WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1983 AND 1984

Compiled by L. J. Combs

U.S. GEOLOGICAL SURVEY

Open-File Report 85-178

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1985

UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

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ABSTRACT

The principal mission of the U.S. Geological Survey, Water Resources Division, in Kansas is to investigate the occurrence, quantity, quality, distribution, and movement of surface and ground waters throughout the State. Primary activities include the systematic collection, analysis, and interpretation of hydrologic data, evaluation of water demands, and water-resources research. Hydrologic investigations are conducted through four basic types of projects: (1) data-collection programs, (2) local or areal investigations, (3) statewide or regional investigations, and (4) research projects. These projects are funded through cooperative agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds.

Fifty water-related projects were ongoing during fiscal years 1983 and 1984 in Kansas. This report describes for each of these water-resources activities the problem that initiated the study, the objectives of the project, and the approach designed to achieve these objectives. Information on data-collection stations in Kansas is presented in maps and tables. A list of the 40 reports approved for publication by the U.S. Geological Survey, its cooperators, or technical and scientific organizations during 1983 and 1984 is provided.

INTRODUCTION

The Organic Act of March 3, 1879, established the U.S. Geological Survey as a separate Bureau of the Department of the Interior. The Survey's principal mission became (1) the classification and survey of public lands, (2) the examination of the geologic structure and the mineral resources of the national domain, and (3) the determination of the water resources of the United States. Seven years later, in 1886, the first water-resources investigation by the U.S. Geological Survey in Kansas was completed by A. C. Peale. A cooperative program with the Kansas State Board of Irrigation and Surveys instituted the first stream-gaging stations in western Kansas during 1895. The gaging program was extended to eastern Kansas in 1899.

From these early beginnings, the U.S. Geological Survey has expanded its work in Kansas to meet the growing demand for scientific data by Federal, State, and local agencies for use in the management of one of the State's most precious resources--water. The Kansas District, with headquarters in Lawrence and a subdistrict office in Garden City (fig. 1), investigates the occurrence, quantity, quality, distribution, and movement of surface and ground waters. Its activities include the systematic collection, analysis, and interpretation of data; the investigation of water demand for public supply, industrial, domestic, and agricultural purposes; and the research and development of new techniques to improve the scientific basis of data collection and investigative principles.

Hydrologic-data collection and analyses and investigative studies are conducted at project offices in Lawrence and Garden City. Hydrologic data management, the district sediment laboratory, computer applications, and the scientific reports section are centered at the District office in Lawrence. The fiscal year for Federal government operations extends from October 1 of each year to September 30 of the following year. In publications of the U.S. Geological Survey, this time period is also known as a water year.

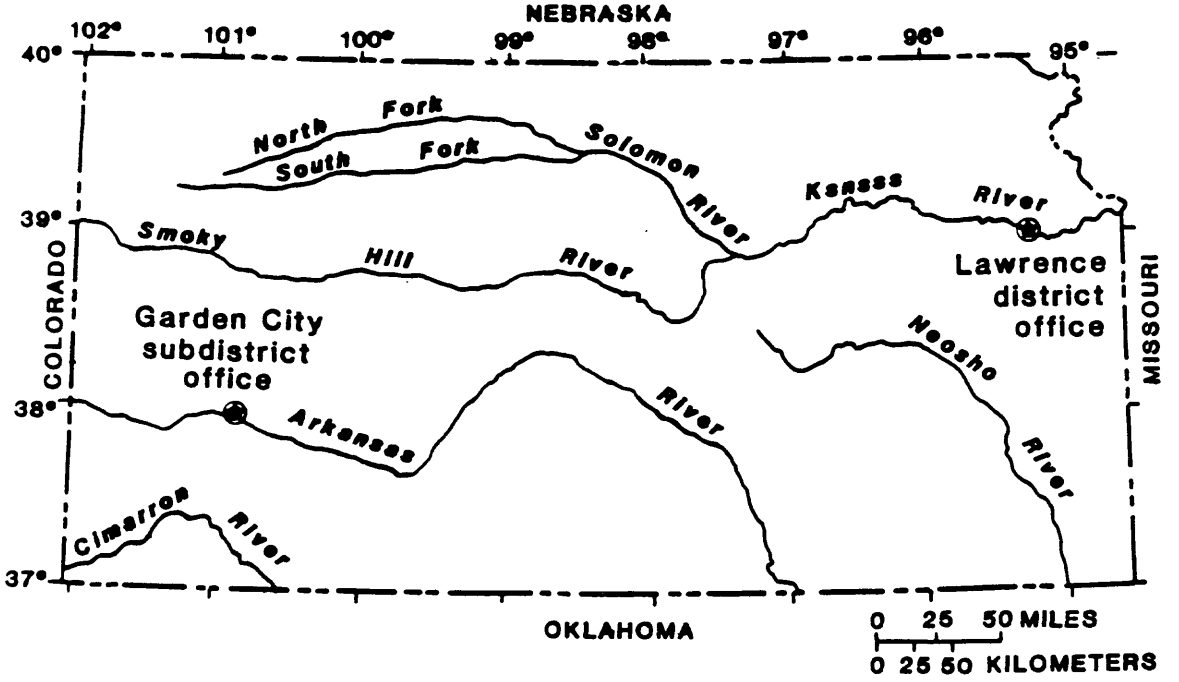


Figure 1.--Location of offices of the U.S. Geological Survey in Kansas.

PROGRAM FUNDING AND COOPERATION

Moneys for program operation of the U.S. Geological Survey in Kansas come from joint-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal allotments to the U.S. Geological Survey. Distribution of funding for program operation in FY83-84 is illustrated in figure 2. Those agencies cooperating with the U.S. Geological Survey in Kansas during the 1983 and 1984 fiscal years were:

State and local agencies

Kansas Geological Survey
Kansas Water Office
Kansas State Board of Agriculture, Division of Water Resources
Kansas Department of Health and Environment
City of Hays
City of Wichita
Western Kansas Groundwater Management District No. 1
Southwest Kansas Groundwater Management District No. 3
Kansas-Oklahoma Arkansas River Commission
Arkansas River Compact Administration
Harvey County

Federal agencies

U.S. Department of Army, Corps of Engineers
U.S. Bureau of Reclamation

PUBLICATIONS

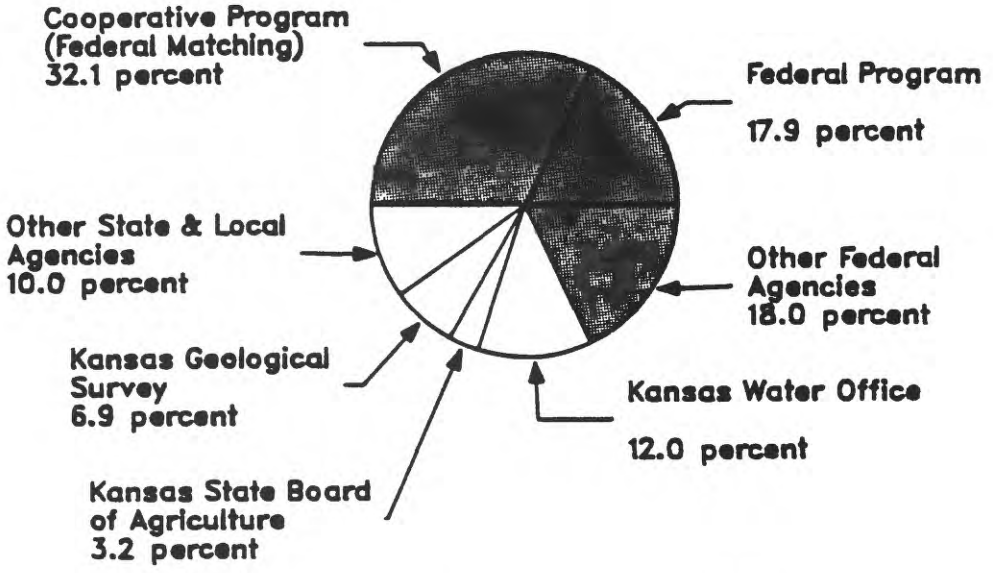
Water-resources data and the results of hydrologic investigations in Kansas are published or released either by the U.S. Geological Survey, by cooperating agencies, or by journals of technical and scientific organizations. Requests for such information and for publications resulting from past or present investigations of the U.S. Geological Survey in Kansas should be addressed to one of the following:

District Chief
U.S. Geological Survey
Water Resources Division
1950 Constant Avenue - Campus West
Lawrence, Kansas 66046
Phone: 913-864-4321

Subdistrict Chief
U.S. Geological Survey
Water Resources Division
206 Fulton Terrace
Garden City, Kansas 67846
Phone: 316-275-4123

U. S. GEOLOGICAL SURVEY
SUMMARY OF KANSAS DISTRICT PROGRAM

Federal Fiscal Year 1983



Federal Fiscal Year 1984

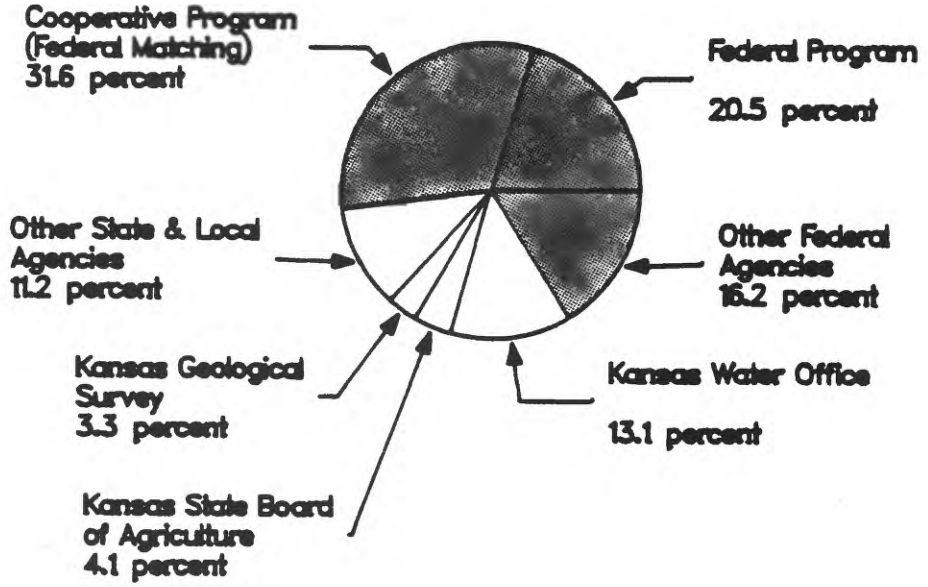


Figure 2.--Distribution of funding for the water-resources program of the U.S. Geological Survey in Kansas, fiscal years 1983 and 1984.

The U.S. Geological Survey also conducts an extensive topographic mapping program in Kansas from its regional office in Rolla, Missouri. Standard quadrangle maps published in the 7 1/2- and 15-minute series provide coverage for the entire State. To obtain an index to these topographic quadrangles or to purchase the maps, contact:

Kansas Geological Survey
Publications Sales, 4th Floor
1930 Constant Avenue - Campus West
Lawrence, Kansas 66046

For additional information on the U.S. Geological Survey's mapping program in Kansas, write to:

Mid-Continent National Cartographic Information Center
U.S. Geological Survey
1400 Independence Road
Rolla, Missouri 65401

Studies in Kansas to investigate the frequency and extent of flooding have resulted in delineation of the 100-year flood boundary on selected topographic quadrangle maps (fig. 3). These maps are available from the Kansas District office in Lawrence.

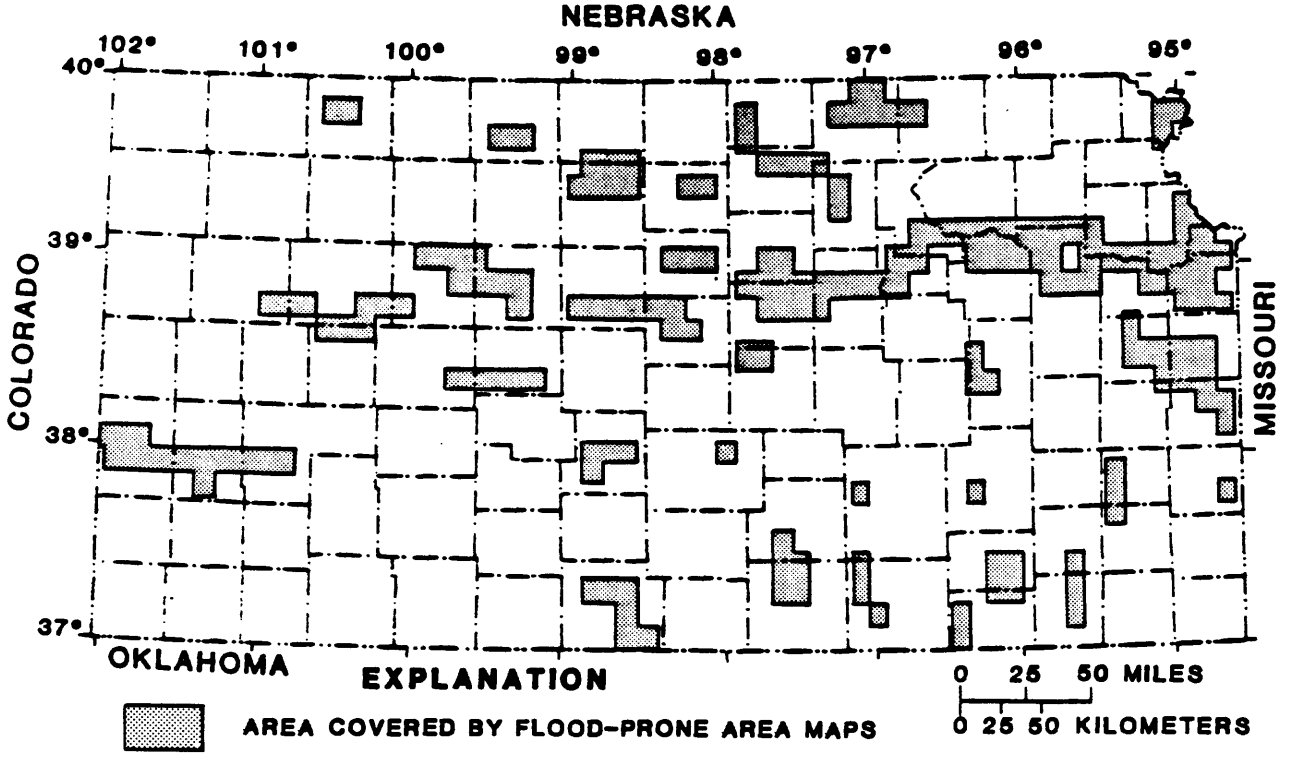


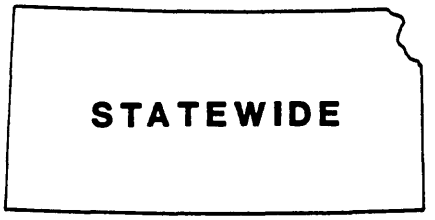
Figure 3.--Availability of flood-prone area maps.

DATA-COLLECTION PROGRAMS

Throughout its long history of service, one mission of the U.S. Geological Survey, Water Resources Division, has been the comprehensive and systematic collection of hydrologic data and the timely release of such data for public use. To help provide this service, a network of hydrologic-data stations is maintained throughout Kansas to obtain records of (1) stage, discharge, chemical quality, and sediment yield of streams; (2) stage, content, and chemical quality of lakes and reservoirs; (3) precipitation; and (4) water levels and chemical quality of ground water.

Hydrologic data collected in Kansas as part of the water-resources-data network are published annually in a comprehensive report entitled "Water-Resources Data for Kansas, Water Year 19--". Each water-data report carries an identification number consisting of the two-letter state abbreviation, the last two digits of the water year, and the volume number. For example, the report for the 1983 water year is identified as "U.S. Geological Survey Water-Data Report KS-83-1. Reports for each water year are released the following calendar year. Water-data reports are available from the U.S. Geological Survey office in Lawrence, Kansas, or from the National Technical Information Service, U.S. Department of Commerce, Springfield Virginia 22161.

Hydrologic data also are stored in both current and historical computer files in the U.S. Geological Survey's National Water-Data Storage and Retrieval System (WATSTORE). The data are available for water planning and management in machine-readable form, computer-printed tables or graphs, statistical analyses, and digital plots. Local assistance in the acquisition of computer services is available from the Kansas District office in Lawrence.



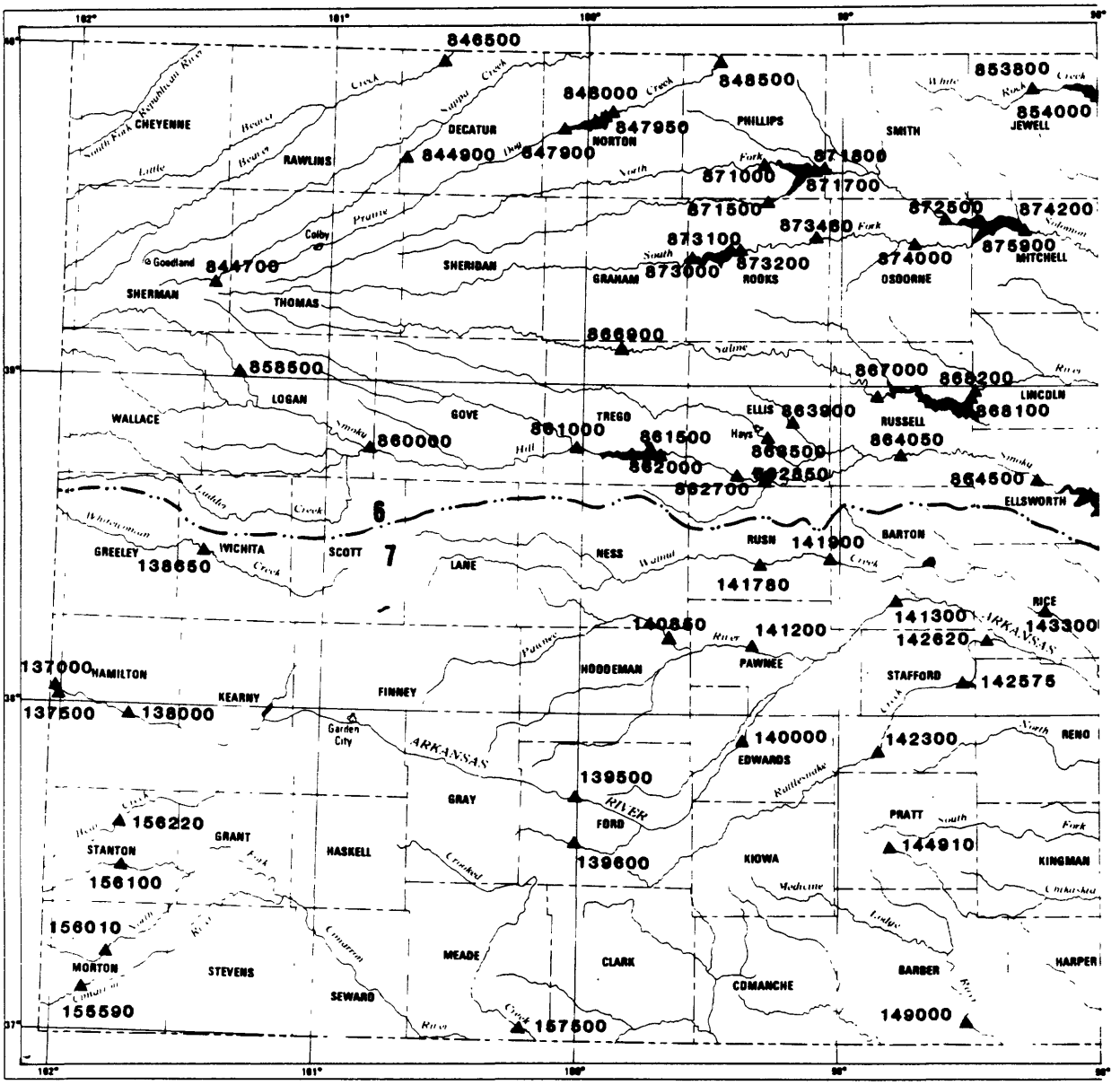
PROJECT TITLE: Surface-water data program
PROJECT NUMBER: KS-001
COOPERATING AGENCY: Multi-agency
PROJECT CHIEF: C. O. Geiger

Problem -- Surface-water information is needed for purposes of surveillance, planning, design, hazard warning, operation, and management in such water-related fields as water supply, hydroelectric power, flood control, irrigation, floodplain management, and water-resources development. To provide this information, an appropriate and comprehensive data base is necessary.

