data by the U.S. Geological Survey in Kansas was initiated in 1895 and has been a traditional responsibility to the present. As indicated in figure 5, the program increased steadily until the 1960's and then, except for a few years, remained relatively constant. Streamflow-gaging stations are operated in cooperation with various State and local agencies and with other Federal agencies. Also, some stations are part of a Federally mandated program, and funds are appropriated directly to the U.S. Geological Survey for station operations. The relative contributions of various cooperators to the collection of continuous-record streamflow-gaging data are shown in figure 6.

Continuous-record streamflow data are collected in terms of continuous-stage records and periodic discharge measurements. Based on these onsite measurements, a mean daily discharge record is computed and published. The geographic distribution of the streamflow-gaging stations for the 1985 water year is shown in figure 7a. Continuous-record reservoir elevation data are collected at all major storage reservoirs in Kansas. The U.S. Army Corps of Engineers funds 17 sites; the U.S. Bureau of Reclamation, 1 site; the Kansas Water Office, 5 sites; and the city of Wichita, 1 site.

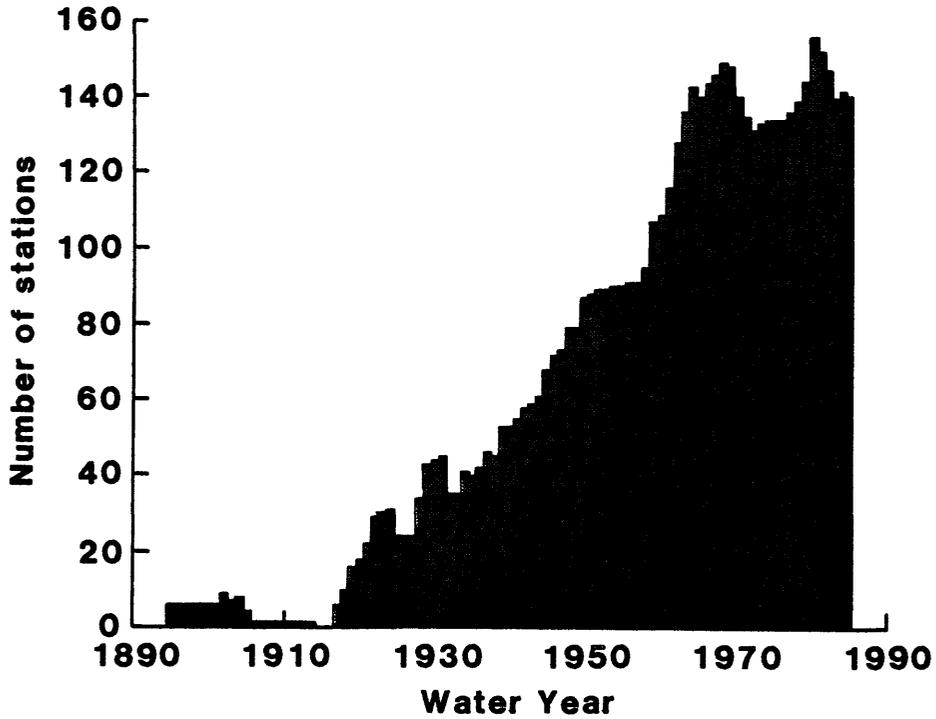


Figure 5.--Number of continuous-record streamflow-gaging stations in Kansas, water years 1895-1985.

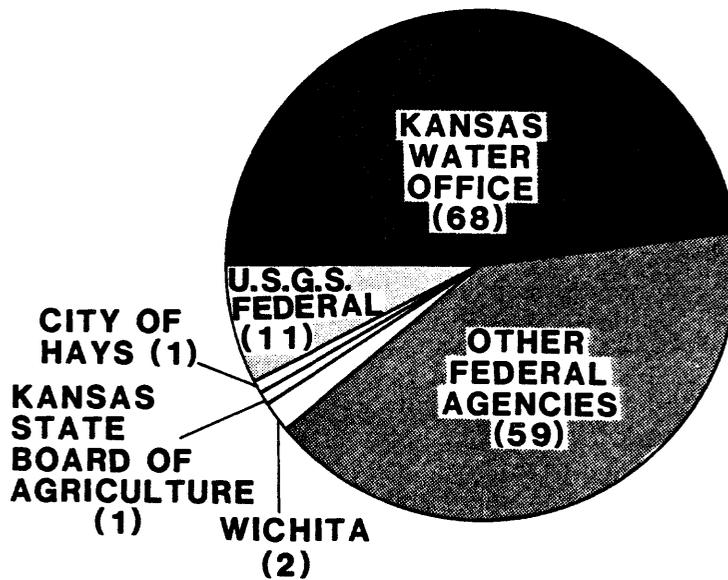


Figure 6.--Number of continuous-record streamflow-gaging stations funded by each cooperators, fiscal year 1985.

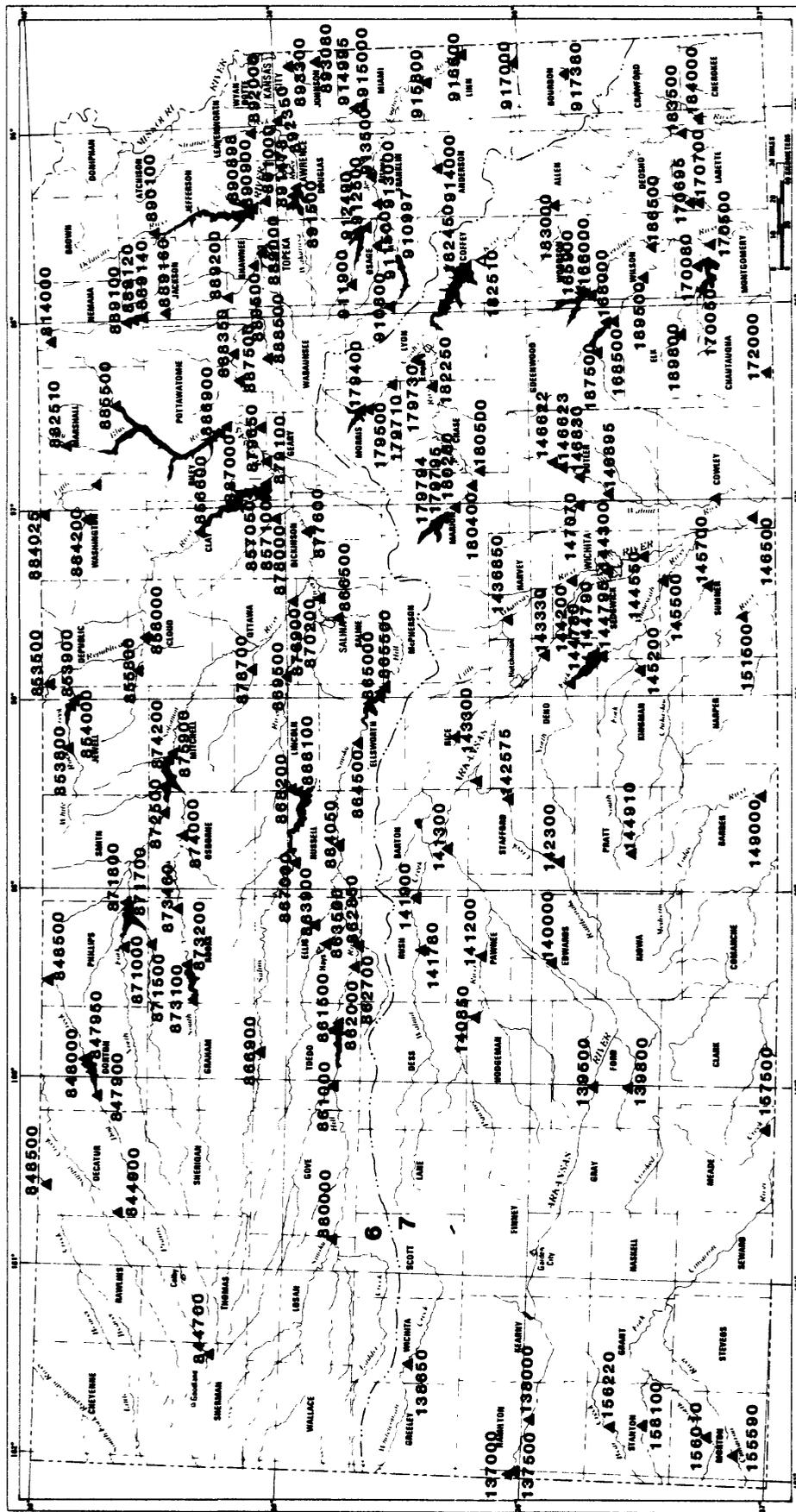


Figure 7a.--Location of complete-record streamflow-gaging stations in operation during 1985 water year.

Partial-record streamflow-gaging stations are sites at which only selected kinds of flow or stage data are collected. The Kansas Department of Transportation supports 60 stations where only high-flow data are recorded and the maximum stage and discharge of the year are published. Fifty-one stations are supported by either the Kansas Water Office or other Federal agencies and include not only high-flow stations but low-flow stations at which flow data are collected during times when no land-surface runoff is occurring. The geographic distribution of the partial-record streamflow-gaging stations for the 1985 water year is shown in figure 7b.