Objectives -- Collect surface-water data sufficient to satisfy needs for current-purpose uses, such as (1) assessment of water resources, (2) operation of reservoirs or industries, (3) forecasting, (4) pollution controls and disposal of wastes, (5) discharge data to accompany water-quality measurements, (6) compact and legal requirements, and (7) research or special studies.

Collect data necessary for analytical studies to define, for any location, the statistical properties of, and trends in, the occurrence of water in streams, lakes, and reservoirs for use in planning and design.

Approach -- A network of gaging stations (figs. 4, 5, 6 and tables 1, 2, and 3 at the end of this report) is maintained to provide surface-water data for management and operation, for determination of long-term trends, and for research and special studies. Data are collected on stage and discharge of streams or canals, on stage, surface area, content of lakes and reservoirs, and on precipitation. The network of stations is revised periodically to ensure the collection of meaningful and worthwhile data.



EXPLANATION

172000

Complete-record stations and number

Note: numbers shown are abbreviated versions of the complete numbers given in text

Drainage basins

6 Missouri River basin

7 Arkansas River basin

Basin boundary

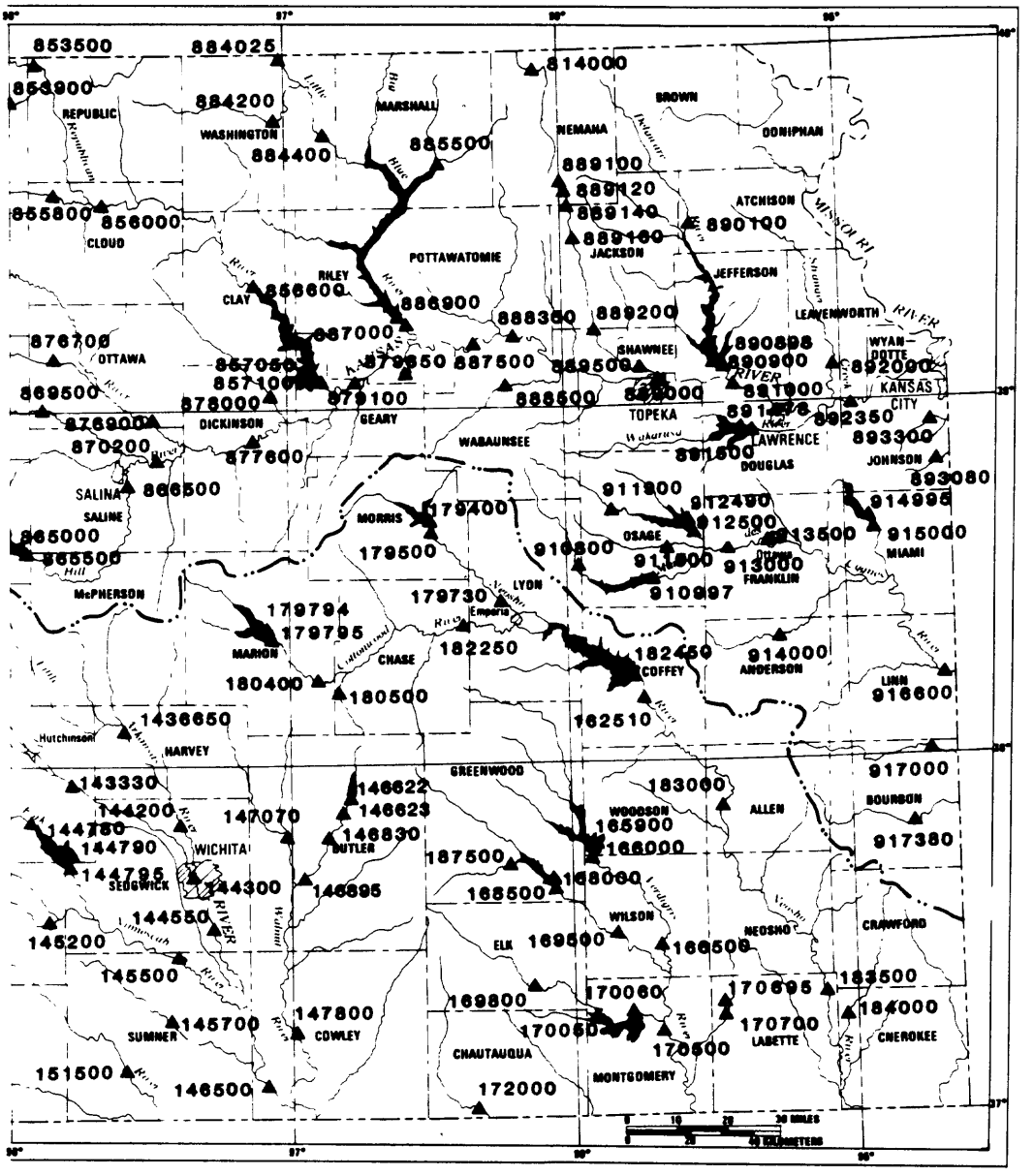
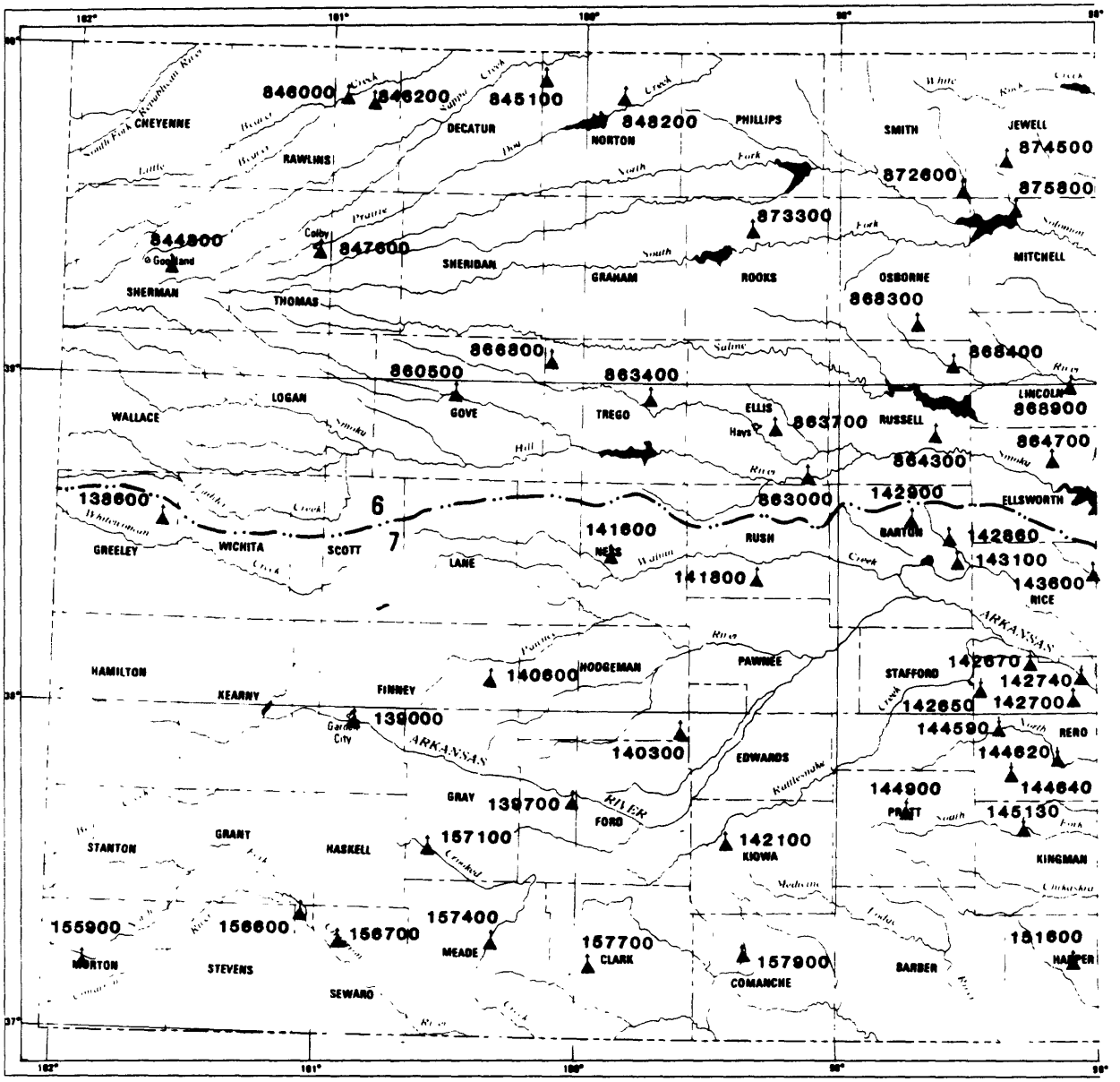


Figure 4.--Location of complete-record surface-water gaging stations, 1984 water year.



EXPLANATION

813700 ▲ Crest-stage station and number

145130 ▲ Low-flow station and number

Note: numbers shown are abbreviated versions of the complete numbers given in text

Drainage basins

6 Missouri River basin

7 Arkansas River basin

Basin boundary

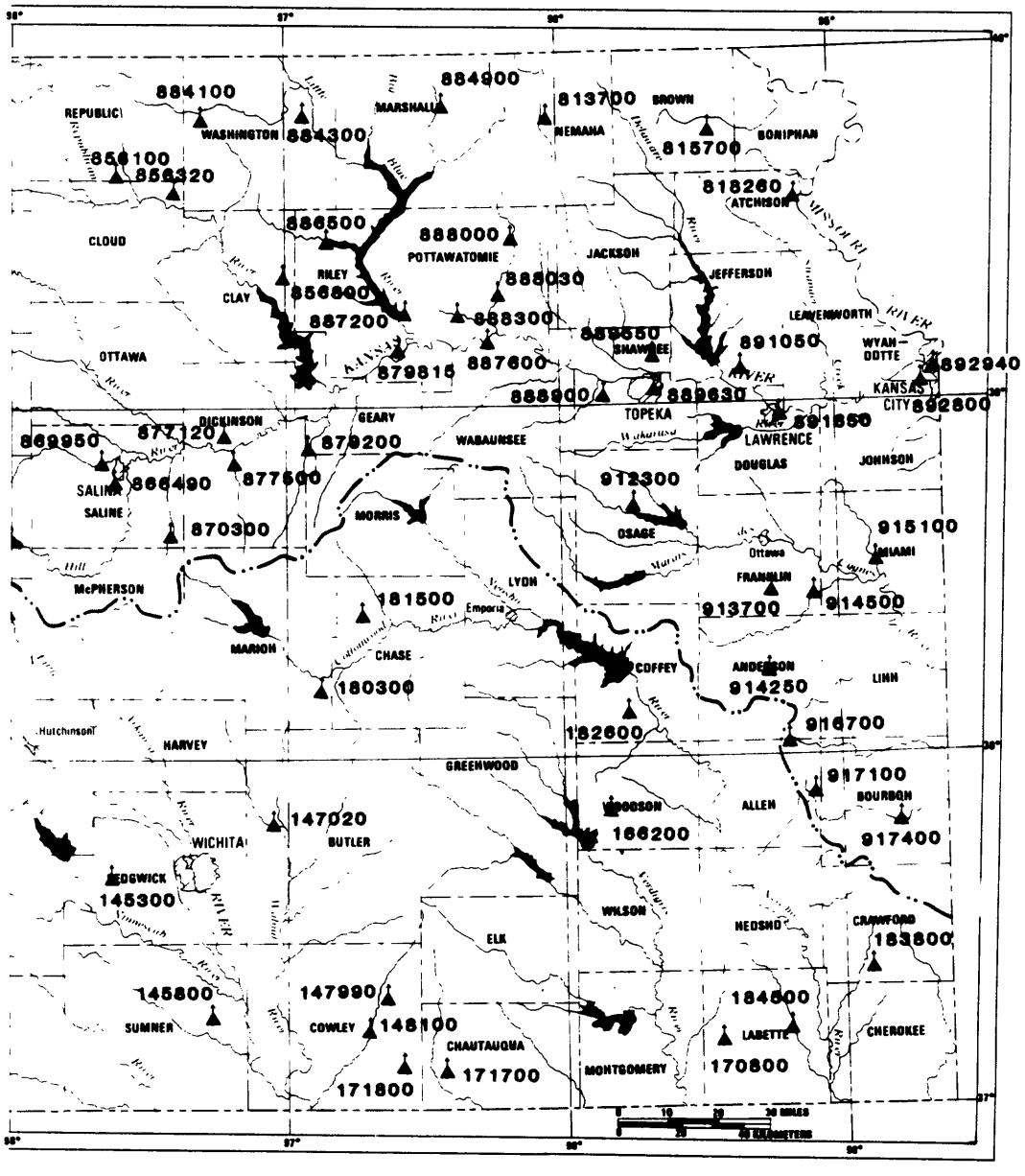


Figure 5.--Location of partial-record surface-water gaging stations, 1984 water year.

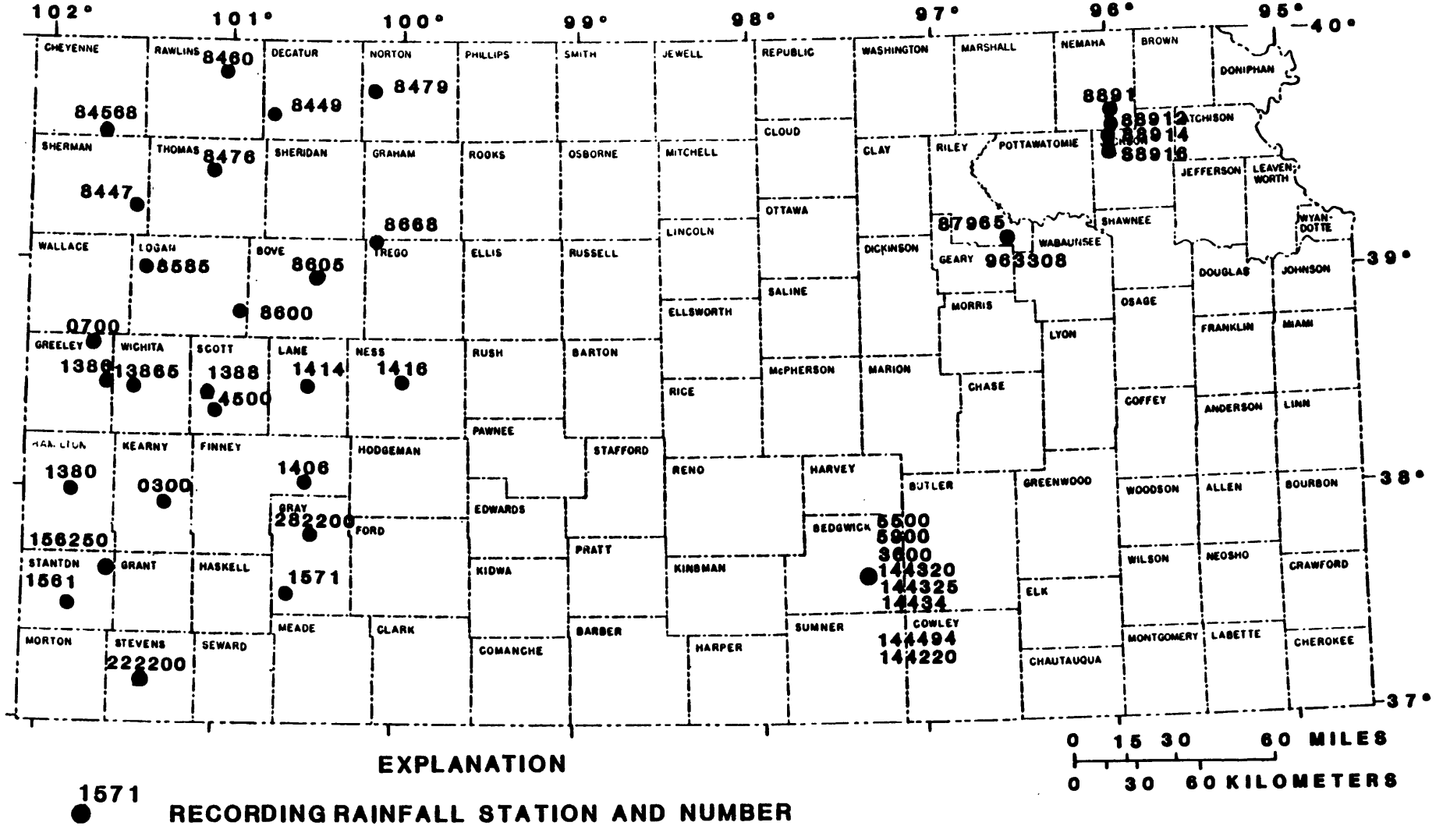


Figure 6.--Location of recording rainfall stations, 1984 water year.