Ground-Water-Level Data

Kansas relies on ground water as a primary source of supply for most of the western part of the State. Therefore, the collection of ground-water-level data is a significant part of the data-collection program. Ground-water-data collection by the U.S. Geological Survey for the 1985 water year includes the determination of water levels at 1,800 wells; water levels were collected on a continuous basis at 11 sites; monthly, at 30 sites; and quarterly, at 388 sites. The remaining sites were measured annually. All ground-water-level data are published annually, and a water-level-decline map is prepared each year for western Kansas. The ground-water-data program became a major effort beginning in the 1960's, as shown in figure 8, and the number of measurement sites per county for the 1985 water year is given in figure 9.

Water-Quality and Sediment Data

The quality of ground water and the quality characteristics and sediment content of surface waters are critical to water users in Kansas. Ground-water-quality data are collected throughout the State, as indicated in figure 10. Samples are collected to determine the natural "background" quality of ground water, as well as to detect the presence and extent of possible contaminants.

Surface-water quality and sediment data-collection activities are supported by the Kansas Water Office, the U.S. Army Corps of Engineers, and the U.S. Geological Survey, as indicated in figure 11. All of the sites supported by the Kansas Water Office are sediment sites; there are no chemical- or biological-quality data sites currently funded by State agencies in Kansas. The location of surface-water quality and sediment sites throughout the State is shown in figure 12.

A general indication of the trend of the water-quality and sediment program in Kansas since 1930 is shown in figure 13. The types of water-quality determinations made include common anions and cations, minor elements, nutrients, bacteria, physical properties (temperature, pH, specific conductance), and sediment. Figure 14 shows the number of sites at which water-quality samples and sediment data are collected.

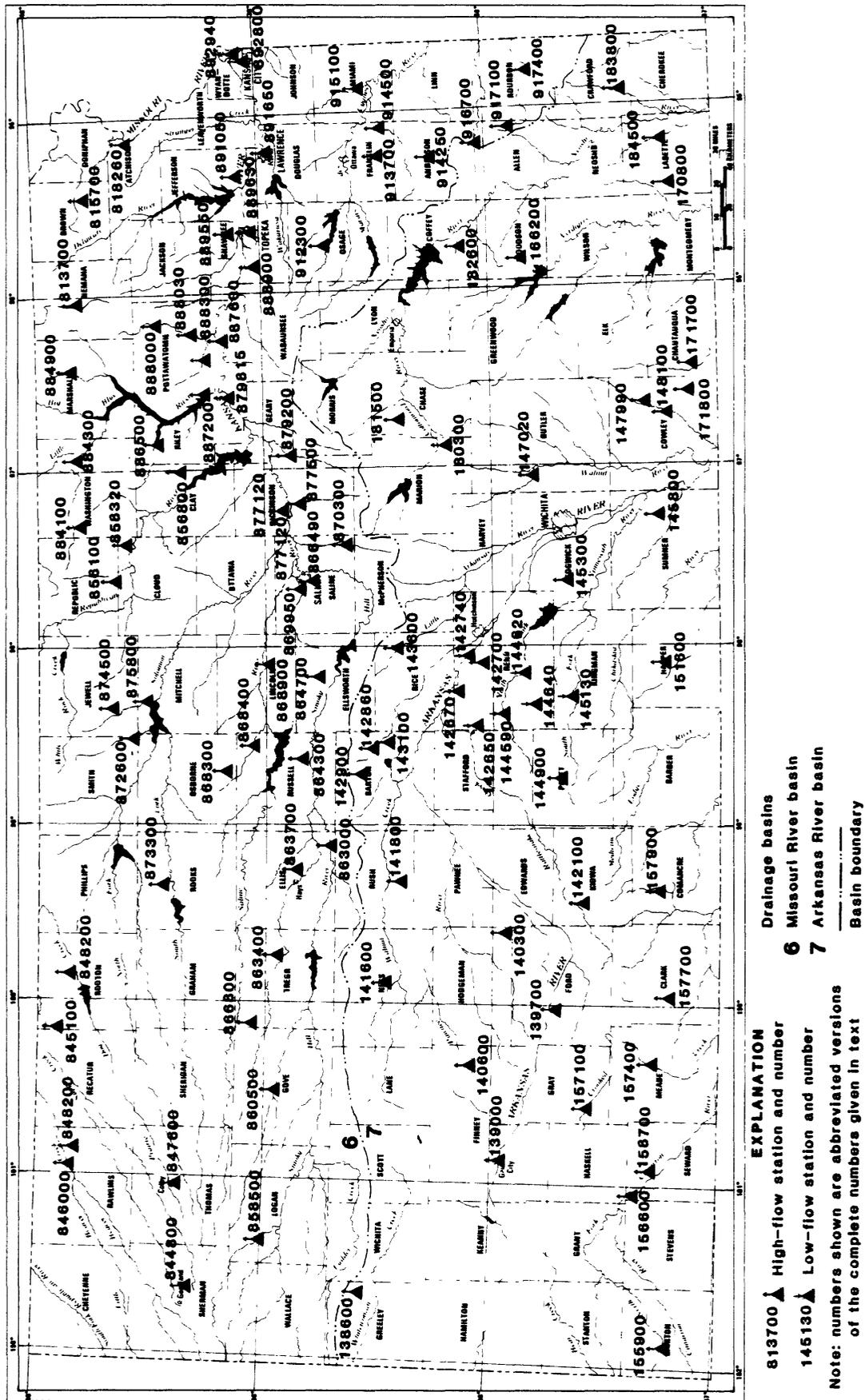


Figure 7b.--Location of partial-record streamflow-gaging stations in operation during 1985 water year.

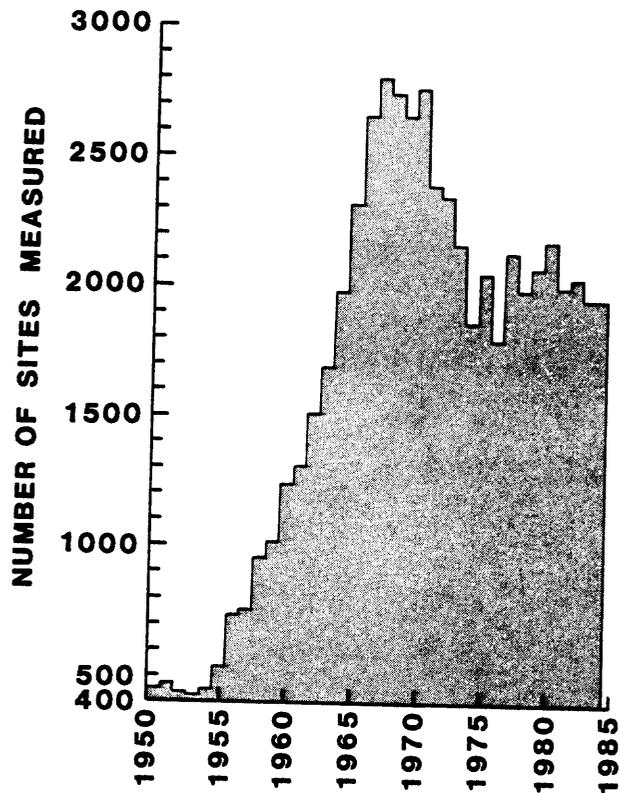


Figure 8.--Number of ground-water-level measurement sites in Kansas, 1950-85 water years.

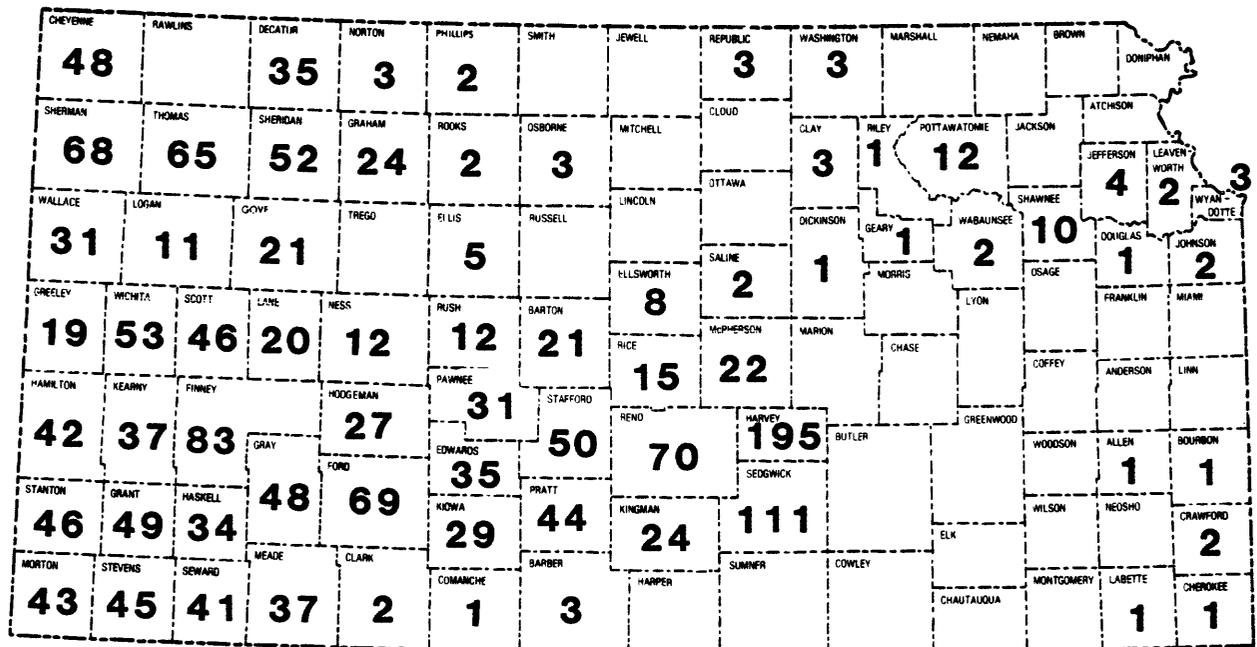


Figure 9.--Number of ground-water-level measurement sites by county for 1985 water year.

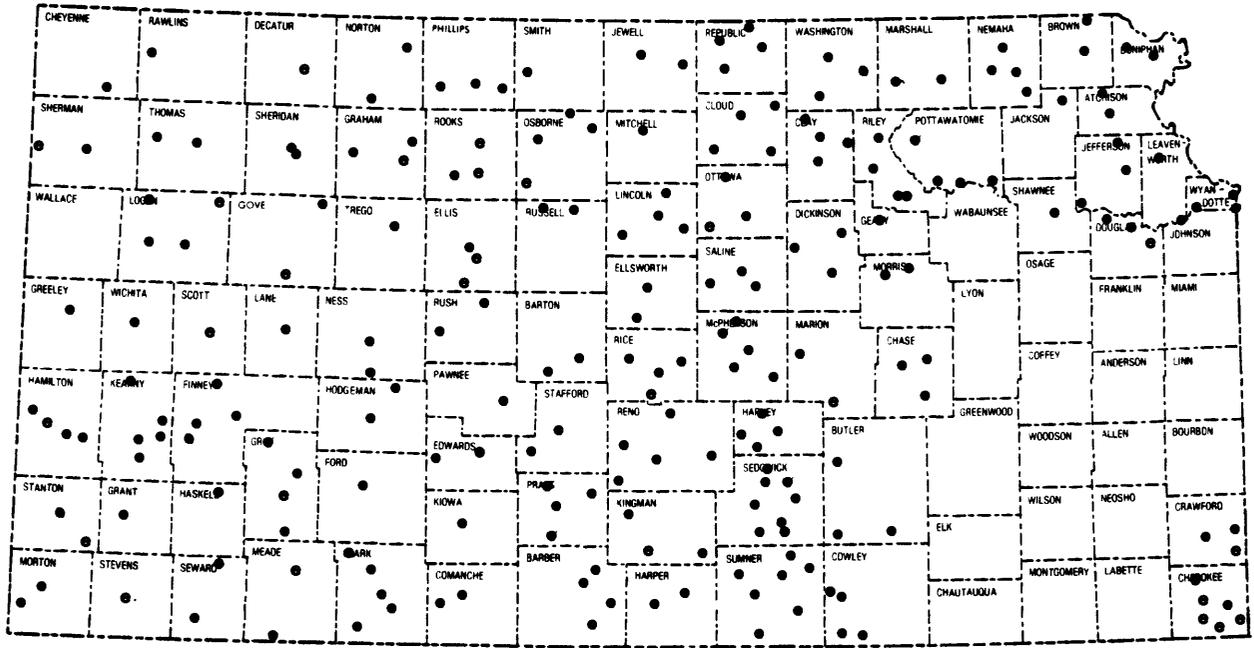


Figure 10.--Location of ground-water-quality sampling sites for 1985 water year.

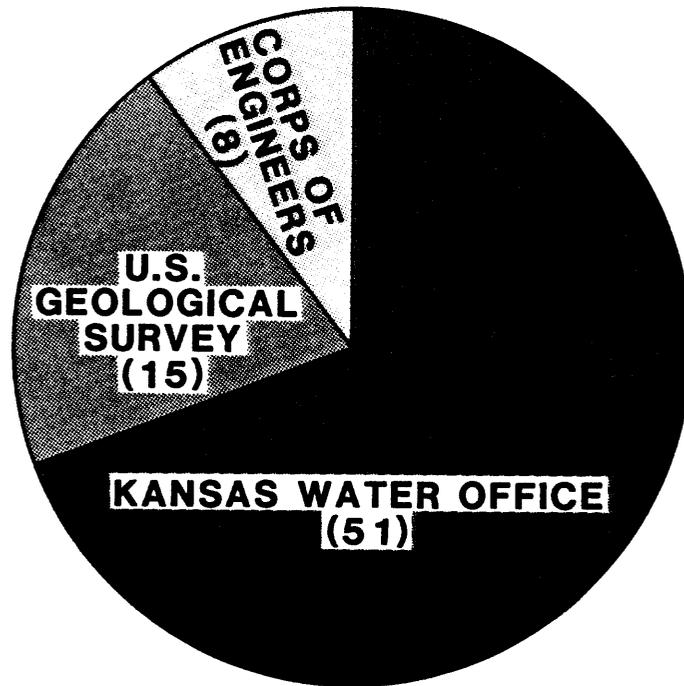


Figure 11.--Number of surface-water-quality and sediment sampling sites in Kansas supported by cooperators during 1985 water year.

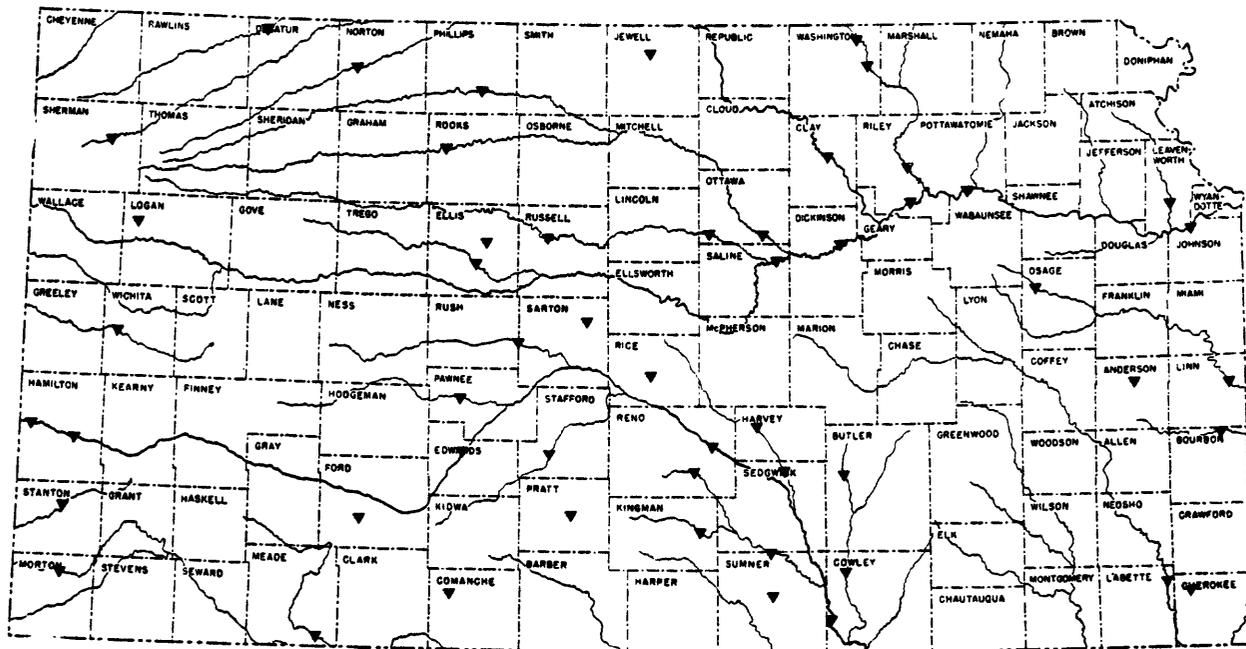


Figure 12.--Location of surface-water-quality and sediment sampling sites for 1984 water year.

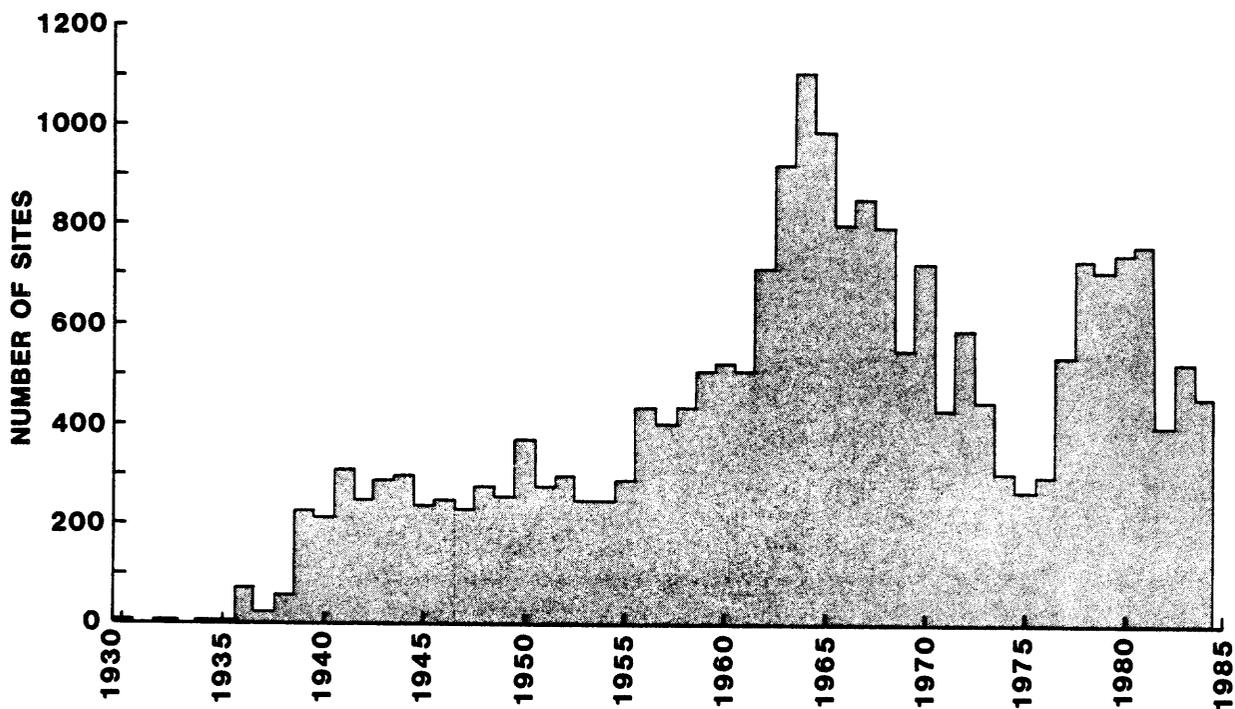


Figure 13.--Number of surface-water-quality and sediment sampling sites in Kansas, 1930-84 water years.