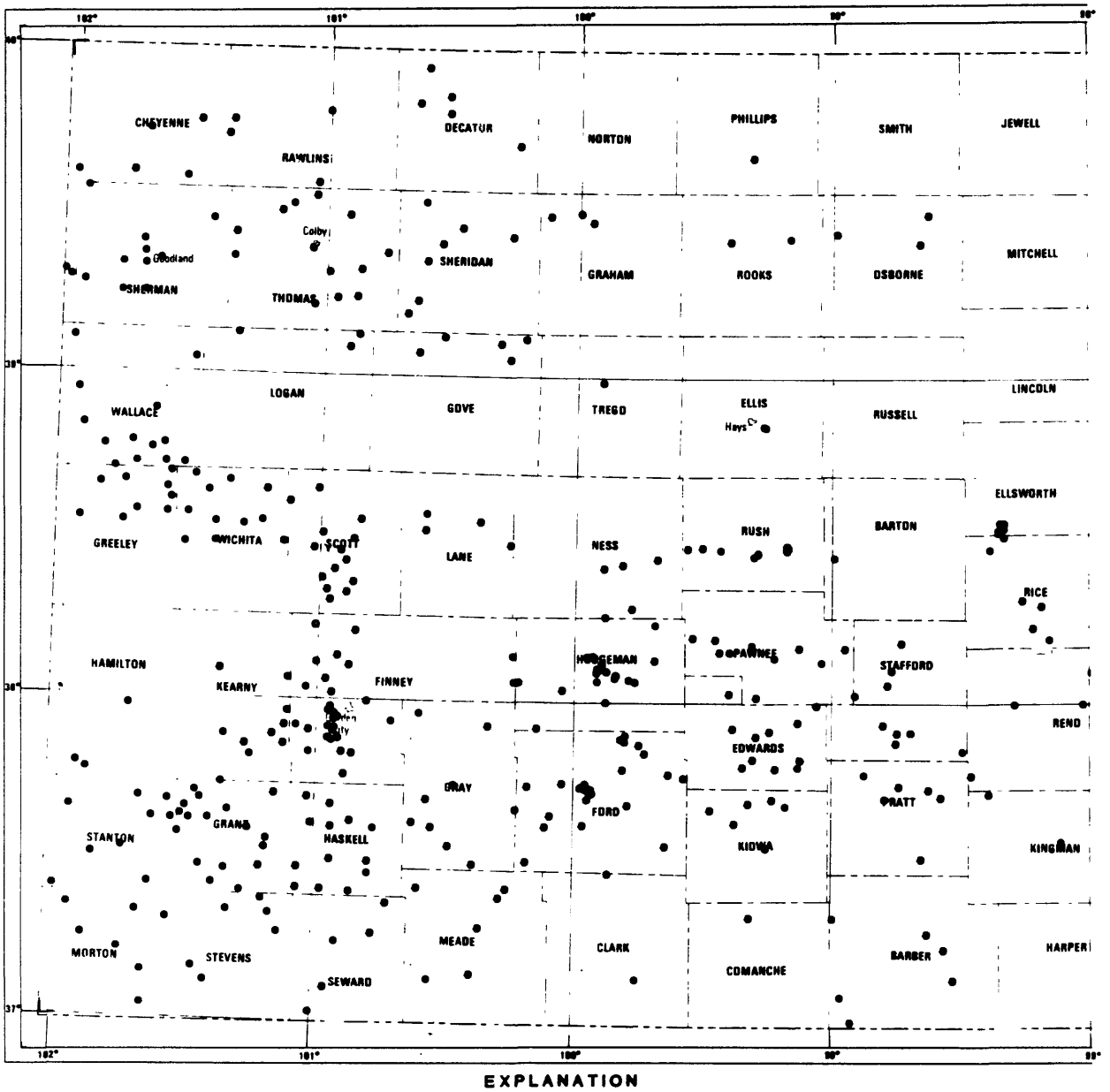
PROJECT TITLE: Ground-water data program
PROJECT NUMBER: KS-002
COOPERATING AGENCY: Multi-agency
PROJECT CHIEF: C. O. Geiger

Problem -- Long-term water-level records are needed (1) to evaluate the effects of climatic variations on the recharge to and discharge from the ground-water systems in Kansas, (2) to provide a data base from which to measure the effects of development, (3) to assist in the prediction of future supplies, and (4) to provide data for management of the resource.

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

Provide a data base against which the short-term records acquired in areal studies can be analyzed. This analysis must (1) provide an assessment of the ground-water resources, (2) allow predictions of future conditions, (3) detect and define pollution and supply problems, and (4) provide the data base necessary for management of the resource.

Approach -- A network of observation wells (fig. 7 and table 4 at the end of this report) is measured to provide a data base for monitoring the general response of ground-water systems to natural climatic variations and to stresses of pumpage. A long-term record of water-level measurements, in conjunction with a description of the hydrological system, provides data for proper planning and management, and for scientific investigations.



EXPLANATION

2

Observation well

Number indicates more than one well at this site

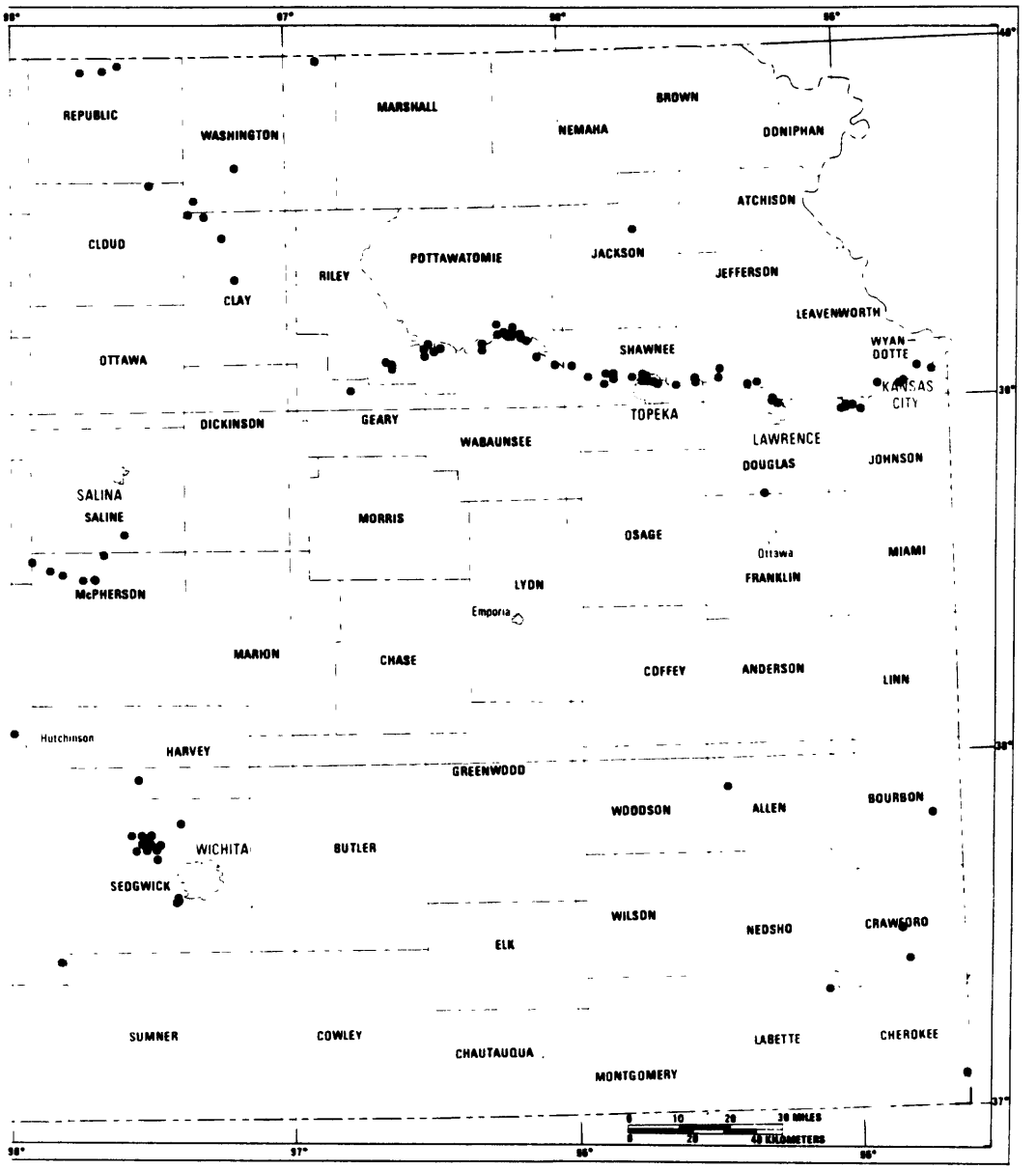
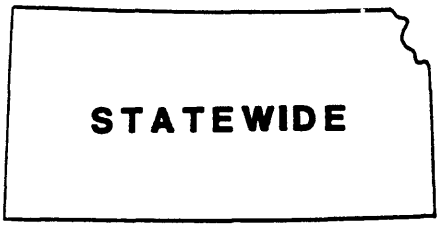


Figure 7.--Location of observation wells, 1984 water year.



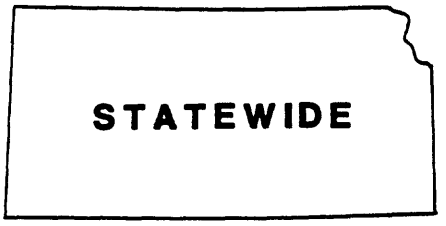
PROJECT TITLE: Water-quality data program
PROJECT NUMBER: KS-003
COOPERATING AGENCY: Multi-agency
PROJECT CHIEF: C. O. Geiger

Problem -- Water-resources planning and water-quality assessment require a national data base of relatively standardized information. For intelligent planning and realistic assessment of the water resource, the chemical and physical quality of the rivers, streams, lakes, and reservoirs, as well as major ground-water aquifer systems, must be defined and monitored.

Objectives -- To provide a national bank of water-quality data for State, local, or Federal planning and action programs, and to provide data for the Federal management of interstate waters. Primary objectives of the network are to depict areal variability of streamflow and water-quality conditions nationwide on a year-by-year basis and to detect and assess long-term changes in streamflow and water quality.

Approach -- Surface-water-quality stations (fig. 8 and table 5 at the end of this report) are maintained in Kansas to monitor long-term and short-term trends related to changes in streamflow, reservoir operation, and local or regional pollution. In addition, a network for collection of surface-water-quality data, identified as the National Stream-Quality Accounting Network (NASQAN), is designed by the U.S. Geological Survey to meet many of the information demands of agencies or groups involved in national or regional water-quality planning and management. Water samples are collected at a few regular surface-water stations, as a Federal interagency activity, for monitoring and concentration and distribution of pesticides in streams where potential contamination could result from continued or future application of the commonly used insecticides and herbicides. As part of a nationwide sampling of major drainage basins, water also is collected at one station to be analyzed for radioisotopes.

Water-quality samples are collected from a network of wells (fig. 9 and table 6 at the end of this report) to determine the chemical characteristics of ground water in the principal aquifers and to assess the suitability of the water for use in domestic and municipal supplies. The data also are used to establish an adequate data base for monitoring changes in water quality according to the provisions of the Safe Drinking Water Act, 1975. Other samples of ground water from various geologic formations at specific locations are analyzed for interpretive hydrologic investigations.

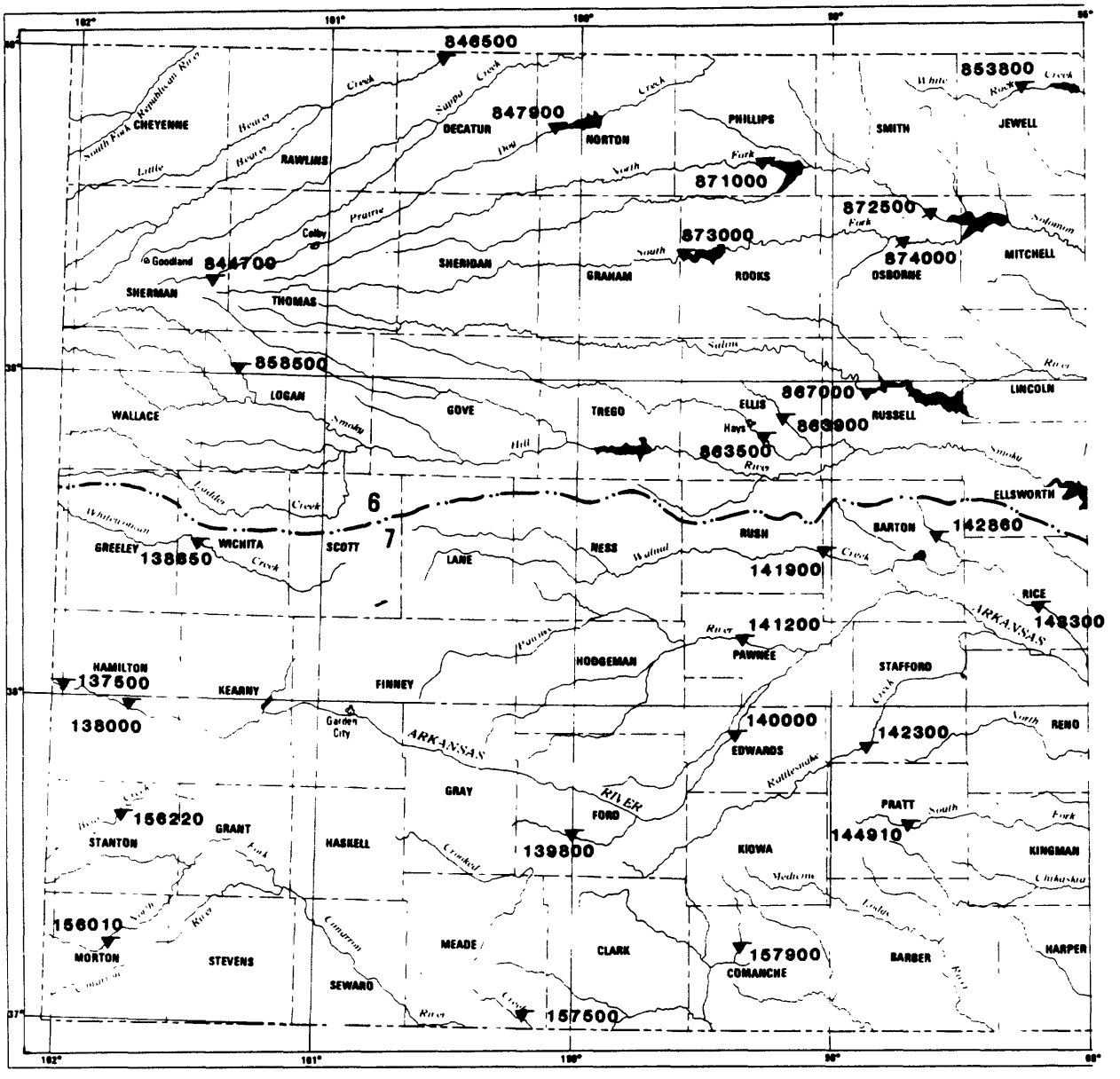


PROJECT TITLE: Sediment data program
PROJECT NUMBER: KS-004
COOPERATING AGENCY: Multi-agency
PROJECT CHIEF: C. O. Geiger

Problem -- Sediment concentrations and discharges in rivers and streams must be defined and monitored in order to make a comprehensive water-quality assessment of the Nation's water resources.

Objectives -- To provide a national data base of standardized sediment information for use in State, local, and Federal planning and action programs, and to provide data for Federal management of interstate waters.

Approach -- A network of sediment stations (listed in table 5 at the end of this report) has been established to provide spatial and temporal averages and trends in concentration, discharge, and particle size of sediment being transported by rivers and streams. Water samples are collected on a routine basis at about 60 stations for analysis and determination or suspended-sediment discharge. In addition, periodic measurements are made of the particle-size distribution of suspended sediment and bed material.



EXPLANATION

▼ Chemical ▼ Biological ▼ Sediment

Note: numbers shown are abbreviated versions of the complete numbers given in text

Drainage basin

6 Missouri River basin

7 Arkansas River basin

Basin boundary

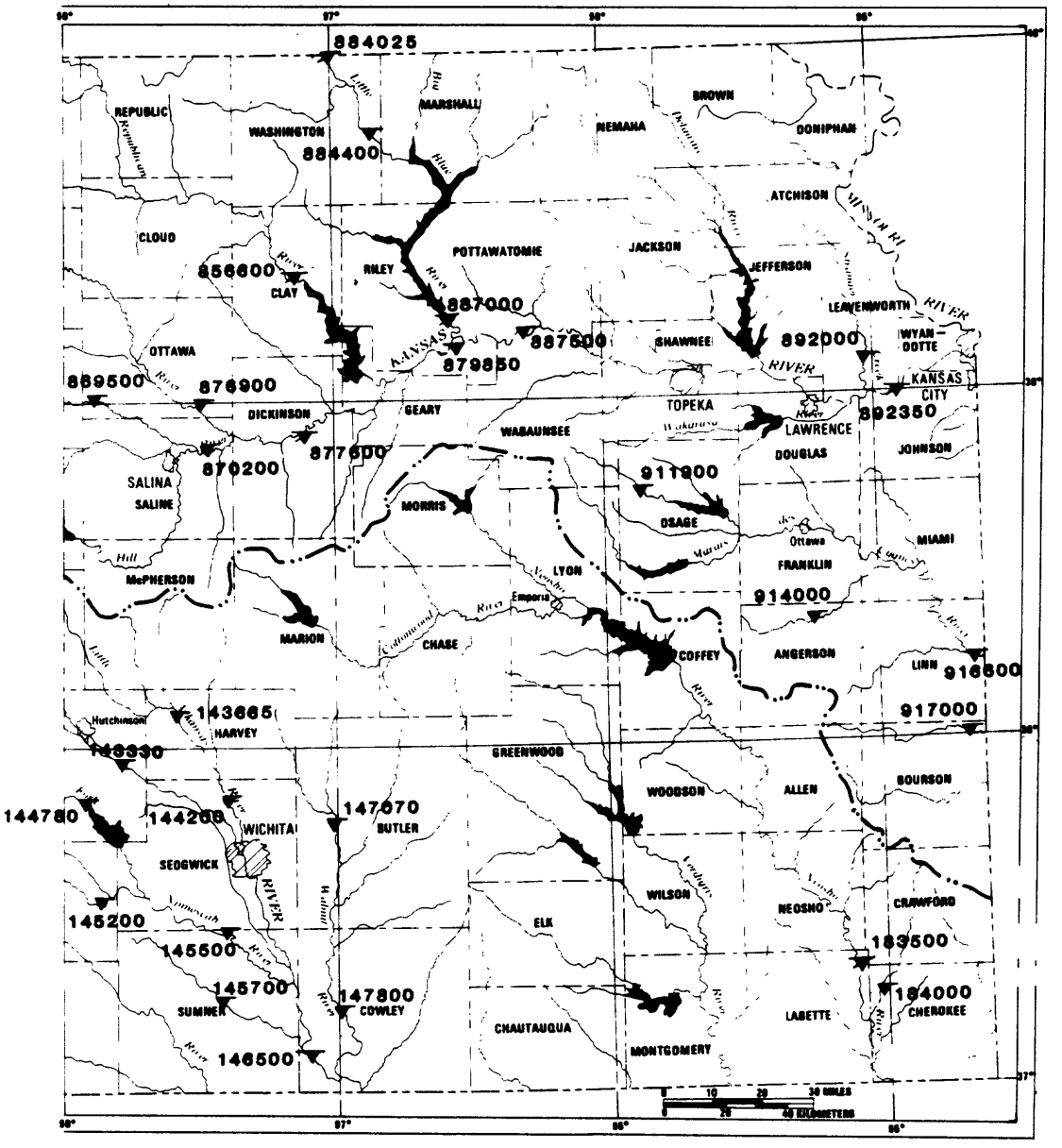
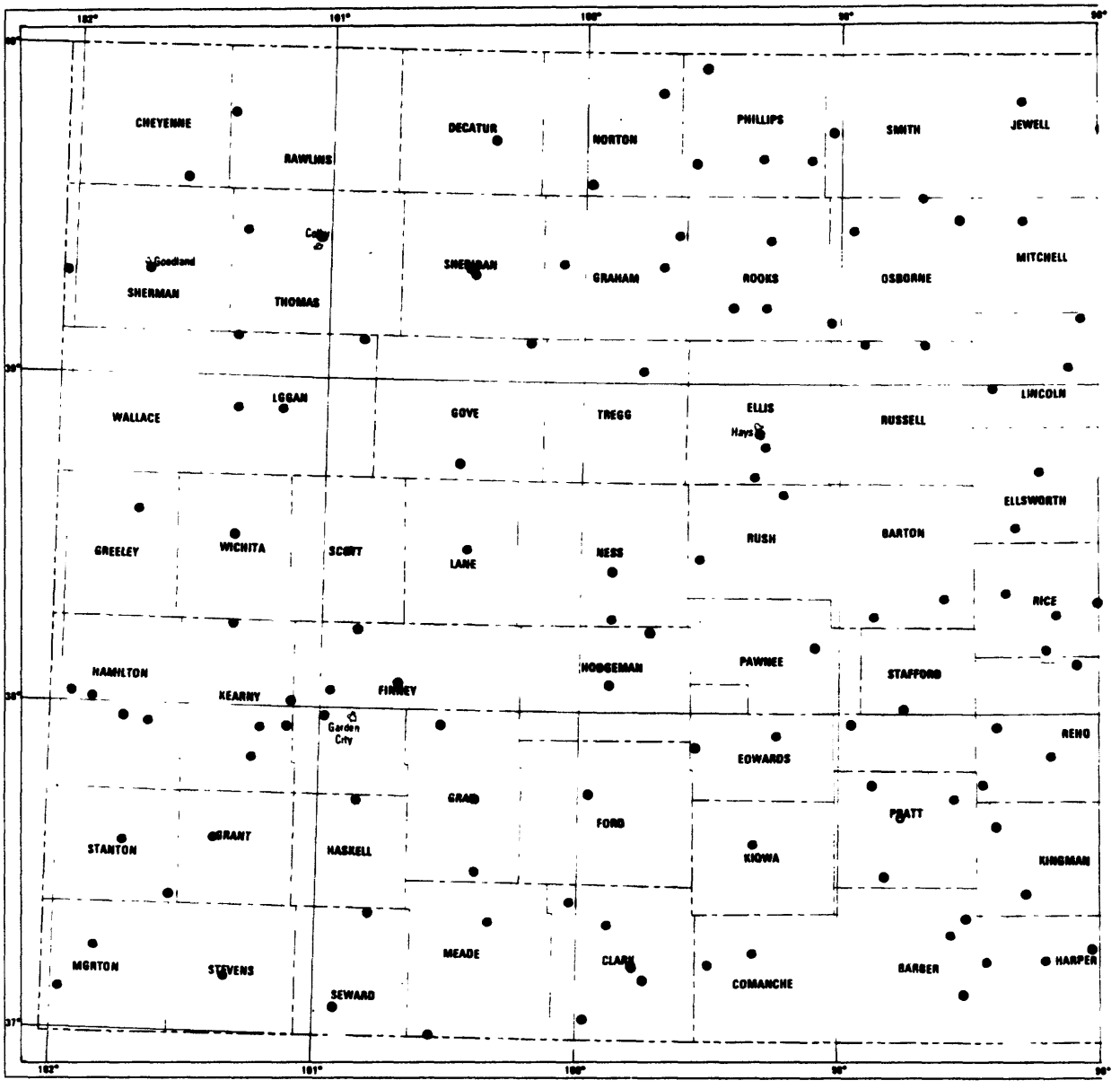


Figure 8.--Location of surface-water-quality gaging stations, 1984 water year.


CHEYENNE
RAWLINS
DECATUR
NORTON
PHILLIPS
SMITH
JEWELL
Goodland
SHERMAN
THOMAS
SHERIDAN
GRAHAM
ROOKS
OSBORNE
MITCHELL
WALLACE
LOGAN
GOVE
TREGG
ELLIS
Hays
RUSSELL
LINCOLN
ELLSWORTH
GREELEY
WICHITA
SCOTT
LANE
NESS
RUSH
BARTON
RICE
HAMILTON
KEARNY
FINNEY
Garden City
HODGEMAN
PAWNEE
STAFFORD
RENO
EDWARDS
GRANT
HASKELL
GRAY
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KINGMAN
MORTON
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SEWARD
MEADE
CLARK
COMANCHE
BARBER
HARPER

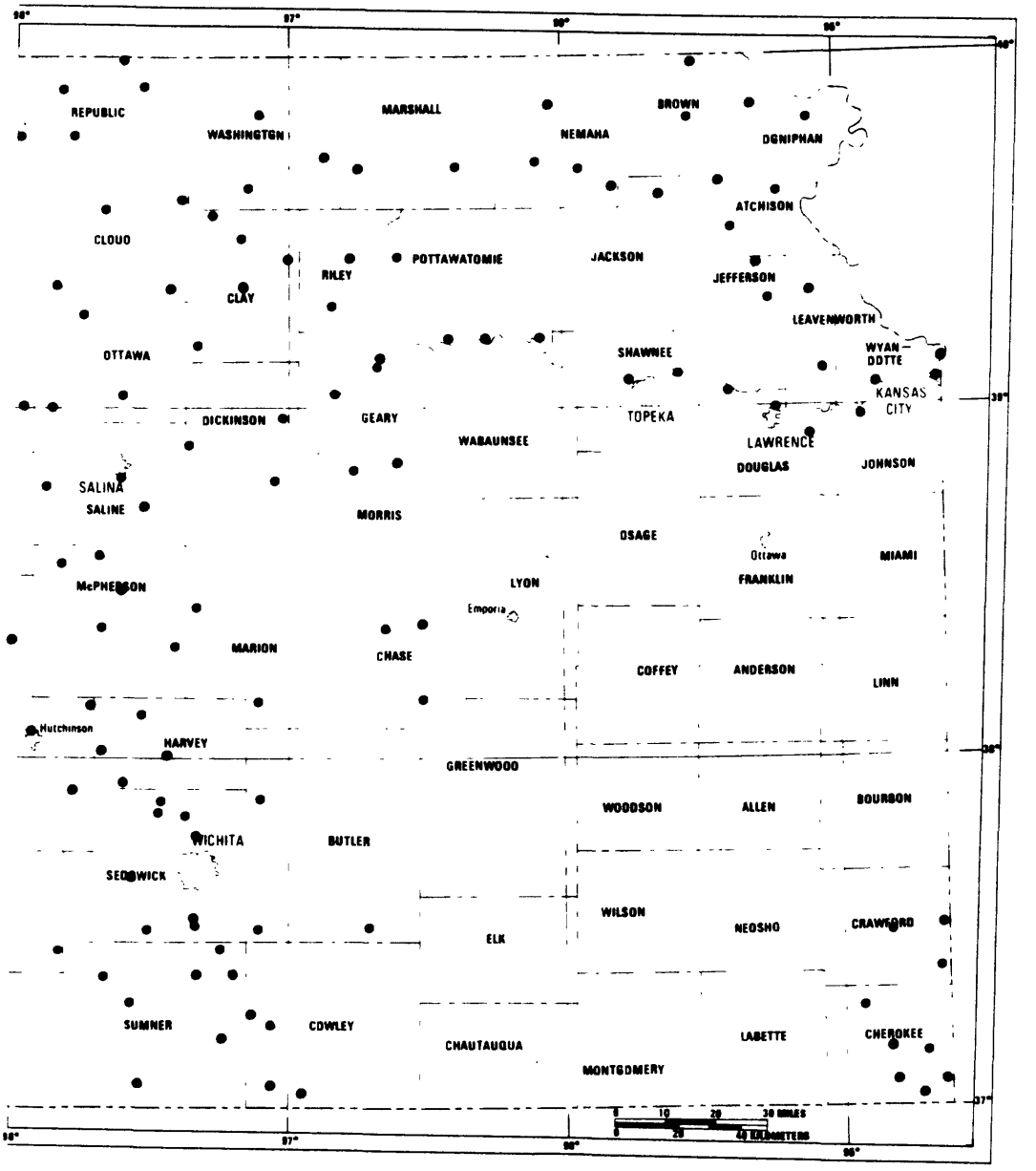
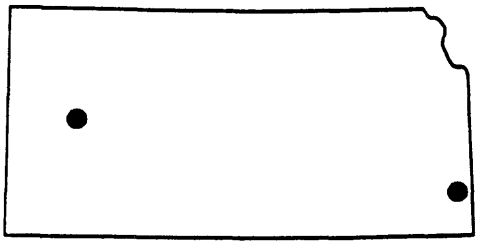


Figure 9.--Location of ground-water-quality sampling sites, 1984 water year.

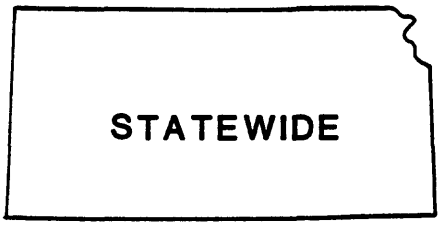


PROJECT TITLE: National Atmospheric Deposition Program and National Trends Network Stations in Kansas
PROJECT NUMBER: KS-005
COOPERATING AGENCY: Federal
PROJECT CHIEF: C. O. Geiger

Problem -- In recent decades human activities have greatly increased both the abundance of substances dispersed in the atmosphere and their impact on the biosphere of the earth. These changes have resulted mainly from increases in: (1) Combustion of fossil fuels in power production, space heating, and transportation; (2) emmissions of dust, aerosols, and gases from industrial and land-management activities; (3) use of fertilizers and other chemicals in intensive agriculture and forestry; and (4) decomposition and combustion of industrial, urban, and agricultural wastes.

Objectives -- Establish a National Atmospheric Deposition Network to determine spatial and temporal trends in the supply of beneficial nutrient elements and injurious substances in precipitation and dry particulate matter. Determine the relative importance and contribution of precipitation, dry particulate matter, aerosols, and gases to the total atmospheric deposition. Coordinate research on the effects of changes in atmospheric deposition on: (1) Productivity of agricultural crops, forests, rangeland, wetlands, and surface water; (2) health and productivity of domestic food, wildlife and fish; and (3) corrosion of metals and other materials.

Approach -- Sites in Kansas, located on the index map above, are equipped with an identical collector of wet/dry deposition, a recording rain gage, and pH and conductivity meters. Samples of precipitation are collected at each site on a weekly basis. During the first phase of network operations, analyses will be made for the following elements, ions, or other properties of each sample: sulfate, nitrate, phosphate, chloride, ammonia, potassium, calcium, magnesium, pH, acidity or alkalinity and conductivity. Later certain additional elements will be added including fluorine, bromine, manganese, zinc, copper, iron, molybdenum, boron, lead, mercury, iodine, nickel, cadmium, and vanadium. Pesticides and radioactive materials will also be added. To insure that the network data are of high quality to provide maximum credibility for a wide variety of fundamental research and mission-oriented purposes, a Quality Assurance Committee oversees the operations.

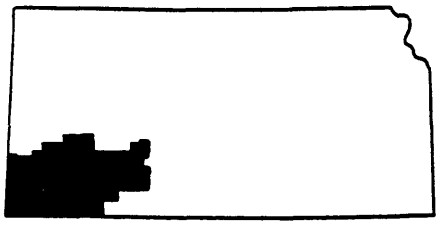


PROJECT TITLE: Automated water-use data base in Kansas
PROJECT NUMBER: KS-007
COOPERATING AGENCY: Division of Water Resources, Kansas State Board of Agriculture
PROJECT CHIEF: C. H. Baker, Jr.

Problem -- Use of Kansas waters and competition among types of uses are increasing each year. State water-rights agencies need detailed information about water use in order to effectively manage the resource. As part of the National Water-Use program in Kansas, plans have been made to create a State-operated and maintained water-use/water-rights data base. This long-term plan has come to the immediate foreground by a growing concern within the State for automated handling of water-use/water-rights data. In order to facilitate the progress of the water-use program in Kansas and to ensure that the resulting State data base will fully meet the needs of the National Water-Use program, it is important for the U.S. Geological Survey to participate in the State data-base development.

Objective -- To design, implement, load, and evaluate an automated State water-use/water-rights data base. The data base will serve the dual functions of a management tool for administering water rights within the State and of acting as a repository for vital water-use data to meet National and State needs.

Approach -- Actual development of the data base will be done by the Kansas State Department of Administration, Division of Computer Services. Data capture, preparation, and input is handled jointly by the Division of Water Resources, Kansas State Board of Agriculture, and the State Division of Computer Services. U.S. Geological Survey personnel work closely with both State agencies to insure that all data elements needed for the National Water-Use program are provided in the data base and to provide for data exchange between the completed State data base and the National Water-Use Data System.

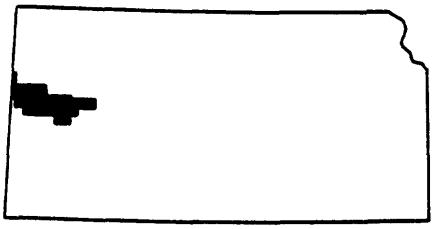


PROJECT TITLE: Hydrologic-data base for management decisions in Southwest Kansas Groundwater Management District No. 3
PROJECT NUMBER: KS-086
COOPERATING AGENCY: Southwest Kansas Groundwater Management District No. 3
PROJECT CHIEF: L. E. Stullken

Problem -- Management, planning, and administration of water rights depend on the availability of and ready access to hydrologic data. State and local water agencies that must make these decisions have requested establishment of a system to provide current information on (1) large-yield wells in southwest Kansas, (2) the amount and time distribution of ground-water withdrawals, (3) the amount and location of irrigated acreage, (4) the hydraulic characteristics of the High Plains (Ogallala) aquifer, (5) the configuration of the water table, (6) the annual changes in saturated thickness, and (7) the movement of ground water through the aquifer system. Most of these data are readily amenable to storage, retrieval, and analysis using digital computers.

Objectives -- To develop and maintain a comprehensive hydrologic-data base for the area within the Southwest Kansas Groundwater Management District and to provide timely storage, retrieval, and analyses of the data for use principally by the Management District and by the Division of Water Resources, Kansas State Board of Agriculture, in the management, planning, and administration of water rights.

Approach -- Establish and monitor a comprehensive observation-well network, produce saturated-thickness maps, perform several aquifer tests on selected wells, and assist the Management District in measuring and monitoring ground-water withdrawals for irrigation. Compile all data pertinent to the hydrology of the area in readily accessible computer files for various analyses essential to management and administrative decisions.



PROJECT TITLE: Hydrologic-data base, Western Kansas Groundwater Management District No. 1
PROJECT NUMBER: KS-117
COOPERATING AGENCY: Western Kansas Groundwater Management District No. 1
PROJECT CHIEF: L. E. Stullken

Problem -- The original saturated thickness in Groundwater Management District No. 1 has been reduced 50 percent or more in five areas of the district covering about 225 square miles. Water is being pumped from the High Plains (Ogallala) aquifer 5 to 35 times faster than it is being recharged. Some irrigation wells have been abandoned, and the groundwater supply is no longer adequate for some domestic wells in areas where the aquifer has been dewatered. The Management District needs a continuing data-collection and analysis program to provide information on ground-water conditions for making management decisions.

Objectives -- (1) Maintain and operate water-level recorders at a recharge reservoir, (2) collect continuous water-level data in problem locations, (3) prepare ground-water depletion maps.

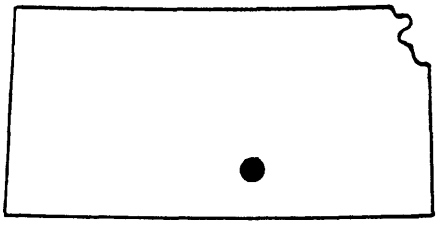
Approach -Continuous recorders monitor surface storage and ground-water conditions at the Janzen recharge reservoir. Hydrologic maps produced using kriging techniques are supplied to the district annually. Previous maps have shown the water-table, the resulting errors-of-estimate from the kriging, saturated thickness, and percentage change in saturated thickness of the High Plains aquifer in west-central Kansas.

Reports -- Pabst, M. E., and Dague, B. J., 1984, Percentage change in saturated thickness of the High Plains aquifer, west-central Kansas, 1950 to average 1982-84: U.S. Geological Survey Water-Resources Investigations Report 84-4357, scale 1: 125,000, 1 sheet.

HYDROLOGIC INVESTIGATIONS

Hydrologic investigations provide water-resources information that is valuable for a wide variety of uses by Federal, State, and local agencies, by the general public, and by universities and the consulting community. These investigations may include regional, state, county, and site-specific studies, as well as applied research. Some of the anticipated uses of the results of these investigations include general resources information and definition of hydrologic systems; water supply (planning and development); protection and conservation of resources; pollution detection, control, abatement, and enforcement; bridge, culvert, and highway design; public safety (flood warning and flood-plain delineation); salinity control and abatement; hazardous waste disposal; land management; and fish and wildlife resources management. These investigations help to assess the State's water resources in terms of quality, quantity, and use of water, and to develop the knowledge and hydrologic understanding necessary to predict the consequences of alternative plans and policies for water development and use.

Areal or Local Investigations



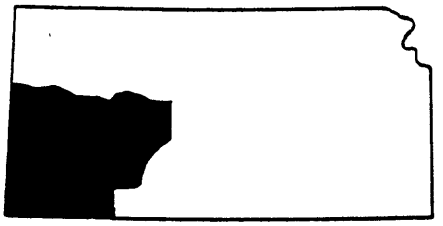
PROJECT TITLE: Effects of urbanization on flood runoff in the Wichita area
PROJECT NUMBER: KS-013
COOPERATING AGENCY: City of Wichita, Kansas
PROJECT CHIEF: C. A. Perry

Problem -- The effects of urbanization on flood-frequency discharges in Kansas have not been quantified. Sprawling urbanization in Wichita and vicinity has caused increased concern for the effect of urbanization on design discharges. Data on the magnitude and frequency of flood flows are needed in designing urban-drainage systems.

Objective -- Derive a method of estimating the relation of peak (flood) discharges to frequencies that is applicable to basins, with various degrees of urbanization, in the Wichita area.

Approach -- Rainfall-runoff data were collected in basins where the land use and percentage of impervious surface could be determined. The shape of unit hydrographs and changes resulting from urbanization were defined. A digital rainfall-runoff model for predicting peak discharges from small urbanized basins was tested and calibrated.

Reports -- Perry, C. A., and Hart, R. J., 1984, Flood-frequency estimates for five gaged basins in Wichita, Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4038, 23 p.



PROJECT TITLE: Availability and chemical quality of ground water from sandstone aquifers in southwest Kansas
PROJECT NUMBER: KS-079
COOPERATING AGENCY: Kansas Geological Survey
PROJECT CHIEF: Jack Kume

Problem -- A significant potential may exist for the development of ground-water supplies from sandstone units in Upper Permian, Upper Jurassic, and Lower Cretaceous rocks in southwest Kansas. Previous studies commonly considered the sandstone units as a single undifferentiated aquifer, which has lead to erroneous conclusions. Detailed studies are needed to define the geohydrology and the chemical quality of water in the sandstone-aquifer system.

Objectives -- Define the character of geologic formations that compose the sandstone-aquifer system; determine the geohydrologic relations between the individual aquifers; describe the chemical quality and suitability of water for most uses; and predict possible effects of ground-water development on the availability and chemical quality of water resulting from induced leakage between sandstone units.

Approach -- Data were compiled from previous studies and from existing wells and drill additional test wells to define the geologic and hydrologic characteristics of the sandstone-aquifer system. More detailed information on the areal extent, thickness, and degree of cementation of individual sandstone units and on the effects of hydraulic interconnection between units were obtained.

Reports -- Kume, Jack, and Spinazola, J. M., 1982, Geohydrologic data from sandstone aquifers in southwestern Kansas: U.S. Geological Survey Open-File Report 82-868, 112 p.

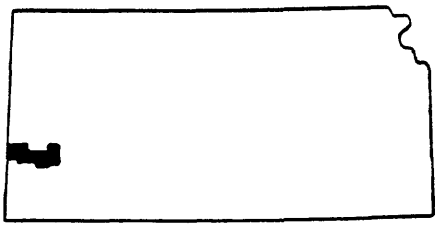
_____1983, Depth and thickness of selected units in Upper Permian, Upper Jurassic, and Lower Cretaceous rocks in southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 83-4095, scale 1: 500,000, 7 sheets.

PROJECT TITLE: Kansas-Nebraska Big Blue River Compact
PROJECT NUMBER: KS-084
COOPERATING AGENCY: Federal
PROJECT CHIEF: E. R. Hedman

Problem -- The Kansas-Nebraska Big Blue River Compact Administration insures equitable apportionment of waters of the Big Blue River between the states of Nebraska and Kansas.

Objective -- To administer the travel funds for the Federal Representative of the Compact.

Approach -- Travel costs incurred by Federal Representative are administered.