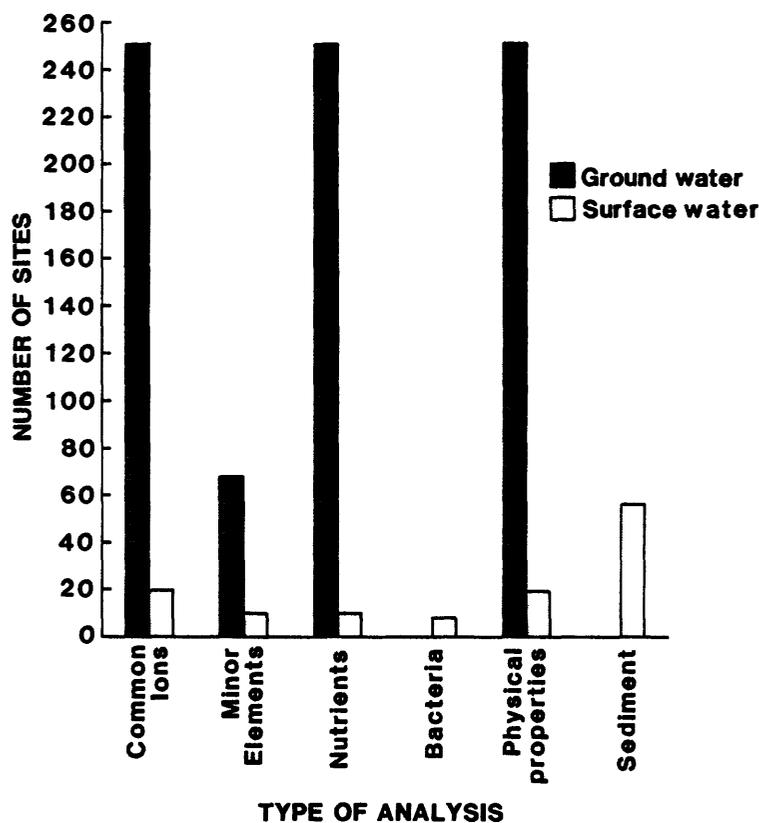


Figure 14.--Number of sampling sites in Kansas for each type of water-quality analysis, 1985 water year.

Rainfall Data

A network of continuous-recording rain gages are maintained and funded primarily by the Kansas Water Office. The location of network data-collection sites is shown in figure 15.

Special-Purpose Data

Three special-purpose categories of data-collection activities are supported by the U.S. Geological Survey's Federal program in Kansas. The largest of these in terms of funding and number of monitoring sites is the National Stream-Quality Accounting Network (NASQAN). The NASQAN monitoring sites, seven of them in Kansas, are intended to document the general water quality at locations on major streams throughout the Nation in order to determine whether the quality of the Nation's surface waters is deteriorating, improving, or remaining unchanged. Another national network that documents water quality is the Hydrologic Bench-Mark Network, which monitors the natural quality of streams draining representative natural basins. Hydrologic bench-mark basins are those that have no artificial storage or diversions, have insignificant ground-water pumpage, and in which human activity does not affect streamflow or water quality. Kansas has one hydro-

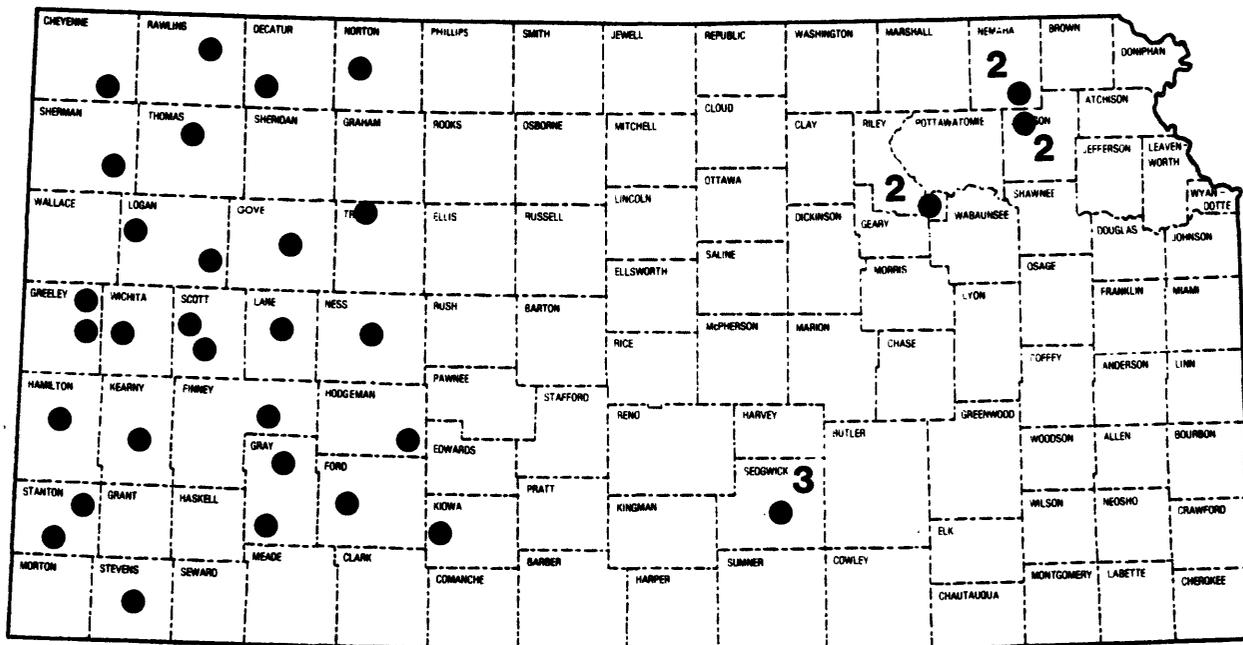


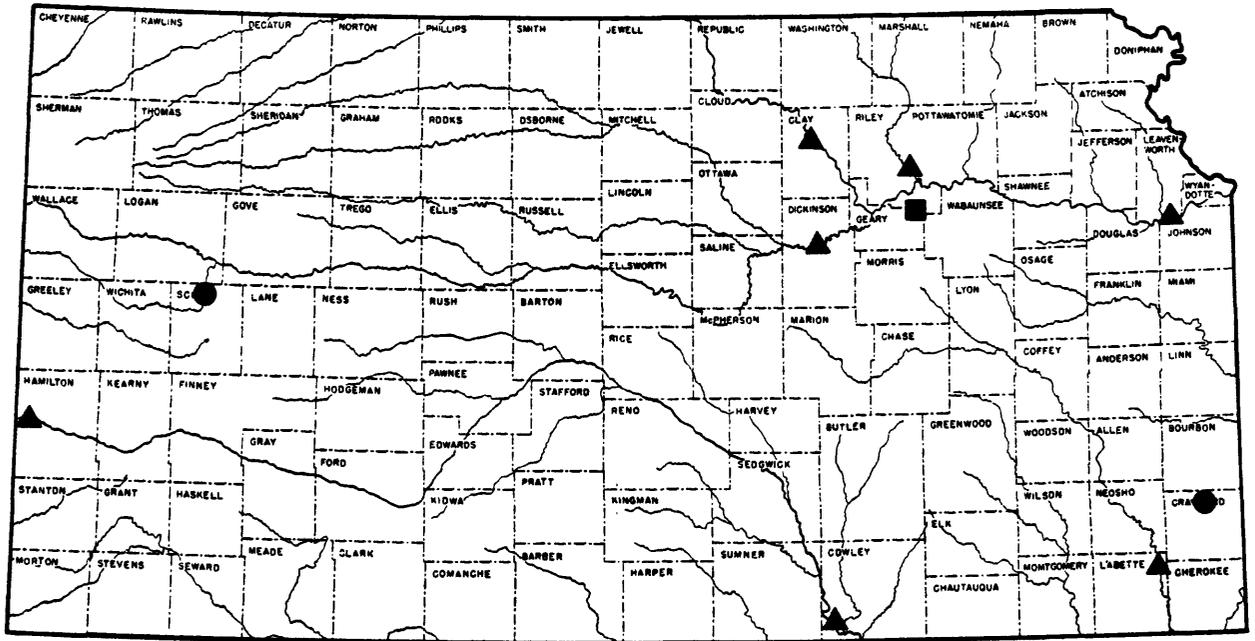
Figure 15.--Location of rainfall data-collection sites, 1984 water year.

logic bench-mark station located in the Konza Prairie Research area (Riley County) administered by Kansas State University at Manhattan. The other special-purpose data program in the U.S. Geological Survey's Federal program in Kansas is called the National Atmospheric Deposition Program, initiated to document the potential for acid-rain formation throughout the Nation. Data-collection sites designated by this program document the quality of wetfall and dryfall on a synoptic basis nationwide.