PROJECT TITLE: Geohydrology of Arkansas River valley in southwest Kansas
PROJECT NUMBER: KS-088
COOPERATING AGENCY: Division of Water Resources, Kansas State Board of Agriculture
PROJECT CHIEF: R. J. Lindgren

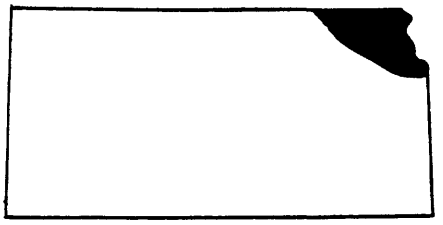
Problem -- Flow of the Arkansas River between the Colorado-Kansas State line and the Kearny-Finney County line in Kansas has continued to decrease in recent years. Consequently, the availability of surface water for diversion at the headgates of irrigation ditches has been inadequate to meet demands. Withdrawals of ground water from wells in the valley alluvium, which is hydraulically connected to the stream, are thought to be depleting streamflow and adversely affecting senior water rights.

Objectives -- Define the relationship between ground water and surface water in the Arkansas River valley and determine the effects of ground-water withdrawals on streamflow. Construct and calibrate a digital model of the river-aquifer system that can be used by State and local management agencies to improve conjunctive use of ground and surface waters within the constraints of water-rights structure in Kansas.

Approach -- The hydrologic boundaries of the stream-aquifer system, the hydraulic characteristics of the aquifer, the hydrologic stresses imposed on the system, and the effects of those stresses on ground-water storage and on streamflow were determined. These data were used in a digital model of the system to predict the results of various management alternatives designed to optimize conjunctive use of ground and surface waters.

Reports -- Barker, R. A., Dunlap, L. E., and Sauer, C. G., 1983, Analysis and computer simulation of stream-aquifer hydrology, Arkansas River valley, southwestern Kansas: U.S. Geological Survey Water-Supply Paper 2200, 59 p.

Dunlap, L. E., Lindgren, R. J., and Sauer, C. G., 1983, Geohydrology and model analysis of stream-aquifer system along the Arkansas River in Kearny and Finney Counties, southwestern Kansas: U.S. Geological Survey Open-File Report 83-222, 84 p.



PROJECT TITLE: Glacial deposits (Pleistocene) in northeast Kansas
PROJECT NUMBER: KS-091
COOPERATING AGENCY: Kansas Geological Survey
PROJECT CHIEF: J. E. Denne

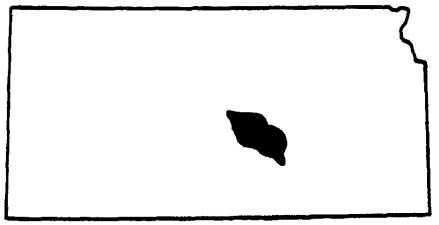
Problem -- As population and demand for water increase in northeast Kansas, ground-water supplies are gaining in significance. They are especially important during periods of low precipitation when surface-water supplies decline. Although the bedrock formations in the area generally contain little, if any, good-quality water, the glacial buried-valley aquifers may yield up to several hundred gallons per minute of freshwater to wells.

Because the buried-valley aquifers are variable in location, extent, and hydrologic characteristics, detailed study of them is necessary. Current aquifer usage and development potential for domestic, municipal, agricultural, and industrial needs also must be evaluated. These analyses will allow realistic water-resource planning for the area. Knowledge of aquifer locations also should allow protection of ground water from contamination.

The geophysical techniques (for example, seismic, resistivity, and thermal) developed and utilized in this program should prove useful for studies of other unconsolidated aquifers in Kansas.

Objectives -- The objectives of this study are to: (1) locate and delineate the major Pleistocene aquifers of northeast Kansas, (2) determine ground-water levels in and saturated thicknesses of these aquifers, (3) analyze the Pleistocene stratigraphy and the 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 for water supplies.

Approach -- Buried-valley aquifers will be located by evaluation of existing hydrogeologic information, interpretation of maps and remote-sensing data, and onsite work (drilling and geophysical investigations). Ground-water levels will be measured in wells and test holes, and saturated thicknesses will be calculated. Grain size and clay mineralogy of sediments will be analyzed for stratigraphic correlation and aquifer evaluation. Chemical constituents of water from Pleistocene aquifers will be determined by sample analyses (performed by the Kansas Department of Health and Environment).

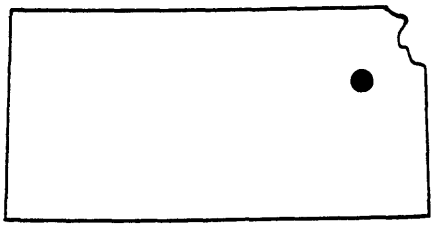


PROJECT TITLE: Hydrogeology of the "Equus beds" aquifer, central Kansas
PROJECT NUMBER: KS-092
COOPERATING AGENCY: Kansas Geological Survey
PROJECT CHIEF: J. M. Spinazola

Problem -- Unconsolidated deposits of Pleistocene age, commonly known as the "Equus beds," are the major source of water for municipal, industrial, and irrigation use in central Kansas. Continued increasing withdrawals of water from this important aquifer can result in mining of water, reduced well yields, deterioration of water quality, and impairment of existing water rights.

Objective -- Determine the effects that increased ground-water withdrawals will have on (1) ground-water availability and (2) chemical quality of the ground water as they relate to the possible contamination of parts of the "Equus beds" as a result of induced movement of saline water now present in the aquifer and saline-water inflow from the underlying Wellington aquifer.

Approach -- Additional data were collected with special emphasis on defining the distribution of chloride concentrations in the aquifer and on modeling of the ground-water-flow system. An appropriate model was selected that would simulate the movement of saline water. Evaluation of the simulation will be made, and new model development may result.



PROJECT TITLE: Quality of water from urban runoff, Topeka
PROJECT NUMBER: KS-096
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: L. M. Pope

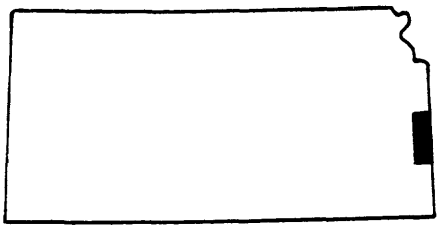
Problem -- The Kansas Department of Health and Environment must obtain information to evaluate the impact of urbanization on the water resources of the State. Some Kansas counties are heavily urbanized, others currently are being urbanized, and still others are planned for urban development. One of the major urban developments in Kansas is in Shawnee County. A critical need exists for data relating to characteristics of urban runoff in the county, primarily with respect to the quality of water from runoff in the city of Topeka.

Objectives -- Establish a data base from selected study areas within the city of Topeka that will include streamflow, physiographic, climatic, and water-quality information. Evaluate the quality of water by defining the physical, chemical, and biological characteristics of runoff from selected urban areas under existing conditions and make projections of these characteristics of runoff that may occur with future urban development.

Approach -- Streamflow, physiographic, climatic, and water-quality data were collected at selected sites, which were equipped with stream-gaging and water-quality monitoring equipment. Data was collected to determine the variation of water quality during storms and among seasons. Peak chemical concentrations were identified, and total constituent loads were calculated. Water-quality determinations consisted of major cations and anions, trace metals, nutrients, organic carbon, bacteria, and suspended sediment.

Reports -- Pope, L. M., Diaz, A. M., and Butler, M. K., 1983, Urban water-quality data and statistical summaries for selected sites in the Shunganunga Creek basin, Topeka, Kansas: Kansas Department of Health and Environment Bulletin B2-49, 203 p.

Pope, L. M., and Bevans, H. E., 1984, Relations of urban land-use and dry-weather, storm, and snowmelt flow characteristics to stream-water quality, Shunganunga Creek basin, Topeka, Kansas: U.S. Geological Survey Open-File Report 84-750 (pending publication as a Water-Supply Paper).



PROJECT TITLE: Hydrologic consequences of strip mining the Mulberry coal in Miami, Linn, and Bourbon Counties of eastern Kansas
PROJECT NUMBER: KS-099
COOPERATING AGENCY: Federal
PROJECT CHIEF: H. E. Bevans

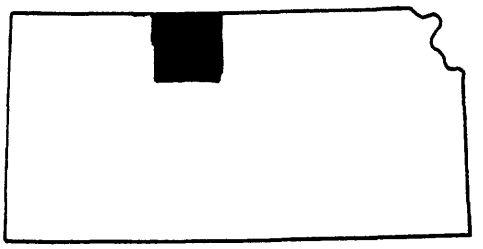
Problem -- The thickest and most extensive remaining coal seam in Kansas is the Mulberry coal. Approximately 260 million short tons of Mulberry coal underlie a 300-square-mile area in Miami, Linn, and Bourbon Counties of eastern Kansas. The great thickness of overburden, up to 100 feet, that must be removed to mine this relatively thin, less than 4 feet, coal seam makes the stripping ratio (thickness of overburden to coal) one of the highest in the Nation. Coal-mining activities can present both immediate and long-term hydrologic consequences. In order to protect the hydrologic environment, State and Federal regulatory agencies and coal-mining companies require information regarding the premining hydrologic environment and the hydrologic consequences of coal mining.

Objectives -- Assemble and interpret the available hydrologic and related data necessary to describe the hydrologic environment. Determine and collect additional hydrologic data needed to describe the hydrologic environment and the consequences of coal mining. Describe the hydrologic consequences of coal mining in the study area.

Approach -- The investigation was carried out in a sequential three-phase approach. Phase I assembled and interpreted available hydrologic and related data in order to describe the hydrologic environment and determine additional hydrologic data necessary to describe and determine the effects of coal mining on the hydrologic environment. Phase II was an intensive data-collection period that acquired the additional hydrologic data. Phase III involved interpretation of hydrologic data to determine the hydrologic consequences of coal mining in the study area.

Reports -- Kenny, J. F., Bevans, H. E., and Diaz, A. M., 1982, Physical and hydrologic environments of the Mulberry Coal reserves in eastern Kansas: U.S. Geological Survey Water-Resources Investigations 82-4074, 50 p.

Bevans, H. E., 1984, Hydrologic responses of streams to mining of the Mulberry Coal reserves in eastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4047, 30 p.



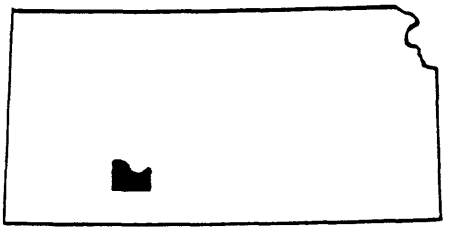
PROJECT TITLE: Conjunctive-use models for North and South Fork Solomon Rivers, north-central Kansas
PROJECT NUMBER: KS-100
COOPERATING AGENCY: U.S. Bureau of Reclamation
PROJECT CHIEF: J. E. Carr

Problem -- The management of surface and ground waters, which are used for irrigation in the Solomon Basin, is becoming more critical. Deficiencies in recent years of surface water for irrigation has resulted in the increasing use of ground water to supplement the available surface water. The conjunctive use of surface and ground waters will be required for optimal use of the water resources of the valleys. The streams and alluvial aquifers are in close hydraulic connection and should be studied as a stream-aquifer system.

Objective -- The objective of the study is to evaluate various management alternatives for the stream-aquifer systems utilizing a digital model.

Approach -- A digital model of each stream-aquifer system was utilized. The model was capable of "inputing" streamflow, surface-water irrigation, pumping, and recharge on a monthly basis. Various water allocations, both of surface and ground waters, were tested as management alternatives, and prediction as to the response of the stream-aquifer system was made. The model of the valley of the South Fork Solomon River was studied as phase 1. The modeling of the North Fork Solomon River was considered as phase 2 and was initiated at about the completion of phase 1.

Reports -- Burnett, R. D., 1984, Predictive simulation of alternatives for managing the water resources of North Fork Solomon River valley between Kirwin Dam and Waconda Lake, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4249, 34 p.



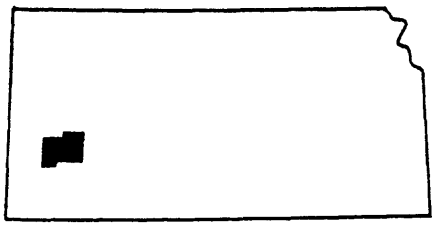
PROJECT TITLE: Water resources of Ford County
PROJECT NUMBER: KS-106
COOPERATING AGENCY: Southwest Kansas Groundwater Management District No. 3
PROJECT CHIEF: J. M. Spinazola

Problem -- The rate of depletion of the water resources in Ford County has accelerated in recent years. Increased ground-water pumpage and coincident drought conditions have caused declines in water levels. Water levels in the unconsolidated aquifer have declined 7 to 10 feet since 1940. Industrial and agricultural demand for water continues to be strong, and available data are not adequate for local water managers to allocate the diminishing water supply in an equitable and hydrologically sound fashion.

Objectives -- (1) Update the hydrologic data base for the county, including an estimate of water use from the unconsolidated aquifer, (2) document the areal aquifer response to pumping stresses, and (3) determine the availability of water, for irrigation or other uses, as defined by the guidelines of the Southwest Kansas Groundwater Management District No. 3.

Approach -- The hydrologic data base was updated by an inventory of large-capacity wells in the county and by measurement of the discharge of about 8 percent of the wells. Total ground-water withdrawal was estimated by an evapotranspiration model, which utilized a soil-moisture accounting procedure. The aquifer's areal response to pumping is shown by a water-table map constructed during the pumping season. Availability of water for large-capacity wells were determined by using the water-table map and the 9-square-mile depletion model developed by the U.S. Geological Survey for a previous project in west-central Kansas.

Reports -- Spinazola, J. M., and Dealy, M. T., 1983, Hydrology of the Ogallala aquifer in Ford County, southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 83-4226, 58 p.



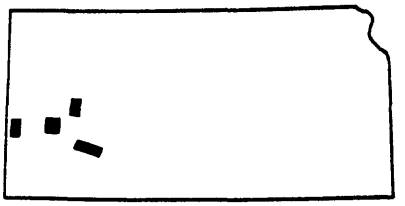
PROJECT TITLE: Effects of ground-water withdrawals on water levels and streamflow in the Arkansas River near Garden City
PROJECT NUMBER: KS-107
COOPERATING AGENCY: Division of Water Resources, Kansas State Board of Agriculture
PROJECT CHIEF: R. J. Lindgren

Problem -- The flow of the Arkansas River at Garden City has diminished during the last decade such that the periods of no flow have increased from about 10 to 90 percent. Concurrently, large-scale irrigation has developed in the sandhills south of the river from the Bear Creek fault in Kearny County to the vicinity of Garden City. Consequently, the yields of old irrigation wells near the river have decreased, and the rate of water-level declines has accelerated. Recent requests for appropriation of large quantities of ground water for industrial use in this area may adversely affect senior water rights.

Objectives -- Define the hydrologic relationships among the Arkansas River, the valley alluvial aquifer, and the underlying unconsolidated aquifer of the Ogallala Formation; determine the changes in the relationship between the ground-water system and the Arkansas River; and construct, test, and apply a digital ground-water-flow model to determine the effects of pumping ground water from the unconsolidated High Plains (Ogallala) aquifer south of the Arkansas River on flow of the river, on the yield of wells in the valley alluvial aquifer, and on water-level declines north of the river.

Approach -- Principal work items in this project were to determine: (1) the hydrologic boundaries of the stream-aquifer system, (2) the hydraulic characteristics of the aquifers, (3) the hydrologic stresses that are being imposed on the system, and (4) the effects of the hydrologic stresses on the stream-aquifer system. These data were used in a multilayer digital ground-water-flow model of the system to evaluate the effects of various management alternatives on the availability of ground water and on flow of the Arkansas River.

Reports -- Dunlap, L. E., Lindgren, R. J., and Carr, J. E., 1984, Projected effects of ground-water withdrawals in the Arkansas River valley, 1980-99, Hamilton and Kearny Counties, southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4082, 168 p.



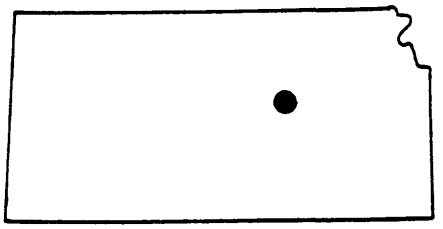
PROJECT TITLE: Geohydrology and water quality of deep-aquifer systems, Cretaceous and Jurassic ages, western Kansas
PROJECT NUMBER: KS-109
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: Jack Kume

Problem -- The High Plains aquifer system has been stressed extensively in much of western Kansas. The underlying rocks of Cretaceous and Jurassic ages contain permeable units that have potential for use as alternative sources of water supply. The permeable zones within these rocks are used for disposal of brine that results from oil and gas production. A real hazard exists for contamination of the Cretaceous-Jurassic aquifer system if brine disposal continues without a sound hydrologic basis.

Objectives -- Define the geohydrology of the rocks of Cretaceous and Jurassic ages in detail at selected sites. Determine the vertical and horizontal variation in chemical quality of water in the permeable zones and determine the hydraulic-head differences between permeable zones and across confining beds. Determine the hydraulic characteristics of principal permeable zones and regionalize the results using available geophysical logs and other oil- and gas-exploration data.

Approach -- Use lithologic and geophysical logs of oil and gas test wells to determine test-drilling sites. A test-drilling program provided detailed geohydrologic data needed to define the hydrology of the aquifers and the confining beds in the rocks of Cretaceous and Jurassic ages. Arrangements were made to re-enter three plugged and abandoned oil and gas test wells. Special well-completion tests were used in the abandoned wells, as applicable, to permit the independent measurements of hydraulic heads in permeable zones, the testing of hydraulic characteristics, and the collecting of ground-water samples.

Reports -- Kume, Jack, 1984, Geohydrology and chemical quailty of water in Middle and Upper Jurassic and Lower Cretaceous rocks, western Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4045, 54 p.

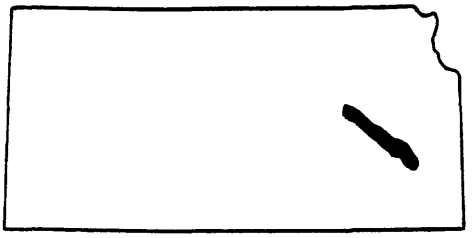


PROJECT TITLE: Geohydrology of Wellington Formation and Smoky Hill Valley alluvium in Salina area, central Kansas
PROJECT NUMBER: KS-110
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: J. B. Gillespie

Problem -- Saline water is discharged from the alluvial aquifer into the Smoky Hill and Solomon Rivers east of Salina. The source of the saline water is brine from the underlying Wellington aquifer. The eastward movement of brine in the Wellington aquifer is believed to be confined to a limited cross section under the alluvium of the Smoky Hill Valley. A tight confining shale layer occurs between the two aquifers northeast of Salina. The most promising method for alleviation of saline-water contamination of the aquifer-stream system may be the construction of a line of relief wells in the area northeast of Salina. The brine discharged from the relief wells could possibly be injected into deep saline aquifers.

Objectives -- Define more accurately the area under which the brine is flowing eastward in the Wellington aquifer. Determine the volume of brine moving eastward and delineate any areas of saline-water contamination in the alluvial aquifer in the Salina area. Determine location of relief wells to intercept eastward-flowing brine and predict the effects of different pumping alternatives on brine flow by using a digital model.

Approach -- Test holes were drilled on the north and south sides of the valley boundaries to determine if there is any brine flowing underneath the adjacent uplands. Also, additional wells were installed in the Wellington aquifer underlying the valley alluvium. Aquifer tests were conducted on these wells, and the brine was injected into the deep Arbuckle aquifer. Short- and long-term aquifer tests were conducted on both aquifers simultaneously. Observation wells were augered in the alluvium. Water samples from both the Wellington and alluvial aquifers were collected for chemical analysis. A quasi-three-dimensional digital model will be constructed to predict the effects of different pumping on brine flow.