The location of special-purpose data-collection sites are shown in figure 16. The frequency of sampling is bimonthly for the NASQAN stations, except the one on the Arkansas River in Hamilton County, which is quarterly. The hydrologic bench-mark station is sampled quarterly. The atmospheric deposition sites are sampled at 9:00 a.m. every Tuesday.

Real-time Data Transmission

There has always been a need for "real-time" information by water-resource managers and forecasting agencies. Development of new technologies in instrumentation for monitoring and remote transmission of hydrologic information has increased the interest in the real-time transmission of data. Newly acquired computer-, electronic-, and satellite-communication facilities enable the U.S. Geological Survey to provide reliable and accurate real-time data. The current system relies on the transmission of hydrologic data from a streamflow-gaging station to a satellite, which



- ▲ National Stream-Quality Accounting Network Station (NASQAN)
- National Hydrologic Bench-Mark Station
- National Atmospheric Deposition Program

Figure 16.--Location of special-purpose data-collection sites.

in turn transmits the information to a computer-receiving station on the ground. The computer at the receiving station then transmits the data by telecommunications to a local computer in Kansas or other states. Cooperators then have continuous access to the information through the U.S. Geological Survey computer system. Presently, the U.S. Army Corps of Engineers funds most of the real-time data-transmission sites in Kansas. The location of these sites is shown in figure 17.

Network Analysis

An evaluation of the data program is made periodically to assure that the data-collection sites are effective in providing hydrologic information to Kansas. The objective in any network evaluation is to answer two questions:

1. What is the sacrifice in information for a given decrease in data-collection effort?
2. What is the additional information gained for a given increase in data-collection effort?

There have been three network evaluations since 1983. The first was an evaluation of the operation of the surface-water data program (Medina and

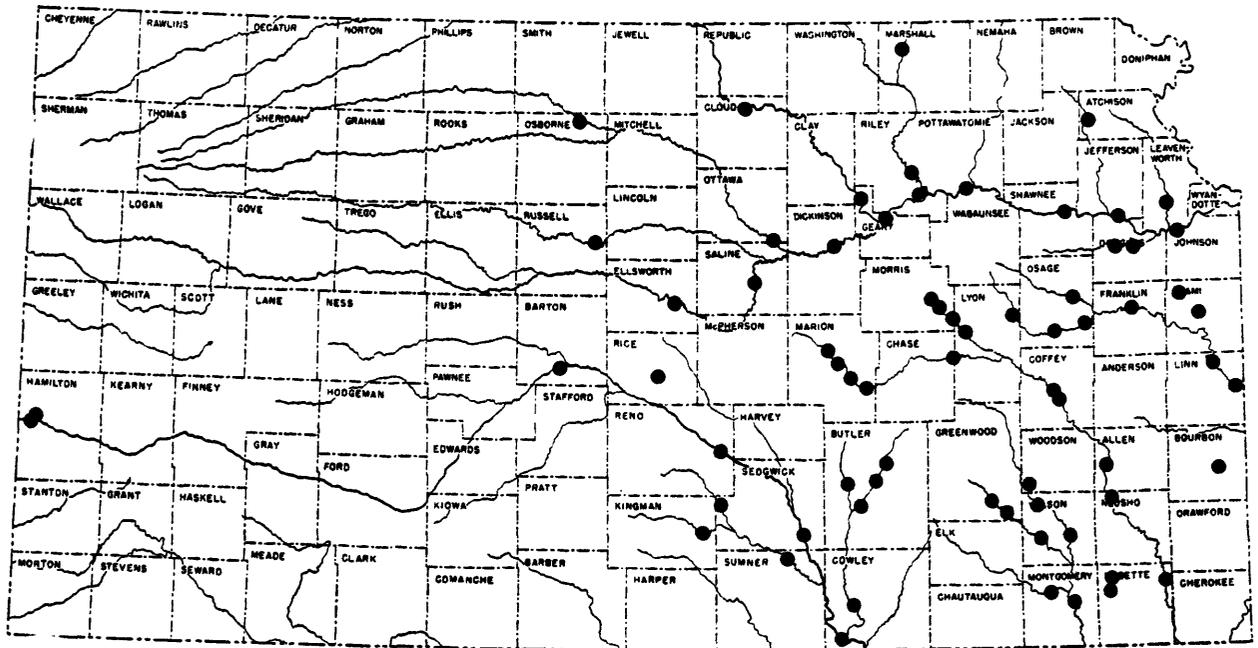


Figure 17.--Location of real-time data-transmission sites for 1985 water year.

Geiger, 1984). Adjustments to the surface-water data-collection program are being made based on the results of this study. Also, an evaluation of the sediment-data network has been completed (Jordan, 1985), and the Kansas Water Office is in the process of working with the U.S. Geological Survey to make appropriate adjustments to the sediment-data network. Finally, an analysis of the surface-water network related to its effectiveness in providing regional hydrologic information has recently been completed (K. D. Medina, U.S. Geological Survey, written commun., 1985). An evaluation of the ground-water network was conducted in 1983 (T. B. Spruill, U.S. Geological Survey, written commun., 1985), and appropriate adjustments were made to the ground-water data network.

Water-Use Data

Documentation of water use is the means by which water-resources management establishes its goals for planning and operation of water supplies. The water-use program in Kansas is directed toward the following objectives:

- * development of improved monitoring methods through instrumentation;
- * statistical sampling of ground-water pumpage in selected irrigation areas;

- * identification of crops and irrigated areas through remote sensing;
- * determination of crop water requirements; and
- * use of computer software for data compilation and annual reporting.

The U.S. Geological Survey documents water use in Kansas for the following categories:

- * irrigation
- * industry
- * public supply
- * domestic
- * stock
- * recreation
- * power

Water-use data efforts are dominated by the need for irrigation water-use information because it is the major use in Kansas and accurate data are difficult to obtain.

Distributed Information System

The U.S. Geological Survey has an obligation to make all the data it collects available to the public. To meet that obligation, an annual water-data report is published (Geiger and others, 1984). In addition to the annual data report, a national data base is maintained on the U.S. Geological Survey computer system that is accessible by cooperators and the public upon request. The data base that provides this service is the National Water Data Storage and Retrieval System (WATSTORE). Prior to 1984, all information in the WATSTORE system was processed and stored on a mainframe computer system at Survey headquarters in Reston, Virginia. Since 1984, the U.S. Geological Survey has developed a new direction in data processing and storage. This new direction involves the establishment of a distributed-information concept in which data are not centrally processed but are processed locally, and a communication link is provided to integrate the data base by providing computer access to each local processing system. The U.S. Geological Survey's new system is called the Distributed Information System (DIS). Cooperators may obtain access to the DIS upon request, just as they have with WATSTORE in the past.

INTERPRETIVE PROJECTS AND RESEARCH

Interpretive projects and research in the Federal-State cooperative program are synonymous with "problem solving" and involve varying levels and degrees of research and applied research. These problems are usually associated with an identified water-resources need, which if solved will provide an answer, or information, about hydrologic systems or processes. This information then can be used to guide or suggest courses of action that will best manage or protect the water resources of Kansas. In con-

ducting these project activities to solve problems, the U.S. Geological Survey, in cooperation with State and local governments and with other Federal agencies, collects hydrologic data, conducts resources appraisals and research, disseminates water data and results of studies, coordinates activities of Federal agencies in the acquisition of water data, and provides scientific and technical assistance.

Projects are conducted through completion by the assignment of a project chief. Support personnel are provided as needed and include hydrologic technicians and technical-staff assistance. Assistance provided by District, Regional, and Headquarters technical staff can substantially improve the design and results of a project. These Survey staff members are organized at each level by hydrologic discipline, such as surface water (fig. 18). In addition, they usually have a background in all hydrologic disciplines because of their previous activities on multi-discipline project work. Project personnel may obtain assistance from Region or Headquarters at any time for ongoing project work or for planning anticipated work.

Once a project is formulated and all goals are clearly defined, the project chief and the District staff monitor the progress of a project by completion of work units, or milestones. These milestones usually mark completion of such activities as data collection and analysis, modeling, and report writing. The report--the principal product of the project--is

PROJECT TECHNICAL SUPPORT

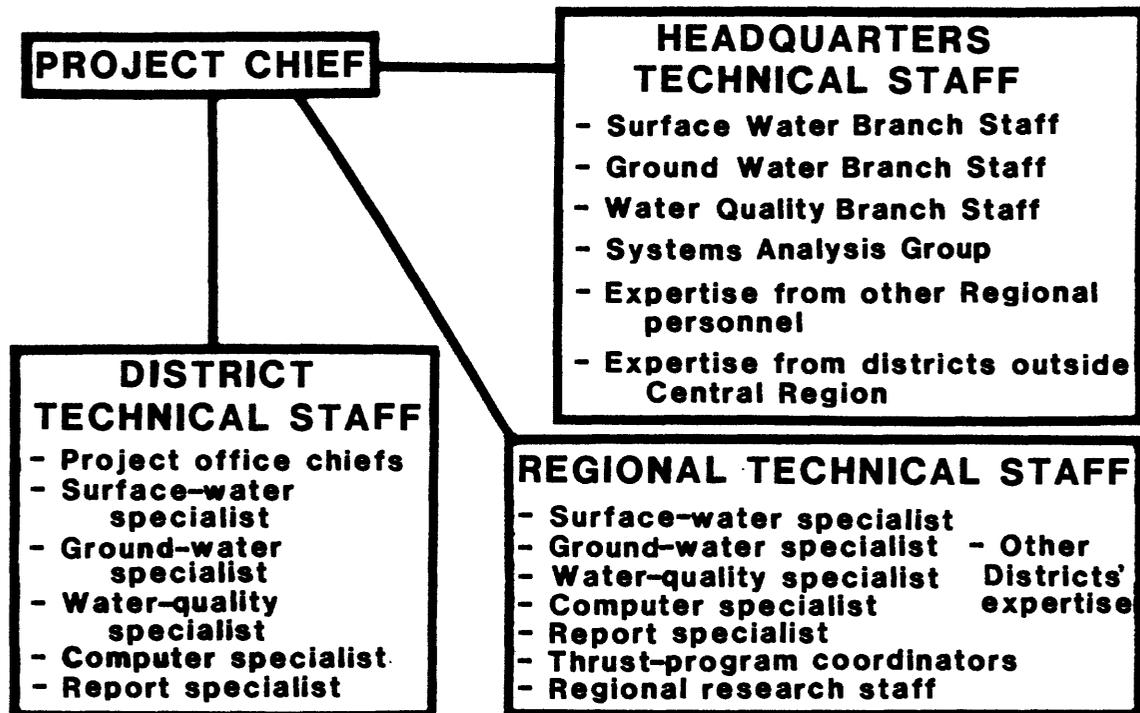


Figure 18.--Levels of project technical support in the Water Resources Division of the U.S. Geological Survey.

produced, evaluated, and approved at several different levels. District staff review and guidance is carried out throughout the report-preparation process to insure technical quality control and timeliness of the report. A formal colleague review is scheduled when the report has met Survey standards. After the author has responded to colleague-review comments, the report is made available to the cooperator for review. Next the report undergoes review and approval by Regional and Headquarters staff. After Director's approval is obtained, the final report is published and released to the public. This process is illustrated in figure 19.

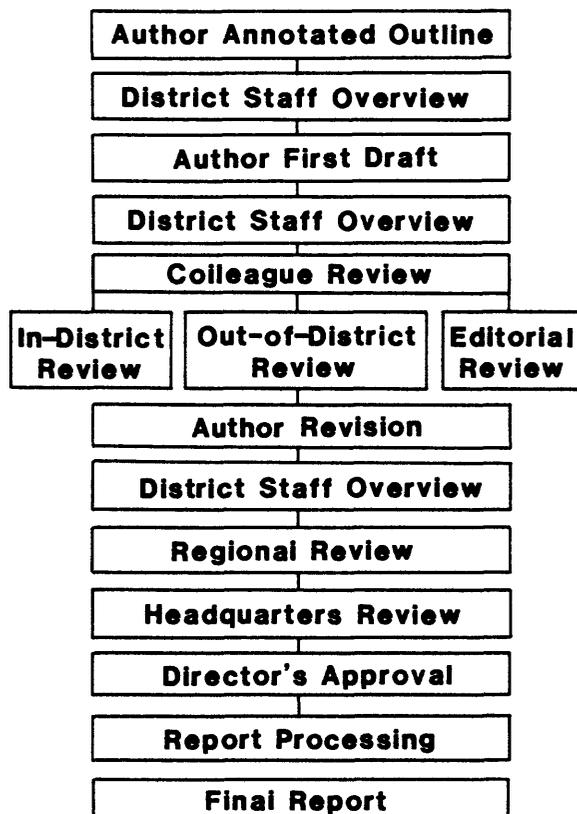


Figure 19.--Report-preparation and review process.

During 1980-85, the U.S. Geological Survey in Kansas published 106 water-related reports (fig. 20). This total included 81 interpretive reports and 25 data reports. Topics of the reports included stream-aquifer interaction, application of remote-sensing techniques in selected coal-mined areas, determination of irrigation pumpage, nitrate concentrations in ground water, natural ground-water recharge, flood-frequency analysis, urban effects on stream-water quality, and assessment of water resources in lead-zinc mined areas in southeast Kansas. Study areas ranged from small, local natural-recharge sites to areas that included the entire State. The number of reports published by the U.S. Geological Survey on the hydrology of Kansas have varied from year-to-year but have averaged about 18 annually during the last 10 years. In general, the number of reports produced has increased per unit of program dollar. A listing of the reports

published and/or prepared by the U.S. Geological Survey is given in the report "Water-resources reports prepared by or in cooperation with the U.S. Geological Survey from 1886 to 1983" (Combs, 1985b). An insert for 1984 was provided in the seminar material.

Specific interpretive-project activities are listed in table 3. The projects are categorized based on completion since July 1984, or ongoing as of July 1985.

FEDERAL PROJECTS AND THRUST PROGRAMS IN KANSAS

Federal funds are appropriated by Congress to the U.S. Geological Survey and are identified in the budget for specific objectives. Also, the U.S. Geological Survey is funded by other Federal agencies for hydrologic studies. These activities provide hydrologic information to Kansas in addition to and independent of the Federal-State Cooperative Program. The U.S. Geological Survey's Federal program and other Federal-agency activities accounted for 36.8 percent of the total program in Kansas during fiscal year 1984.

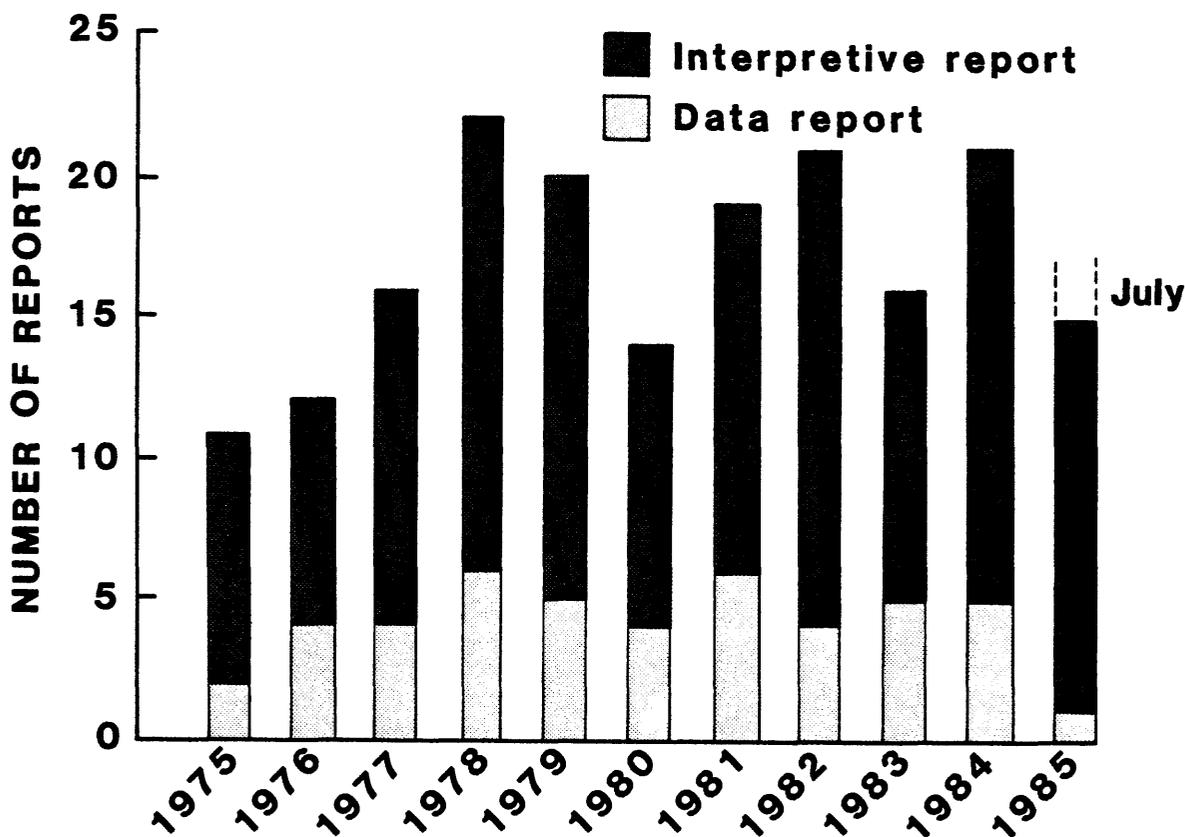


Figure 20.--U.S. Geological Survey report productivity in Kansas, 1975-85.