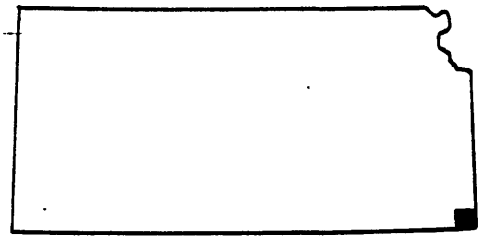


PROJECT TITLE: Transit losses and traveltimes for reservoir release during drought conditions along the Neosho River from Council Grove Lake to Iola, east-central Kansas
PROJECT NUMBER: KS-115
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: R. J. Hart

Problem -- The management of surface water and ground water, which are used for water supply and irrigation in the Neosho River, is becoming more critical. The use of water directly from the river for irrigation has increased in recent years. All the water supply available from John Redmond Reservoir, about 100 miles downstream from Council Grove, has been purchased; therefore, additional water supplies are only available from Council Grove Reservoir. Natural streamflow gains and losses in the river must be calculated to determine the required amount of water released at the reservoir to supply the target discharge at the point of use.

Objective -- The purpose of this study is to determine the magnitude of natural streamflow gains and losses during drought conditions in two reaches of the Neosho River. One reach is from the outlet of Council Grove Reservoir to Neosho Rapids. The other reach is from the outlet of John Redmond Reservoir to the U.S. Geological Survey streamflow gage near Iola.

Approach -- The approach to this study entailed a data-acquisition phase and a modeling phase. First, a data base was developed from existing data and additional data that were collected to adequately describe the stream-aquifer system. The modeling phase entailed selection, calibration, and verification of a stream-aquifer model. The modeling phase also was devoted to using the calibrated model to determine streamflow losses under varying reservoir-release conditions during drought conditions.



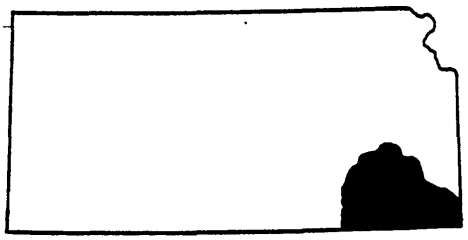
PROJECT TITLE: Quality of water in lead-zinc mined areas of southeast Kansas
PROJECT NUMBER: KS-119
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: T. B. Spruill

Problem -- Seepage from abandoned tailings piles and contaminated water from underground lead-zinc mines present a continuing source of chemical pollutants to ground and surface waters in a tri-state area that includes southwest Missouri, northeast Oklahoma, and southeast Cherokee County, Kansas. Determination of the characteristics and extent of pollution in the area is necessary in order to evaluate the severity of potential hazards to local water resources.

Objectives -- (1) Define water-quality characteristics of ground and surface waters of the lead-zinc mined areas, (2) determine extent and type of chemical pollution present, (3) describe the hydrology and geochemistry of the area.

Approach -- Collect water samples from mines, wells, and surface-water sites for chemical analysis, compile historical water-quality and hydrologic data, and evaluate data using appropriate statistical and geochemical analytical techniques. The extent to which the natural hydrologic system has been affected by abandoned lead-zinc mines will be examined.

Reports -- Spruill, T. B., 1984, Assessment of water resources in lead-zinc mined areas in Cherokee County, Kansas, and adjacent areas: U.S. Geological Survey Open-File Report 84-439 (pending publication as a Water-Supply Paper), 102 p.



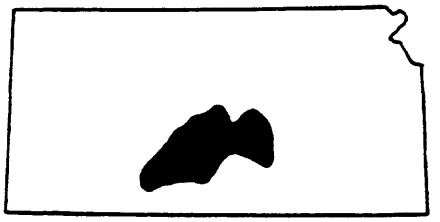
PROJECT TITLE: Hydrology of Coal Area 40, Western Interior Coal Province, Kansas
PROJECT NUMBER: KS-121
COOPERATING AGENCY: Federal
PROJECT CHIEF: J. F. Kenny

Problem -- Continued production of coal in the Western Interior Coal Province will require the stripping and reclamation of large land-surface areas. In recognizing the potentially adverse effects of coal mining on water resources, the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87) requires that comprehensive hydrologic information be provided on the general area prior to mining. This information is needed by surface-mine owners and operators and consulting engineers in the analysis of proposed mine sites and adjacent areas and by Federal and State regulatory agencies in appraising the adequacy of permit applications.

Objectives -- The U.S. Geological Survey is helping to provide data required by Public Law 95-87 through a series of reports covering the coal provinces nationwide. This study will provide broad hydrologic and related information and assess existing hydrologic conditions for Area 40 in southeastern Kansas, southwestern Missouri, and northeastern Oklahoma. Additional data needed to evaluate the impacts of strip mining on the water resources of Area 40 will be indicated, and extensive references to sources of more detailed information will be provided.

Approach -- Available data from previous and ongoing hydrologic investigations were compiled by personnel from the Kansas and Oklahoma Districts. These data will be presented in a report consisting of a brief text with an accompanying map, chart, graph, or other illustration for each of a number of water-resources related topics. The summation of the topical discussions will provide a description of the hydrology of Area 40.

Reports -- Marcher, M. V., Kenny, J. F., and others, 1983, Hydrology of Area 40, Western Region, Interior Coal Province, Kansas, Oklahoma, and Missouri: U.S. Geological Survey Water-Resources Investigations Report 83-266, (in press).



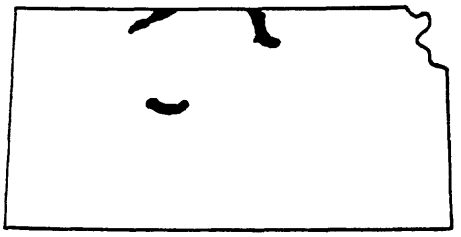
PROJECT TITLE: Natural ground-water recharge dynamics in the Kansas Plains
PROJECT NUMBER: KS-122
COOPERATING AGENCY: Kansas Geological Survey
PROJECT CHIEFS: Marios Sophocleous and C. A. Perry

Problem -- Recent large-scale irrigation development in Kansas and the consequent declines in ground-water supplies focused attention on ground-water-recharge rates. These rates are not sufficient to meet the current demands over a long period of time. The lack of detailed information about natural recharge aggravates the problems of planning for and managing the ground-water resources of Kansas.

Objectives -- (1) Investigate the mechanisms of natural ground-water recharge; (2) quantify the amount of recharge water and specify its time distribution for two areas in Kansas, one in the "Equus beds" and the other in the Big Bend region; (3) study and evaluate the latest technology with regard to instrumentation and techniques for studying ground-water recharge; and (4) coordinate onsite and laboratory measurements with mathematical modeling techniques to develop improved methods of estimating ground-water recharge.

Approach -- Two experimental sites were instrumented to provide integrated and automated measurements of the subsurface flow regime on a year-round basis. Onsite data were supplemented with laboratory determinations and were used to modify numerical models and thus to better understand and predict the recharge process.

Reports -- Sophocleus, Marios, and Perry, C. A., 1984, Experimental studies in natural groundwater recharge dynamics--Assessment of recent advances in instrumentation: Journal of Hydrology, v. 70, p. 369-382.

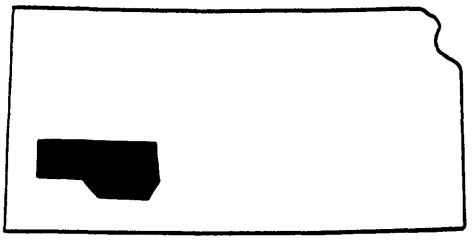


PROJECT TITLE: Effects of irrigation return flow on the chemical quality of water in the Smoky Hill River, Prairie Dog Creek, and Republican River, Kansas
PROJECT NUMBER: KS-125
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: T. B. Spruill

Problem -- Although ground water now provides the principal source of irrigation water in central and western Kansas, surface-water sources may become more important in the future because of gradual depletion of ground-water reservoirs. Application of irrigation water in a semiarid region, such as western Kansas, may cause changes in the local hydrologic regime, as well as causing potentially deleterious changes in the soils and in ground- and surface-water quality. Water draining from an irrigated basin may be rendered unfit for other beneficial uses. There is a need to document current conditions and possible long-term deleterious effects of irrigation to provide information useful for management decisions directed at minimizing these problems.

Objectives -- (1) Areally define post-irrigation season surface- and ground-water quality characteristics within the irrigation districts and adjacent areas in the Prairie Dog Creek and Republican River valleys. (2) Statistically compare possible differences in surface- and ground-water quality of areas within each irrigaton district that are minimally irrigated, irrigated with ground water, and irrigated with surface water. (3) Define possible seasonal changes in hydrologic conditions and ground- and surface-water quality of areas that are minimally irrigated, irrigated with ground water, and irrigated with surface water. (4) Determine possible long-term effects of ground- and surface-water quality in the Cedar Bluff and Almena Irrigation Districts.

Approach -- Irrigation, domestic, and public-supply wells were selected in each of the three areas for water-quality sampling. Each of these areas contained 6 to 15 wells. Samples of well water in the Almena and Cedar Bluffs Districts were collected during the fall 1981, and spring, summer, and fall 1982. Samples of well water in the Bostwick District were collected from April to November 1982. Several seepage investigations were also conducted in each area. Data obtained from the study will be statistically analyzed to determine significant areal, seasonal, and temporal changes in water quality.



PROJECT TITLE: Hydrology of the Lower Cretaceous sandstone aquifers of southwest Kansas
PROJECT NUMBER: KS-127
COOPERATING AGENCY: Groundwater Management District No. 3
PROJECT CHIEF: K. R. Watts

Problem -- Sandstones of Early Cretaceous age form a major aquifer system in southwest Kansas. As the heavily developed High Plains aquifer becomes depleted, more water users will tap the resources of these deeper aquifers. The Southwest Kansas Groundwater Management District No. 3 is responsible for controlling development of ground-water resources in parts of southwest Kansas, and has established criteria for well spacing and yield appropriation of ground water. Detailed knowledge of the hydrology of the sandstone aquifers and possible hydraulic connections with the High Plains aquifer and underlying aquifers is needed so that the Management District may refine their selection criteria.

Objective -- To define the hydrologic boundaries, aquifer characteristics and fluxes, potentiometric surfaces, water quality, and the water-supply potential of the sandstone aquifers and their connection with the High Plains aquifer.

Approach -- (1) Lithologic and geophysical data were used to refine the knowledge of the geologic and hydrologic boundaries of these aquifers;

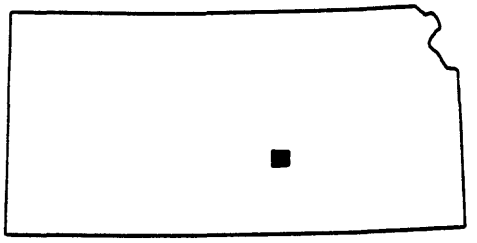
(2) aquifer characteristics, transmissivity, and storativity were determined from pump-test data;

(3) water-level information was collected from observation wells;

(4) water use from the aquifers was estimated for major water-use categories;

(5) an inventory of large-capacity wells completed in the Dakota aquifer will be used to update the Ground-Water Site Inventory (GWSI) files; and

(6) a three-dimensional finite-element ground-water flow model consisting of up to five layers will be calibrated and used to evaluate management strategies.



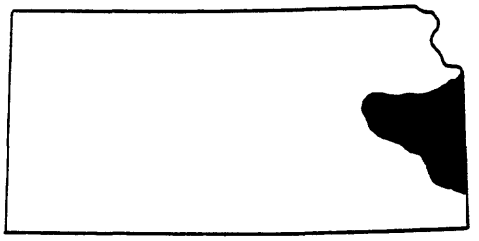
PROJECT TITLE: Natural ground-water recharge in Harvey County, Kansas
PROJECT NUMBER: KS-128
COOPERATING AGENCY: Harvey County
PROJECT CHIEF: C. A. Perry

Problem -- The "Equus beds" aquifer supplies large quantities of water for cities including Wichita and Newton, as well as for irrigation, at a steadily increasing rate. To best direct development in this area, the Harvey County Planning Office needs information on the natural recharge of this aquifer in areas where the lithology of the unsaturated zone is different.

Objective -- To determine natural ground-water recharge rates in areas of different soil types in Harvey County.

Approach -- Three sites were established in conjunction with the ongoing recharge project, KS-122. Sites were equipped with an observation well, a neutron moisture-probe access tube, and a recording rain gage. The data collected were used in an unsaturated-flow simulation model to estimate the natural ground-water recharge.

Reports -- Perry, C. A., 1984, Natural ground-water-recharge data from three selected sites in Harvey County, south-central Kansas: U.S. Geological Survey Open-File Report 84-457, 31 p.



PROJECT TITLE: Hydrology of Coal Area 39, Western Interior Coal Province, Kansas
PROJECT NUMBER: KS-129
COOPERATING AGENCY: Federal
PROJECT CHIEF: H. E. Bevans

Problem -- The Kansas part of Coal Area 39 of the Western Interior Province contains approximately 295 megatons of strippable bituminous coal reserves. The Marais des Cygnes, Little Osage, and Marmaton Rivers drain the area. Large stripping ratios (overburden thickness/coal thickness) will require large volumes of land to be disturbed during mining operations. Comprehensive hydrologic information is needed to help guide mining operators, regulatory agencies, legislators, and the public in assessing the hydrologic consequences of coal mining in this area.

Objectives -- The objectives of this investigation are to assemble and interpret existing hydrologic and related data to: (1) Evaluate the adequacy of the existing data, (2) define current hydrologic and related conditions, (3) describe the hydrologic consequences of coal mining, and (4) determine additional data and investigations needed to assess the hydrologic impacts of coal mining.

Approach -- Historic data and data collected from ongoing hydrologic investigations were compiled and interpreted in a report that will consist of a series of maps, each with a brief text describing a water-resources related topic. These maps depict hydrologic and related environments.

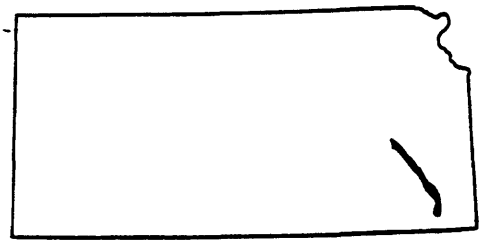
Reports -- Bevans, H. E., Skelton, John, Kenny, J. F., and Davis, J. V., 1984, Hydrology of Area 39, Western Region, Interior Coal Province, Kansas and Missouri: U.S. Geological Survey Water-Resources Investigations Report 83-851 (in press).

PROJECT TITLE: Estimating stream-aquifer interactions in coal areas of eastern Kansas
PROJECT NUMBER: KS-131
COOPERATING AGENCY: Federal
PROJECT CHIEF: H. E. Bevans

Problem -- Information about stream-aquifer interactions in coal areas of eastern Kansas, necessary to predict and manage the effects of strip mining, is generally unavailable because of the lack of aquifer-test data. Previously developed quantitative analytical procedures are available that can provide alternative approaches to estimating stream-aquifer interactions. There is a need to demonstrate the application and evaluate the accuracy of these procedures.

Objectives -- The objectives of this investigation are to: (1) Demonstrate the application of quantitative analytical procedures for estimating stream-aquifer interactions, (2) evaluate the accuracy and transferability of the procedures, and (3) develop a method for estimating stream-aquifer interactions for ungaged streams in coal areas of eastern Kansas.

Approach -- Available streamflow data were utilized in quantitative analytical procedures to estimate stream-aquifer interactions in coal areas of eastern Kansas. The estimated interactions were compared between subareas to determine their transferability within the study area.



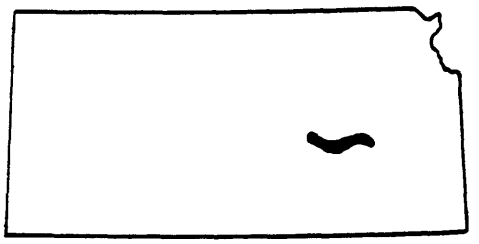
PROJECT TITLE: Availability of natural and regulated streamflows for instream uses during historical droughts, lower Neosho River, southeastern Kansas
PROJECT NUMBER: KS-133
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: R. J. Hart

Problem: The magnitude of natural streamflow and reservoir releases needed to achieve minimum desirable flows are critical to the management of water resources in the Neosho River basin. The volume of reservoir storage needed for augmentation of natural flows has not been determined for either typical or more severe conditions.

Objectives -- The objectives of this project are to quantify augmentation requirements during historical drought periods lasting from 1 to 4 years. The project will also determine the magnitude of reservoir storage necessary to maintain these flows through releases and the magnitude and duration of deficiencies in flow resulting from lesser amounts of storage.

Approach -- The basic approach of this project was to compare recommended desirable flows to observed and simulated daily streamflow during three drought periods. The analyses were done separately for both natural flow conditions and for flow regulated by John Redmond Reservoir. Flow simulation was provided by a reservoir-routing model and a streamflow-routing model.

Reports -- Hart, R. J., and Stiles, T. C., 1984, Availability of natural and regulated streamflows for instream uses during historical droughts, lower Neosho River, southeastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4292, 42 p.

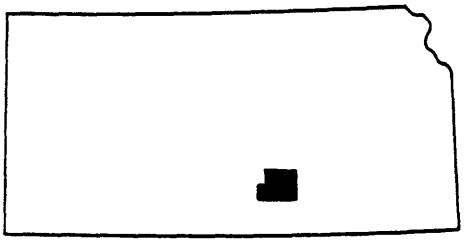


PROJECT TITLE: Transit loss, traveltimes, and related hydraulic and hydrologic characteristics of selected stream-aquifer systems
PROJECT NUMBER: KS-134
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: P. R. Jordan

Problem -- For most stream reaches downstream from the major water-supply reservoirs in Kansas, little is known of losses of streamflow to bank storage, ground water, and evapotranspiration. The components of the natural system must be evaluated during various combinations of natural conditions and reservoir releases in order to provide information for the sound planning and management of water supplies.

Objectives -- (1) Define the hydraulic and hydrologic characteristics of selected stream-aquifer systems. (2) Quantify the movement of water between stream, aquifer, and atmosphere. (3) Evaluate the effects of changes in natural hydrologic conditions and of specific water management alternatives.

Approach -- Currently under study is the Cottonwood River. The project will begin with selection of a model after examination of the available stream-aquifer models through literature review and consultation with knowledgeable individuals. Existing data will be assembled and interpreted. New data will be collected where needed. The model will be calibrated, then used to simulate a variety of conditions that might occur naturally or be imposed.

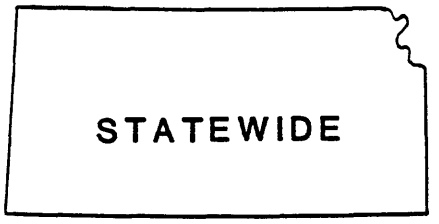


PROJECT TITLE: Hydrology and water quality of Sedgwick County, Kansas
PROJECT NUMBER: KS-136
COOPERATING AGENCIES: Sedgwick County and the city of Wichita
PROJECT CHIEF: H. E. Bevans

Problem -- Increasing population in Sedgwick County, the most populous county in Kansas, and in Wichita, its principal city, requires careful management of county water resources to provide adequate supplies for domestic, industrial, and irrigation use. The county and city currently (1984) are relying on information from a 1965 geohydrologic study to manage their water resources. Current information regarding the availability and quality of ground- and surface-water resources is necessary to determine changes since 1965 and to predict future impacts.

Objectives -- This study will be directed towards: (1) Inventorying the current quantity and quality of surface- and ground-water resources in Sedgwick County; (2) evaluating the water resources with respect to supplies required for domestic, industrial, and irrigation uses; and (3) determining trends with respect to the quantity and quality of the water resources over the past 20 years to predict future impacts.