Table 3.-- Synopsis of interpretive projects in the Federal-State cooperative program that were selected for seminar presentation

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|------------------------------------|-----------|---|--|--|
| Projects completed since July 1984 | | | | |
| Quality of urban runoff | L. Pope | The effects of urbanization on receiving streams need to be defined. | Establish a data base of hydrology and land use; determine variability in water quality of urban streams; develop relationships between land use and runoff quality. | Urban water-quality data and statistical summaries for selected sites in the Shunganunga Creek basin (Pope and others, 1983) |
| Quality of supply lakes | L. Pope | Formation of trihalomethanes from chlorination processes makes the knowledge of trihalomethane in supply lakes important. | Define water-quality characteristics of selected supply lakes; develop relationships between lake water quality and lake physical characteristics; develop relationships between trihalomethane formation and lake physical characteristics. | Relations of urban land-use and dry-weather, storm, and snowmelt flow characteristics to stream-water quality, Shunganunga Creek basin (Pope and Bevans, 1984) Water-quality renaissance of selected water-supply lakes in eastern Kansas (Pope and others, 1985) |

Table 3.--Synopsis of interpretive projects in the Federal-State cooperative program that were selected for seminar presentation--Continued

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|--|------------|---|--|---|
| Projects completed since July 1984--Continued | | | | |
| Effects of irrigation return flow on water quality | T. Spruill | Possible changes in quality of ground and surface water due to agricultural practices need documenting. | Statistically summarize and describe chemical quality of ground water and base flow in three selected irrigation districts; detect possible long-term effects of irrigation on ground-water and base-flow quality. | Statistical evaluation of the effects of irrigation on quality of ground water and base flow of three stream basins in north central Kansas (Spruill, 1985) |
| Flood volume and high-flow volume | R. Clement | High-flow information is needed for design and evaluation of flood control and water supply on gaged and ungaged streams. | Develop relationships between peak discharge, physical, climatic, and basin characteristics and observed streamflow volumes. | A method of estimating flood volume western Kansas (Perry, 1984) Magnitude and frequency of high flows of unregulated streams in Kansas (Jordan, 1984) |
| Transit loss and traveltime | T. Stiles | Components of the natural flow system and impacts of reservoir releases need to be defined to properly manage water supply. | Define characteristics of movement of water between stream, aquifer, and atmosphere; quantify flow augmentation and reservoir storage requirements during droughts; evaluate effects of changes in | Transit losses and traveltimes for releasing reservoir releases during drought conditions along the Neosho River from Council Grove Lake to Iola, east-central Kansas (Carswell and Hart, 1985) |

Table 3.--Synopsis of interpretive projects in the Federal-State cooperative program that were selected for seminar presentation--Continued

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|------------------------------------|----------------|---|--|--|
| Transit loss and traveltime--Cont. | T. Stiles | Projects completed since July 1984--Continued | | Availability of natural and regulated streamflows for in-stream uses during historical droughts, lower Neosho River, southeastern Kansas (Hart and Stiles, 1984) |
| Ground-water recharge | M. Sophocleous | The magnitude of natural recharge is not well known but is important in determining the potential for withdrawal of ground water. | Investigate mechanisms of natural recharge; quantify recharge rates; compare field and laboratory measurements with model results. | Experimental studies in natural ground-water recharge dynamics--Assessment of recent advances in instrumentation (Sophocleous and Perry, 1984) |
| | | | Experimental studies in natural ground-water recharge dynamics--The analysis of observed recharge events (Sophocleous and Perry, 1985) | |
| | | | | Natural ground-water instrumentation and computation at sites in south-central Kansas (in preparation) |

Table 3.--Synopsis of interpretive projects in the Federal-State cooperative program that were selected for seminar presentation--Continued

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|--|--------------|--|---|--|
| Ongoing projects as of July 1985 | | | | |
| Equus beds transport and flow modeling | R. Hart | Demands on the Equus Beds for water supply is expected to increase and the capability of the aquifer to meet the demands needs to be better defined. | Describe the flow system in the Equus Beds and underlying Wellington aquifers; define the movement of chloride ion through the Equus Beds aquifer. | Model analysis of ground-water flow and solute transport in the Equus Beds area south-central Kansas (in preparation) |
| Analysis of salinity in Wellington aquifer near Salina | J. Gillespie | Saline ground water is discharged to the Smoky Hill River, and this process needs to be better understood. | Define more accurately the areas of brine movement; estimate the volume of brine moving eastward in the Wellington; define any areas of saline water in the alluvial aquifer; determine location of relief wells to intercept brines moving into the alluvium and the Smoky Hill River. | Geohydrology of the Wellington-alluvial aquifer system and simulated effects of relief wells on saline ground-water discharge to the Smoky Hill River near Salina, central Kansas (in preparation) |
| Injection potential of Arbuckle Group | J. Carr | Impacts of waste injection into the Arbuckle need evaluating. | Define the general regional geohydrology; assess the potential for large-scale waste injection to evaluate the potential effects of waste injection on overlying aquifers and freshwater in south-central Kansas. | Preliminary data from Arbuckle test wells, Miami, Douglas, Saline, and Labette Counties, Kansas (Gogel, 1981) Geohydrology of the Arbuckle Group in Kansas (in preparation) |

Table 3.--Synopsis of interpretive projects in the Federal-State cooperative program that were selected
seminar for presentation--Continued

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|---|-----------|--|---|---|
| Ongoing projects as of July 1985--Continued | | | | |
| Glacial deposits | J. Denne | Bedrock formations contain little if any freshwater, but large quantities may be available from buried glacial deposits if their extent, loca- | <p>(1) Locate and delineate major Pleistocene aquifers of northeastern Kansas, (2) determine ground-water levels in and saturated thicknesses of these aquifers, (3) analyze the Pleistocene stratigraphy and character of the glacial deposits, (4) analyze the quality of waters contained in the Pleistocene aquifers, (5) determine current municipal, agricultural, and industrial usage of the aquifers, and (6) evaluate future potential of the aquifers as water supplies.</p> | The hydrogeology and geochemistry of glacial deposits in northeastern Kansas (in preparation) |

Table 3.--Synopsis of interpretive projects in the Federal-State cooperative program that were selected
seminar for presentation--Continued

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|---|------------|--|---|--|
| Ongoing projects as of July 1985--Continued | | | | |
| Evaluation of hazardous-waste sites | T. Spruill | Hazards to health and the environment from hazardous-waste disposal need to be determined. | Compile site history and hydrogeologic and chemical-quality information to evaluate possible contamination at hazardous-waste sites; identify principal contaminants associated with specific types of waste sites. | Evaluation of potential hazardous-waste sites in Kansas (in preparation) |
| Flood-frequency analyses | R. Clement | Flood magnitude and frequency need defining to assist in highway and drainage design; floodplain management and determination of flood risk. | Define flood-frequency characteristics of gaged streams in Kansas; maintain a data base of flood information; develop methods for estimating flood-frequency characteristics at ungaged sites. | Determination of flood-frequency characteristics on unregulated streams in Kansas, with estimation techniques for ungaged locations (in preparation) |

Table 3.--Synopsis of interpretive projects in the Federal-State cooperative program that were selected for presentation--Continued

| Project short title | Presenter | Problem | Objectives | Reports published or in preparation |
|---------------------------|-----------|--|---|---|
| Sedgwick County hydrology | H. Bevans | Current hydrologic information is needed to provide a scientific basis for managing water resources. | <p>Ongoing projects as of July 1985--Continued</p> <p>Document the current quantity and quality characteristics of the water resources; determine the extent and causes of historic changes in water-resources characteristics; evaluate water resources with respect to water-supply requirements.</p> | <p>Water-resources characteristics in Sedgwick County, Kansas (in preparation)</p> <p>Water supply and demand in Sedgwick County, Kansas (in preparation)</p> |

Other Federal agencies that cooperate with the U.S Geological Survey are the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and the U.S. Environmental Protection Agency. The Corps of Engineers provides funding for the operation of streamflow-gaging stations and data-collection platforms. The Bureau of Reclamation has funded studies to evaluate various management alternatives for stream-aquifer systems in the North Fork and South Fork Solomon Rivers and for the operation of one streamflow-gaging station. The Environmental Protection Agency has funded computerized contouring of depth to water for selected counties in the United States. The U.S. Geological Survey's Federal program in Kansas includes the National Water Data Exchange (NAWDEX), an index of computerized water information, hydrologic data collection and analysis, hydrology in coal areas, acid-rain data, regional aquifer system analyses, and toxic-substances hydrology.

The U.S. Geological Survey's Federal program in data collection includes the National Stream-Quality Accounting Network (NASQAN) and the hydrologic bench-mark network. These are part of the nationwide data networks for water-quality monitoring.

The coal-hydrology program was initiated to provide water data and hydrologic information needed to evaluate the effects of mining and reclamation on streams and aquifers and to aid in the leasing and permitting process for mining coal on Federal lands. Coal deposits in Kansas are not on Federal lands, but they are located in the Western Region of the Interior Coal Province (fig. 21) in east-central and southeast Kansas. The U.S. Geological Survey has either contributed independently or jointly to 11 reports on coal hydrology in the State. Eight of the reports were part of

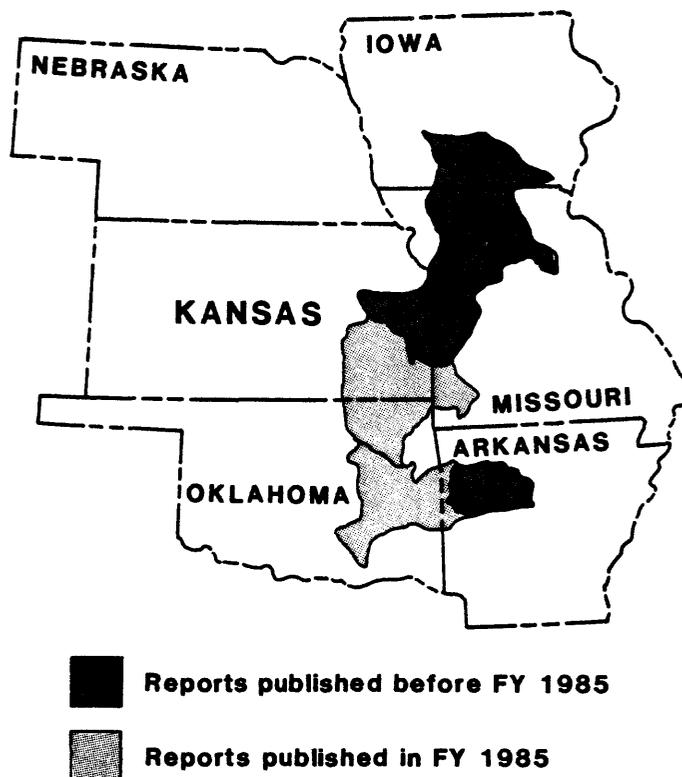


Figure 21.--Study area of coal deposits in the Western Region, Interior Coal Province.

the Federal coal program and three were part of the Federal-State cooperative program with the Kansas Department of Health and Environment or the Kansas Geological Survey.

A Regional Aquifer System Analysis (RASA) is a systematic study of a number of regional ground-water systems that represent a significant part of the Nation's water supply. The purpose of the program is to provide the necessary information to develop and manage water resources from a regional perspective. Two of the 13 RASA projects in the Nation are underway in Kansas--the High Plains and the Central Midwest projects. The High Plains project is headquartered in Denver, Colorado, and the Kansas portion is directed out of the Survey office in Garden City, Kansas. The Central Midwest project is headquartered in Lawrence, Kansas, and the Kansas portion is directed out of Lawrence.

The Ogallala Formation is the uppermost and principal geologic unit in the High Plains aquifer (fig. 22). A digital model of the High Plains aquifer was developed by the Survey to define the general flow pattern and aquifer characteristics. The general water quality of the aquifer also was determined. Eight reports on the High Plains aquifer in Kansas have been prepared (see "Selected References").

Another RASA study presently underway is the Central Midwest RASA study, which encompasses parts of 10 states and all of Kansas (fig. 23). The focus of the Kansas project is on the hydrology of the freshwater, brackish-water, and saline-water aquifer systems in rocks of Cambrian-Ordovician to Cretaceous ages that underlie the High Plains aquifer in the western part of Kansas. The Dakota aquifer is being investigated as a

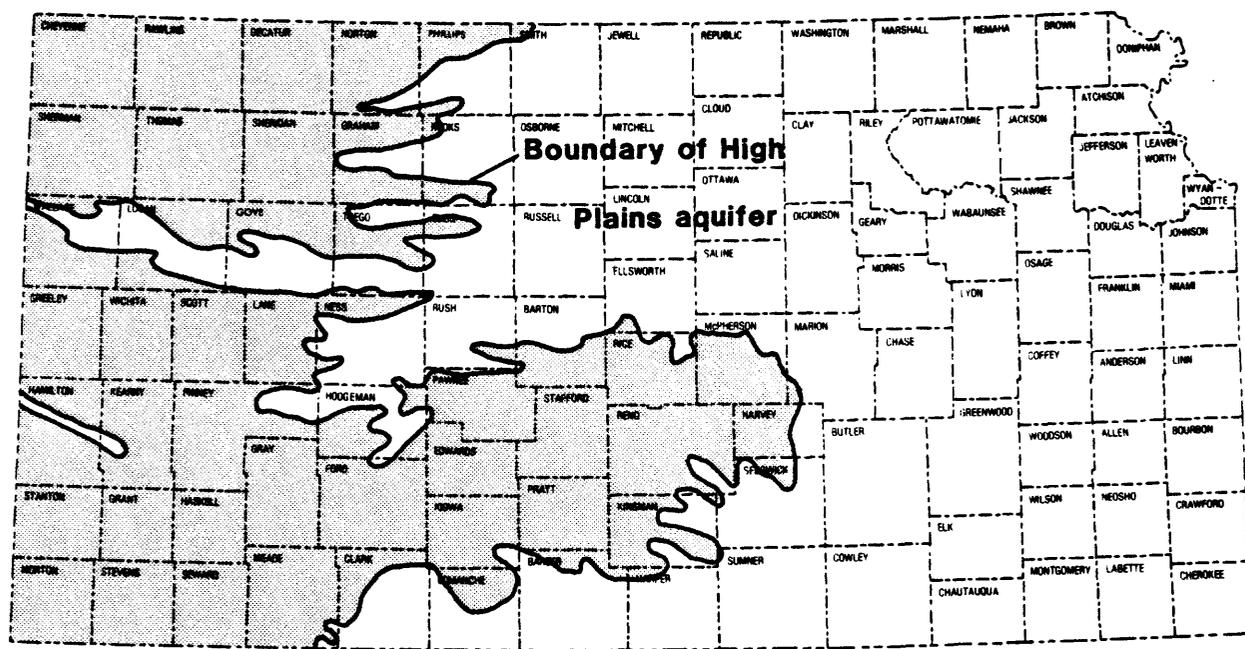


Figure 22.--Area underlain by High Plains aquifer and included in Kansas portion of the High Plains RASA study.

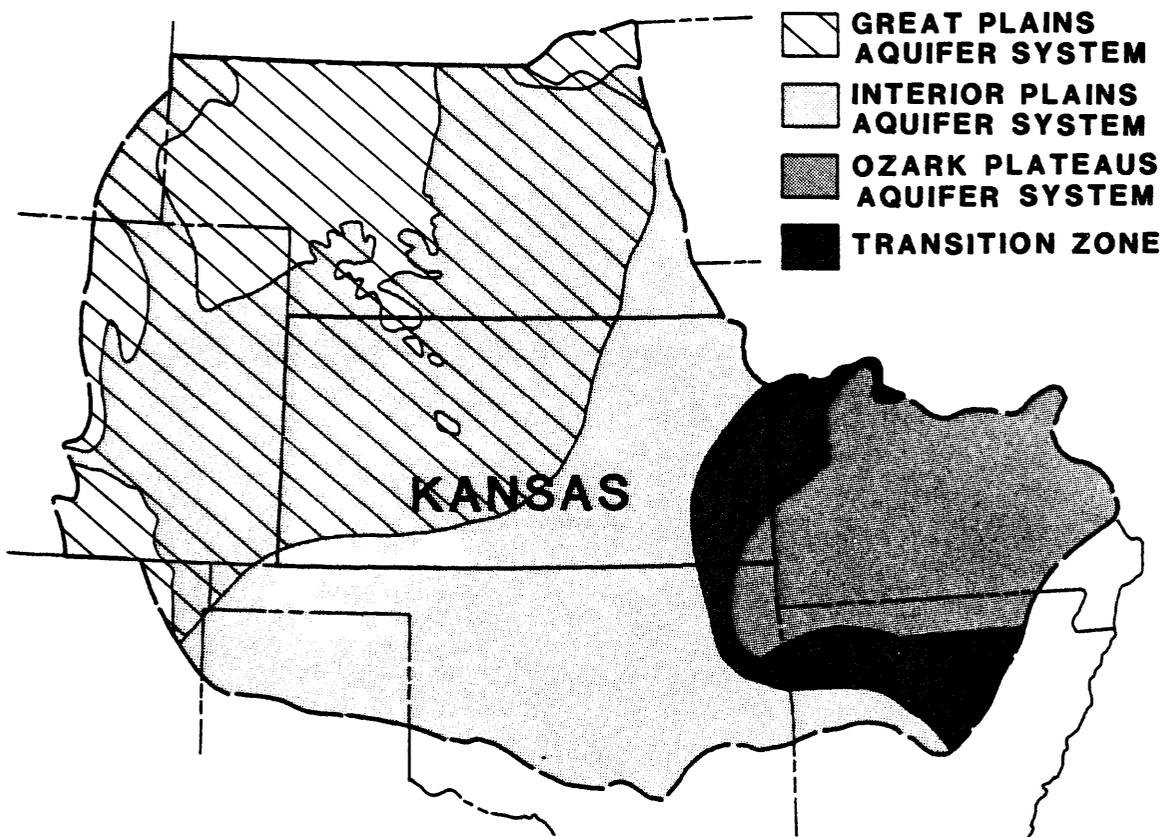


Figure 23.--Area included in the Central Midwest RASA study.

potential source of water supply to supplement the limited High Plains aquifer. Five reports are in progress for the Central Midwest project in Kansas.

Toxic-waste ground-water hydrology programs include the national appraisal of ground-water quality. There are 14 national appraisals, one of which is a study of the High Plains aquifer in Kansas. The purpose of the study is to evaluate the impacts of land use on ground-water quality. Initial studies are of a reconnaissance nature. The study in Kansas is related to agricultural and petroleum activities in the western part of the State. Project work began in 1984 and is continuing. The project is being conducted from the Survey office in Garden City. A draft of an interim report describing the results of studies on agriculture has been prepared, and a report on the results of ground-water studies relating to the petroleum industry will follow.

FINAL REMARKS

The July 1985 seminar resulted in a thorough overview of U.S. Geological Survey programs in Kansas and provided the initial step in a continued effort toward increased coordination between Federal and State water agencies. Discussions indicated that subsequent seminars should provide a balanced forum where all participants contribute to discussions related to priorities of the Federal-State Cooperative Program from their agency's perspective.

There is a tendency for individual agencies, both Federal and State, to become narrower in perspective and to limit their interests to short-term priorities. The U.S. Geological has an obligation to the public to be persistent in its efforts to provide long-term direction to water-resource information-gathering activities as State-agency priorities change with time. Hydrologic analysis often requires an uninterrupted flow of information for extended periods of time to be of any value. Therefore, State agencies need to be sensitive to the collective needs for information by individual programs and to continually resist the temptation for parochialism, which increases the potential for loss of hydrologic information to the State.

The initial momentum has been provided for an annual discussion and coordination of individual agency programs in water resources. The Kansas Water Office and the U.S. Geological Survey will continue to provide an opportunity for information transfer on a timely basis in the future.

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