Approach -- A thorough review of available data and literature will be used to establish a frame of reference for determining trends in county water resources and to determine additional data needs. Land-use and water-use data will be compiled and analyzed to establish a representative data-collection network. Additional water data will be collected for developing a potentiometric-surface map, describing water-quality characteristics of ground and surface waters, constructing a solute-transport model for determining the effects of ground-water withdrawals on water quality in the Arkansas River alluvium south of Wichita, quantifying ground- and surface-water resources available for county supplies, and determining trends by comparisons to historical data.



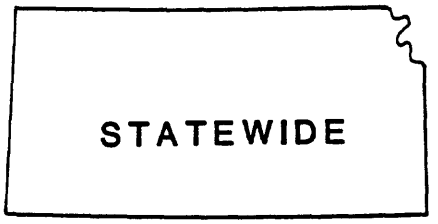
PROJECT TITLE: Flood hydrology and hydraulics for transportation applications.
PROJECT NUMBER: KS-010
COOPERATING AGENCY: Kansas Department of Transportation
PROJECT CHIEF: R. W. Clement

Problem --There is a continuing need for adequately defined flood-frequency characteristics for Kansas streams to assist in the efficient design of highway-drainage structures, for flood-plain analysis, and to evaluate flood-risk factors. Long-term records of annual peak discharges are necessary to adequately define flood-frequency characteristics. Although streamflow records have been collected on Kansas streams since 1895, they are limited primarily to those streams that drain areas larger than 100 square miles. Very little long-term data are available for streams draining areas of less than 100 square miles.

Objectives -- Define the flood-frequency characteristics on gaged streams in Kansas using long-term data, both observed and synthesized, and develop techniques to extend those characteristics to ungaged locations.

Approach -- Records of annual peak discharges for small drainage areas are obtained from a crest-stage gage network. Selected crest-stage gage sites are equipped to collect simultaneous records of continuous rainfall and discharge. Long-term records of annual peak discharges are synthesized through the use of a rainfall-runoff model and a record of long-term rainfall. Data for large drainage areas are available from the regular stream-gaging network. Flood-frequency relations, determined by statistical methods, are extended to ungaged sites by using physical and climatic factors.

Reports -- Clement, R. W., 1983, Improvement of flood-frequency estimates for selected small watersheds in eastern Kansas using a rainfall-runoff model: U.S. Geological Survey Water-Resources Investigations Report 83-4110, 22 p.



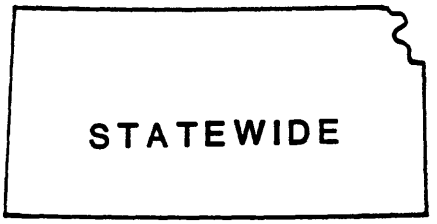
PROJECT TITLE: Streamflow characteristics
PROJECT NUMBER: KS-011
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: P. R. Jordan

Problem -- There is a need to express basic streamflow records in more useful forms and to develop improved methods of estimating the frequency of various types of flow in gaged and ungaged streams in Kansas.

Objectives -- Define the significant characteristics of streamflow in Kansas; determine the interrelation between streamflow and ground-water storage; analyze and summarize existing data in useful terms for developing optimum benefit from the available water supplies and optimum protection from floods.

Approach -- Analyze significant streamflow characteristics and update results of previous studies using improved methods applied to initial data and additional data from 16 to 20 years of record, particularly the data from small drainage basins. Where available, improved analytical techniques will be used to determine flow probabilities.

Reports -- Jordan, P. R., 1983, Magnitude and frequency of low flows of unregulated streams in Kansas, and estimation of flow-duration curves for ungaged sites: Kansas Water Office Technical Report No. 17, 55 p.



PROJECT TITLE: Evaluation of the Ground-Water-Quality Monitoring Network
PROJECT NUMBER: KS-077
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: T. B. Spruill

Problem -- Data on the chemical quality of ground water is needed from a statewide network of wells in response to State and Federal regulations imposed by the Safe Drinking Water Act of 1974 (Public Law 93-523). A continuing evaluation of the adequacy of the network is needed for monitoring ground-water quality in the principal aquifers of the State. These data are necessary for effective management decisions regarding the State's water resources.

Objective -- Evaluate the chemical-quality data to determine the adequacy of the network for describing baseline ground-water quality, to detect pollution of the principal aquifers in the State, and to determine the significance of the data in respect to State and Federal water-quality standards imposed by the Safe Drinking Water Act.

Approach -- Collect water samples for chemical analysis from a statewide network of about 500 wells. The wells will be sampled to provide baseline data for determining the general chemical quality of ground water in the principal aquifers and to provide a basis for detecting possible long-term changes in regional ground-water quality. Interpretation of sampled data will continue, and the adequacy of data will be reanalyzed for detecting changes in chemical quality and in local occurrence of pollution.

Reports -- Spruill, T. B., 1983a, Relationship of nitrate concentrations to distance of well screen openings below casing water levels: American Water Resources Association, Water Resources Bulletin, v. 19, no. 6, December 1983, p. 977-981.

_____1983b, Statistical summaries of selected chemical constituents in Kansas ground-water supplies, 1976-81: U.S. Geological Survey Open-File Report 83-263, 29 p.

_____1984, Use of data from regional ground-water-quality monitoring networks: 29th Annual Midwest Groundwater Conference, Proceedings, Lawrence, Kansas, October 1-4, 1984, p. 12.

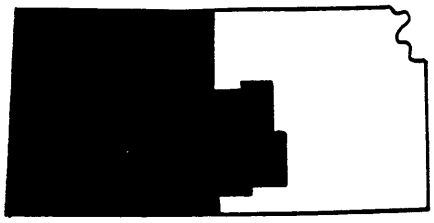
PROJECT TITLE: Potential for liquid-waste injection into the Arbuckle Group
PROJECT NUMBER: KS-078
COOPERATING AGENCY: Kansas Geological Survey
PROJECT CHIEF: J. E. Carr

Problem -- Rocks of the Arbuckle Group, which underlie nearly all of Kansas, are important oil reservoirs in much of the State and are an important freshwater aquifer in the southeastern part. The rocks also are a primary horizon for waste disposal, particularly oilfield brine. Little is known about the regional geohydrology and the potential effects of contamination to freshwater aquifers.

Objectives -- Determine the regional geohydrology of the Arbuckle Group from available data and further define the Arbuckle Group by making a preliminary assessment of the potential for waste injection to the aquifer. Determine the hydraulic characteristics and potential for liquid-waste injection in selected areas.

Approach -- Data were compiled to determine the areal extent and thickness of aquifers, the areal changes in hydraulic characteristics and chemical characteristics of the water, and the configuration of the potentiometric surface of saline water in the Arbuckle and other aquifers. Test wells were installed at selected sites to determine aquifer properties and chemical quality. Modeling techniques will be used to evaluate the potential for future injection and storage of liquid wastes and to assess the effects of waste injection on freshwater aquifers.

Reports -- Gogel, Tony, 1981, Preliminary data from Arbuckle test wells, Miami, Douglas, Saline, and Labette Counties, Kansas: U.S. Geological Survey Open-File Report 81-1112, 156 p.



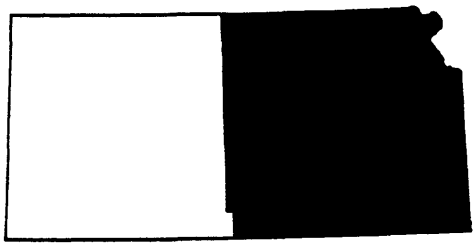
PROJECT TITLE: Techniques for estimating ground-water withdrawals in western Kansas
PROJECT NUMBER: KS-090
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: C. H. Baker, Jr.

Problem -- One of the principal unknown factors in quantitative ground-water hydrology and management of ground-water resources is the quantity of water withdrawn for irrigation use. The measurement of ground-water pumpage by installation of totalizing flow meters is possible but very expensive.

Objectives -- Investigate methods, other than metering of wells, for determining the withdrawal of ground water from irrigation wells in Kansas with an acceptable degree of accuracy and test such methods by application to a large irrigated area.

Approach -- The project was divided into two parts: Part 1 was to list, describe, and evaluate different methods of obtaining discharges at a well site and for an area; Part 2 was to field test any suitable method(s) evaluated in Part 1 on a large irrigated area, such as a ground-water management district.

Reports -- Baker, C. H., Jr., 1983, Evaluation of techniques for estimating ground-water withdrawals for irrigation in western Kansas: Kansas Water Office Bulletin 26, 14 p.

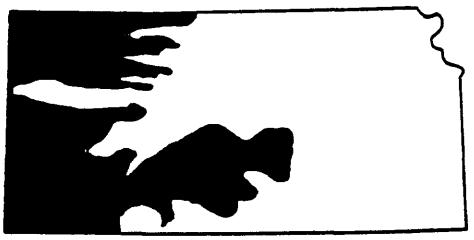


PROJECT TITLE: Aquifer-test evaluation
PROJECT NUMBER: KS-093
COOPERATING AGENCY: Kansas Geological Survey
PROJECT CHIEF: J. B. Gillespie

Problem -- Presently ongoing aquifer appraisal projects in eastern Kansas require accurate determination of aquifer charateristics. The files of the U.S. Geological Survey, Kansas Geological Survey, and Division of Water Resources of the Kansas State Board of Agriculture contain numerous aquifer tests that have been conducted since 1937. These tests need to be reanalyzed to provide a cohesive set of reliable aquifer parameters. Aquifer parameters are the basic building blocks for all quantitative aquifer evaluations.

Objectives -- To create an accurate reproducible documented file of aquifer parameters by aquifer and by area for use in ongoing areal investigations and investigations that are scheduled to begin in the next fiscal year.

Approach -- All available aquifer tests in eastern Kansas were compiled, and the tests were evaluated for adequacy of documentation. Supplemental data were collected as needed. Appropriate analytical or numerical techniques were determined and applied to each aquifer test. Aquifer-test results will be collated.



PROJECT TITLE: High Plains regional aquifer-system analysis, western Kansas
PROJECT NUMBER: KS-094
COOPERATING AGENCY: Federal
PROJECT CHIEF: L. E. Stullken

Problem -- The Ogallala Formation is the principal aquifer underlying the High Plains. The aquifer contains about 2 billion acre-feet of water in storage, but water is being withdrawn for irrigation in excess of the rate of natural replenishment. The economic future of the High Plains in eight states, including Kansas, is dependent upon the capacity of the aquifer to sustain withdrawals. A detailed knowledge of the aquifer system is needed so that the system can be simulated, water-management alternatives evaluated, and the economic life of the aquifer projected.

Objective -- Previous studies of the hydrology of the High Plains have been limited by political boundaries. This study will provide a regional description of the water resources and the operation of the hydrologic system consistent with the natural hydrologic boundaries of the High Plains.

Approach -- Existing hydrologic data were compiled and reviewed. Data-collection networks were revised or initiated to provide adequate coverage for the study area. The data were regionalized to provide a detailed description of the aquifer system and stored in a digital computer for processing and retrieval. Computer simulations of flow in the aquifer system were made to evaluate additional data needs and add to knowledge of the system's flow characteristics.

Reports -- Pabst, M. E., and Stullken, L. E., 1981, Altitude and configuration of water table in High Plains aquifer in Kansas, 1980: U.S. Geological Survey Water-Resources Investigations, Open-File Report 81-1004, scale 1: 500,000, 1 sheet.

_____1982a, Altitude and configuration of water table in High Plains aquifer, 1960: U.S. Geological Survey Open-File Report 82-429, scale 1: 500,000, 1 sheet.

_____1982b, Altitude and configuration of water table in High Plains aquifer, 1970: U.S. Geological Survey Open-File Report 82-448, scale 1: 500,000, 1 sheet.

_____1982c, Altitude and configuration of water table in High Plains aquifer, 1965: U.S. Geological Survey Open-File Report 82-449, scale 1: 500,000, 1 sheet.

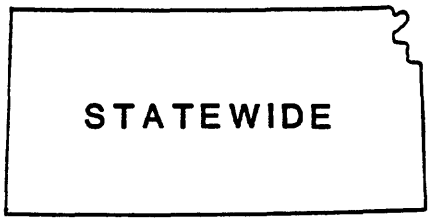
High Plains regional aquifer-system analysis, western Kansas (KS-094)--Continued

Reports -- Continued

Stullken, L. E., and Pabst, M. E., 1981, Altitude and configuration of water table in High Plains regional aquifer system of Kansas, 1975: U.S. Geological Survey Open-File Report 81-144, scale 1: 500,000, 1 sheet.

_____1982, Altitude and configuration of water table in High Plains aquifer of Kansas, pre-1950: U.S. Geological Survey Open-File Report 82-117, scale 1: 500,000, 1 sheet.

Watts, K. R., and Stullken, L. E., 1981, Generalized configuration of the base of the High Plains aquifer in Kansas: U.S. Geological Survey Open-File Report 81-344, scale 1: 500,000, 1 sheet.

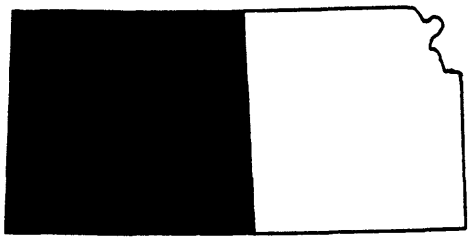


PROJECT TITLE: Central Midwest regional aquifer-system analysis, Kansas
PROJECT NUMBER: KS-111
COOPERATING AGENCY: Federal
PROJECT CHIEF: R. J. Wolf

Problem -- The hydrology of the freshwater, brackish-water, and saline-water aquifer systems in rocks of Cambrian-Ordovician to Cretaceous ages is not well defined. Because of the increased demand for water from the overlying High Plains aquifer system in western Kansas, aquifers in this deeper rock system are being looked upon as a potential source of additional water supply. In addition, increased pumpage in eastern Kansas has caused saline-water encroachment into aquifers of this rock system. Added to these problems are those resulting from injection of industrial wastes and oilfield brine into these rocks.

Objectives -- Describe the hydrology of the freshwater, brackish-water, and saline-water aquifer systems in rocks of Cambrian-Ordovician to Cretaceous ages. Create a regional data base for the rock systems and describe present and potential problems associated with current and future water use. Evaluate the aquifer-system's response to future stresses.

Approach -- A search of the available literature was made to determine the extent of geologic-framework interpretations and available data. Data were compiled to establish a data base of regional significance that includes detailed lithologic descriptions for selected wells, water-quality information, hydraulic characteristics of the rock systems, and information on water use, waste disposal, and brine injection. Appropriate maps will be prepared for steady-state digital-model construction to test the conceptual-flow system and to define additional data needs to calibrate a digital model capable of simulating the flow system for predictive purposes.



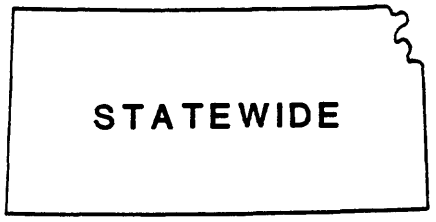
PROJECT TITLE: Determination of flood volume in small basins in western Kansas using CSI peak discharge and storm depth-duration
PROJECT NUMBER: KS 81-113
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: C. A. Perry

Problem -- In western Kansas, there is a need for determining flood-flow volumes at locations other than those served by continuous-record gaging stations. Many smaller streams have crest-stage indicator (CSI) gages that provide measurement of peak discharge. If a relationship could be developed so that storm-runoff volumes could be evaluated from CSI peak discharges, useful estimates could be made for discharge volumes. This additional information on flood-flow volumes is needed for developing better generalized volume-frequency relations.

Objective -- Develop relationships among peak discharge, storm depth-duration, and observed streamflow volume for individual storms at continuous-record stations in a form that can be used to estimate flow volume for individual storms at CSI gages on small basins in western Kansas.

Approach -- Relationships between physical and climatic characteristics, rainfall depth-duration, and flood hydrographs were examined at continuous-record stations. An effective base length was determined using a triangular-hydrograph equation. Rainfall depth-duration determination was improved by using average storm movement for the region. Multivariate regression techniques were used to develop a predictive equation for calculating flood volumes at CSI sites.

Reports -- Perry, C. A., 1984, A method of estimating flood volumes in western Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4164, 18 p.



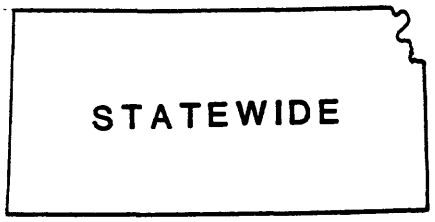
PROJECT TITLE: High-flow volume-frequency relations for Kansas
PROJECT NUMBER: KS-116
COOPERATING AGENCY: Kansas Water Office
PROJECT CHIEF: P. R. Jordan

Problem -- Better information on high-flow volumes is needed as a basis for review of existing and planned reservoirs. Information based on adequate records of observed flows is superior to synthetic hydrographs based on estimated runoff relations and average storm patterns. State regulations require certain classes of new reservoirs to provide flood-control storage equal to the inflow volume of specified frequency. Inspection of existing reservoirs for safety must include consideration of the volumes of flood water they must store or pass through.

Objectives -- The study will provide high-flow volume information that can be used in design of new reservoirs and safety evaluation of existing reservoirs. Emphasis will be on small streams. The report will provide high-flow volume-frequency information at gaging stations throughout Kansas and will provide relations to basin characteristics that can be used for ungaged sites.

Approach -- The study used available data from gaging stations with at least 10 years of record and drainage areas smaller than 3,000 square miles. Data on basin characteristics were available for these stations. High-flow volume frequency characteristics were determined using WATSTORE program A969 and statistical curve fitting. Some study of skew coefficients were needed for the curve fitting. A stepwise multiple-regression model then was used to determine relations of high-flow volumes to basin characteristics.

Reports -- Jordan, P. R., 1984, Magnitude and frequency of high flows of unregulated streams in Kansas: U.S. Geological Survey Open-File Report 84-453 (pending publication as a Water-Supply Paper), 45 p.



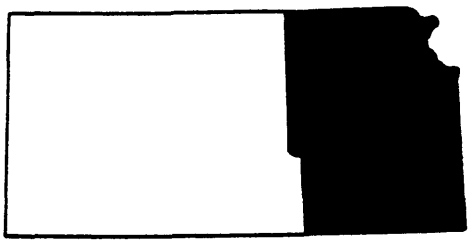
PROJECT TITLE: Kansas surface-water network evaluation using Kalman filtering (KCERA) techniques
PROJECT NUMBER: KS-130
COOPERATING AGENCY: Federal
PROJECT CHIEF: K. D. Medina

Problem -- The Water Resources Division of the U.S. Geological Survey operates in excess of 100 streamflow-gaging stations in Kansas. It is essential that an analysis be made of this network to assure maximum cost effectiveness, in concert with the uses of the data, the accuracy of the data, and the availability of other methodologies for providing the data.

Objectives -- Analyze historical hydrologic data to achieve optimum benefit from available supplies, and evaluate surface-water networks with respect to cost effectivenes, network design, and data use and accuracy.

Approach -- The surface-water network was evaluated using K-CERA techniques, which included identification of data uses, costs, and needs.

Reports -- Medina, K. D., and Geiger, C. O., 1984, Evaluation of the cost effectiveness of the 1983 stream-gaging program in Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4107, 57 p.

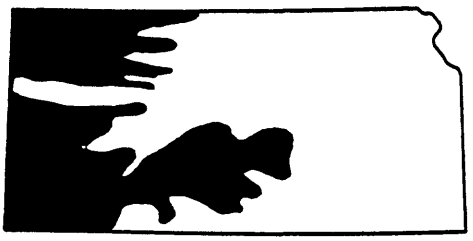


PROJECT TITLE: Effects of multipurpose use on the water quality of public water-supply lakes
PROJECT NUMBER: KS-132
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: L. M. Pope

Problem -- Assessment of the water-quality characteristics of selected public water-supply lakes in eastern Kansas can be used to evaluate their suitability as drinking-water supplies. The use of lakes for various activities can affect the quality of water in such a manner that may accelerate natural eutrophication processes, which, in turn could increase the concentrations of organic substances in the water. The contribution of nutrients (nitrogen and phosphorus) by the inflow from the area drained by the lake(s) can enhance the growth of the phytoplankton populations and algae, which can also accelerate the eutrophication processes. The increased concentrations of organic substances, nutrients, phytoplankton, and algae can cause taste, odor, and turbidity problems and pose a potential for the formation of organohalides as byproducts of the interaction of disinfectants with natural organic substances.

Objectives -- The purpose of this investigation is to evaluate the effects of multipurpose use on the water quality of selected public water supply lakes. Specific objectives of the investigation are to: (1) Identify and quantify organic chemicals, nutrients, and phytoplankton populations; (2) determine seasonal and spatial variations in organic chemicals, nutrients, phytoplankton populations, and dissolved oxygen; (3) select lakes representative in size, age, trophic state, and degree of water-quality degradation for an intensive 3-5 year investigation.

Approach -- A reconnaissance survey of selected public water-supply lakes was made in eastern Kansas. The selection of lakes was based on variations in size and management practices. Water samples were collected during low-flow conditions when water-quality degradation was most apparent and when water-treatment plants were experiencing taste and odor problems. Water samples were collected at inflow and outflow points of the lake and at points within the lake selected by determinations of spatial variation in temperature, dissolved oxygen, pH, specific conductance, and turbidity. The water samples were analyzed for dissolved solids, nutrients, chlorophyll a, and total and organic carbon. The resultant water-quality data will be analyzed and used to select lakes for more intensive study.

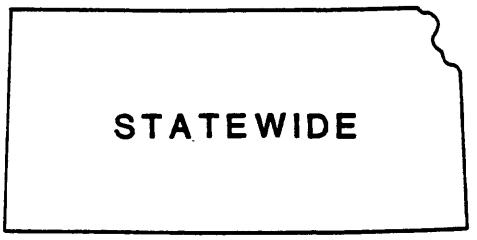


PROJECT TITLE: Water quality in the High Plains aquifer, western Kansas, related to petroleum production, irrigated, and nonirrigated cropping land use
PROJECT NUMBER: KS-135
COOPERATING AGENCY: Federal
PROJECT CHIEF: L. E. Stullken

Problem -- Little is known about the contamination of the High Plains aquifer by organic compounds and trace metals. Agricultural chemicals applied at land surface to control weeds and insects are potentially hazardous to public health as they infiltrate to the water table. Contamination by oilfield brines presents yet another hazard. Sample collection and data interpretation with special emphasis on the relation of organic substances and trace metals in ground water to agricultural use and oilfield brines are needed.

Objectives -- To provide the intensive data collection and analysis needed to thoroughly describe the current quality of water associated with major types of land use in the High Plains of Kansas (petroleum production and irrigated and dryland farming). Special attention to analysis of trace metals and organic substances is needed because of the present lack of this information. Project results are expected to provide water quality and land-use relationships that will have transfer value to other areas of similar climate and geohydrology.

Approach -- A four-phase approach of reconnaissance, network design, intensive sampling, and analysis/reporting will be used. In phase 1, "typical" areas will be selected, researched, and some initial samples collected and analyzed. In phase 2, statistical techniques (for example, kriging) will be used to design an optimized network for further sampling. Phase 3 will consist of locating, drilling, and sampling from observation wells as indicated by network design. Phase 4 will consist of a thorough data analysis and reporting of results.



PROJECT TITLE: Geohydrologic evaluation of hazardous waste sites in selected areas of Kansas
PROJECT NUMBER: KS-138
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: T. B. Spruill

Problem -- Hazardous-waste sites can pose significant risks to the public health and quality of the environment. At least 201 potential hazardous-waste sites have been identified in Kansas (Kansas Department of Health and Environment, written commun., 1983). The State has performed an initial assessment of 81 sites. There is a need to document which of the remaining sites have contaminated ground and surface waters in Kansas and to identify those sites that warrant intensive geohydrologic investigation.

Objectives -- Principal objectives of the study are to: (1) Compile site history, hydrogeologic, and chemical-quality information to document possible ground- and surface-water contamination at selected hazardous-waste sites in Kansas; (2) identify principal chemical contaminants that may be associated with specific types of hazardous-waste sites (private, county, municipal, industrial, etc.) in specific regions of the State; (3) determine principal geochemical and hydrogeologic factors that affect the mobility of major chemical contaminants from harzardous-waste sites in selected regions of the State.

Approach -- Information will be collected for each site, including types of waste stored, mode of storage, time of storage, and geology. Surface geophysical methods will be used to detect possible contaminant plumes. Water samples, water levels, and geophysical logs will be obtained from piezometers. Water samples will be analyzed for major cations and anions, nitrate and ammonia nitrogen, trace metals, total organic carbon, and specific organic compounds. Principal contaminants associated with each waste-site category will be identified.

PROJECT TITLE: Development of distributed information systems
PROJECT NUMBER: KS-102
COOPERATING AGENCY: Federal
PROJECT CHIEF: J. M. McNellis

Problem -- Increasing demand for information about water resources coupled with personnel ceilings slows assessment and distribution of water data. Technology transfer in the computer area is slow to almost nonexistent, particularly for end users.

Objectives -- The primary objective is to demonstrate the feasibility of putting additional computer power in the hands of individual end-user. Technology transfer will accelerate among users, and timely assessment and distribution of water data will occur. A secondary objective is the development of an RFP (Request for Purchase) for acquisiton of microcomputers within WRD.

Approach -- PRIME minicomputers have been installed in almost all District and many Subdistrict offices in WRD. This is a direct result of the prototype study using HARRIS minicomputers carried on in the Kansas and New Mexico District offices. The prototype studies were of material importance in the generation of the RFP that the PRIMES were acquired with. Headquarters in Reston and some District offices will acquire or have already acquired IBM PC/AT microcomputers. These are 16-bit, 2-byte microcomputers that support up to 3 million characters of memory, 3 users, 40,000,000 characters of information on disk, have good graphics capability, and have FORTRAN, spread-sheet, data base, and word-processing software.

Kansas will implement, on the AT, many of the software tools currently available on the PRIMES. These will include ground-water models, a payroll backup, and numerous other applications. Coordination and exhange of software among the Districts having the AT will be maintained.

PROJECT TITLE: Automatic Data Recorder Applications - Kansas
PROJECT NUMBER: KS-124
COOPERATING AGENCY: Federal
PROJECT CHIEF: J. M. McNellis

Problem -- Applications resulting from using an Automatic Data Recorder (ADR) have been in the Survey program library for almost 20 years. These applications are currently processed via batch procedures in Reston. With state-of-the-art minicomputers, the potential for doing all the ADR processing on the local level is high. The expense of developing application software requires that the ADR programs be readily transportable.

Objectives -- This project produced computer programs, documentation, and procedures on the ADR applications. All the ADR techniques from WATSTORE became transportable interactive programs written in FORTRAN 77 and were operational on the Harris minicomputer in Kansas.

Automatic data recorder applications - Kansas (KS-124)--Continued

Approach -- Items pertaining to the ADR processing, with emphasis on program E659, were outlined. This outline was the basis for definition of functions, processes, and computation procedures that comprise the suite of ADR program modules. Documentation and a flow chart of each module and of the complete ADR process were developed as the FORTRAN 77 code developed. Coordination with the Automatic Data Section during the project was a continuing process.

PROJECT TITLE: Regional synthesis of the hydrogeology of the United States
PROJECT NUMBER: KS-137
COOPERATING AGENCY: Federal
PROJECT CHIEF: J. S. Rosenshein

Problem -- A need exists for a comprehensive but succinct up-to-date regional synthesis of the hydrology of the United States and adjacent areas. This need is being addressed by the preparation of a definitive volume on hydrogeology of North America. About one-half of this volume will concern the synthesizing of the hydrogeology of 28 ground-water regions of the United States and adjacent areas.

Objectives -- (1) To ensure that scientifically creditable and comprehensive treatment is given to the 28 ground-water regions of the United States and adjacent areas of North America. (2) To provide the coordination, organization, and guidance needed for preparation of the 28 chapters covering the ground-water regions. (3) To integrate the contributions of about 55 contributors to the regional synthesis part of the volume and to serve as editor for this part of the volume.

Approach -- Identify knowledgeable and qualified contributors for the chapters and assign responsibilities. Provide the broad guidelines and concepts for emphasis in preparation for the 28 chapters. Establish deadlines for outline and drafts. Coordinate preparation effort. Prepare personal contribution. Screen contributions for content. Provide review where needed. Provid final technical editing and integration of the contributions.

LIST OF REPORTS APPROVED FOR PUBLICATION OR RELEASED DURING 1983 AND 1984, KANSAS DISTRICT, U.S. GEOLOGICAL SURVEY

[Contact the District Office for information regarding the availability of these publications]

1. Baker, C. H., Jr., 1983, Evaluation of techniques for estimating ground-water withdrawals for irrigation in western Kansas: Kansas Water Office Bulletin 26, 14 p.

2. Barker, R. A., Dunlap, L. E., and Sauer, C. G., 1983, Analysis and computer simulation of stream-aquifer hydrology, Arkansas River valley, southwestern Kansas: U.S. Geological Survey Water-Supply Paper 2200, 59 p.

3. Bevans, H. E., 1984, Hydrologic responses of streams to mining of the Mulberry Coal reserves in eastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4047, 30 p.

4. Bevans, H. E., Skelton, John, Kenny, J. F., and Davis, J. V., 1984, Hydrology of Area 39, Western Region, Interior Coal Province, Kansas and Missouri: U.S. Geological Survey Water-Resources Investigations Report 83-851, (in press).

5. Burnett, R. D., 1984, Predictive simulations of alternatives for managing the water resources of North Fork Solomon River valley between Kirwin Dam and Waconda Lake, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4249, 34 p.

6. Clement, R. W., 1983, Improvement of flood-frequency estimates for selected small watersheds in eastern Kansas using a rainfall-runoff model: U.S. Geological Survey Water-Resources Investigations Report 83-4110, 22 p.

7. Combs, L. J., 1984, Water-resources reports prepared by or in cooperation with the U.S. Geological Survey in Kansas, 1886-1983: U.S. Geological Survey Open-File Report 84-609, 117 p.

8. Dunlap, L. E., Lindgren, R. J., and Carr, J. E., 1984, Projected effects of ground-water withdrawals in the Arkansas River valley, 1980-99, Hamilton and Kearny Counties, southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4082, 168 p.

9. Dunlap, L. E., Lindgren, R. J., and Sauer, C. G., 1983, Geohydrology and model analysis of stream-aquifer system along the Arkansas River in Kearny and Finney Counties, southwestern Kansas: U.S. Geological Survey Open-File Report 83-222, 84 p.

10. Geiger, C. O., Lacock, D. L., Shelton, L. R., Penny, M. L., and Merry, C. E., 1983, Water resources data, Kansas, water year 1982: U.S. Geological Survey Water-Data Report KS-82-1, 485 p.

11. _____1984, Water resources data, Kansas, water year 1983: U.S. Geological Survey Water-Data Report KS-83-1, 483 p.

12. Hart, R. J., and Stiles, T. C., 1984, Availability of natural and regulated streamflows for instream uses during historical droughts, lower Neosho River, southeastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4292, 42 p.

13. Jordan, P. R., 1983, Magnitude and frequency of low flows of unregulated streams in Kansas, and estimation of flow-duration curves for ungaged sites: Kansas Water Office Technical Report No. 17, 55 p.

14. _____1984, Magnitude and frequency of high flows of unregulated streams in Kansas: U.S. Geological Survey Open-File Report 84-453 (pending publication as a Water-Supply Paper), 45 p.

15. Kenny, J. F., and Combs, L. J., 1983, Water-resources investigations of the U.S. Geological Survey in Kansas--fiscal years 1981 and 1982: U.S. Geological Survey Open-File Report 83-932, 87 p.

16. Kenny, J. F., and McCauley, J. R., 1983, Application of remote-sensing techniques to hydrologic studies in selected coal-mined areas of southeastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 83-4007, 33 p.

17. Kume, Jack, 1984, Geohydrology and chemical quality of water in Middle and Upper Jurassic and Lower Cretaceous rocks, western Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4045, 54 p.

18. Kume, Jack, and Spinazola, J. M., 1983, Depth and thickness of selected units in Upper Permian, Upper Jurassic, and Lower Cretaceous rocks in southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 83-4095, scale 1: 500,000, 7 sheets.

19. Leonard, R. B., Signor, D. C., Jorgensen, D. G., and Helgesen, J. O., 1983, Geohydrology and hydrochemistry of the Dakota aquifer, central United States: American Water Resources Association, Water Resources Bulletin, v. 19, no. 6, December 1983, p. 903-911.

20. Livingston, R. K., 1983, Lost gage-height record in Kansas: U.S. Geological Survey Water Resources Division Bulletin, May-December 1983, p. 52-59.

21. Livingston, R. K., and Medina, K. D., 1984, Water-data program of the U.S. Geological Survey in Kansas, fiscal year 1983: U.S. Geological Survey Water-Resources Investigations Report 84-4306, 33 p.

22. Marcher, M. V., Kenny, J. F., and others, 1983, Hydrology of Area 40, Western Region, Interior Coal Province, Kansas, Oklahoma, and Missouri: U.S. Geological Survey Water-Resources Investigations Report 83-266, (in press).

23. Medina, K. D., and Geiger, C. O., 1984, Evaluation of the cost effectiveness of the 1983 stream-gaging program in Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4107, 57 p.

24. Pabst, M. E., 1983a, January 1983 water levels, and data related to water-level changes, western and south-central Kansas: U.S. Geological Survey Open-File Report 83-762, 164 p.

25. _____1983b, Kansas ground-water observation-well network, 1983: U.S. Geological Survey Open-File Report 83-528, 57 p.

26. Pabst, M. E., and Dague, B. J., 1984a, January 1984 water levels, and data related to water-level change in western and south-central Kansas: U.S. Geological Survey Open-File Report 84-613, 162 p.

27. _____1984b, Percentage change in saturated thickness of the High Plains aquifer, west-central Kansas, 1950 to average 1982-84: U.S. Geological Survey Water-Resources Investigations Report 84-4357, scale 1: 125,000, 1 sheet.

28. Perry, C. A., 1984a, A method of estimating flood volumes in western Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4164, 18 p.

29. _____1984b, Natural ground-water-recharge data from three selected sites in Harvey County, south-central Kansas: U.S. Geological Survey Open-File Report 84-457, 31 p.

30. Perry, C. A., and Hart, R. J., 1984, Flood-frequency estimates for five gaged basins in Wichita, Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4038, 23 p.

31. Pope, L. M., and Bevans, H. E., 1984, Relations of urban land-use and dry-weather, storm, and snowmelt flow characteristics to stream-water quality, Shunganunga Creek basin, Topeka, Kansas: U.S. Geological Survey Open-File Report 84-750 (pending publication as a Water-Supply Paper), (in press).

32. Pope, L. M., Diaz, A. M., and Butler, M. K., 1983, Urban water-quality data and statistical summaries for selected sites in the Shunganunga Creek basin, Topeka, Kansas: Kansas Department of Health and Environment Bulletin B2-49, 203 p.

33. Rosenshein, J. S., and Bennett, G. D., editors, 1984, Groundwater hydraulics: American Geophysical Union, Water Resources Monograph 9, 407 p.

34. Sophocleous, Marios, and Perry, C. A., 1984, Experimental studies in natural groundwater recharge dynamics--Assessment of recent advances in instrumentation: Journal of Hydrology, v. 70, p. 369-382.

35. Spinazola, J. M., and Dealy, M. T., 1983, Hydrology of the Ogallala aquifer in Ford County, southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 83-4226, 58 p.

36. Spruill, T. B., 1983a, Relationship of nitrate concentrations to distance of well screen openings below casing water levels: American Water Resources Association, Water Resources Bulletin, v. 19, no. 6, December 1983, p. 977-981.

37. _____1983b, Statistical summaries of selected chemical constituents in Kansas ground-water supplies, 1976-81: U.S. Geological Survey Open-File Report 83-263, 29 p.

38. _____1984a, Assessment of water resources in lead-zinc mined areas in Cherokee County, Kansas, and adjacent areas: U.S. Geological Survey Open-File Report 84-439, 102 p.

39. _____1984b, Use of data from regional ground-water-quality monitoring networks: 29th Annual Midwest Groundwater Conference, Proceedings, Lawrence, Kansas, October 1-4, 1984, p. 12.

40. Stullken, L. E., 1984, Hydrology of Prairie Dog Creek valley, Norton Dam to State line, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4162, 49 p.

HYDROLOGIC-DATA STATIONS IN KANSAS, 1984 WATER YEAR

Explanation of Table Symbols
Surface-Water Stations

Station Purpose, Complete-Record Gaging Stations

B - Benchmark.
C - Current purpose station.
F - Flood forecast (also used by National Weather Service).
H - A hydrologic station to meet objectives of defining regional streamflow characteristics.
I - Interstate Compact.
L - Long-term trend station or drought index station.
P - Principal-stream station to meet objectives of measuring principal unregulated streams.
R - A station required for systems analysis of a regulated stream to meet objective of defining regulated flow.

Type of Gage, Complete-Record Gaging Station

B - Bubble gage
C - Cableway
D - Digital recorder (stage)
Dp - Digital recorder (precipitation)
R - Graphic recorder
T - Telemetering equipment
W - Artificial control

Sampling Purpose, Water-Quality Stations

CHEM	Chemical analysis: cations, anions, nutrients
METAL	Trace metals analysis
BIOL	Biological analysis: phytoplankton, periphyton
TOC	Total organic carbon determination
RAD	Radiochemical analysis
PEST	Pesticide analysis
SED	Suspended sediment: concentration, discharge, particle size
BED	Bed material: particle size
COLI	Coliform count: total, fecal, fecal streptococcal
FIELD	Field measurements: discharge, water temperature, alkalinity, conductance, pH, dissolved oxygen
OBS	Field observer collects samples for conductance, chloride, and water temperature

Cooperator or Supporting Program

ARCA	Arkansas River Compact Administration
BENCHMARK	Hydrologic Benchmark Program (Federal)
CBR	Collection of Basic Records (Federal)
DWR	Kansas State Board of Agriculture, Division of Water Resources
HAYS	City of Hays
KC-CE	Kansas City District, U.S. Army Corps of Engineers
KDHE	Kansas Department of Health and Environment
KDOT	Kansas Department of Transportation
KWO	Kansas Water Office
MRB	Missouri River Basin Program (Federal)
NASQAN	National Stream-Quality Accounting Network (Federal)
OFA	Other Federal Agencies
T-CE	Tulsa District, U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
WICHITA	City of Wichita

Ground-Water Wells

Well Numbers

Well numbers in these listings indicate the location of wells according to the land subdivisions of the U.S. Bureau of Land Management (fig. 10). An example of a typical well number is 12S 06E 06BCAC in Geary County. The first two digits indicate the township, which in Kansas are nearly all south of the 40th parallel base line. The second two digits indicate the range east or west of the Sixth Principal Meridian. The last two digits indicate the section in which the well is located. The first letter after those digits denotes the quarter section or 160-acre tract; the second, the quarter-quarter section or 40-acre tract; the third, the quarter-quarter-quarter section or 10-acre tract; and the fourth, when used, the quarter-quarter-quarter-quarter section or 2 1/2-acre tract. The quarter sections, quarter-quarter sections, and so forth, are designated A, B, C, and D in a counterclockwise direction, beginning with A in the northeast quadrant. If two or more wells are located within the smallest subdivision indicated, the wells are numbered serially.

Water-Level Notes

A - Annual observation
Q - Quarterly observation
M - Monthly observation
R - Continuous recorder

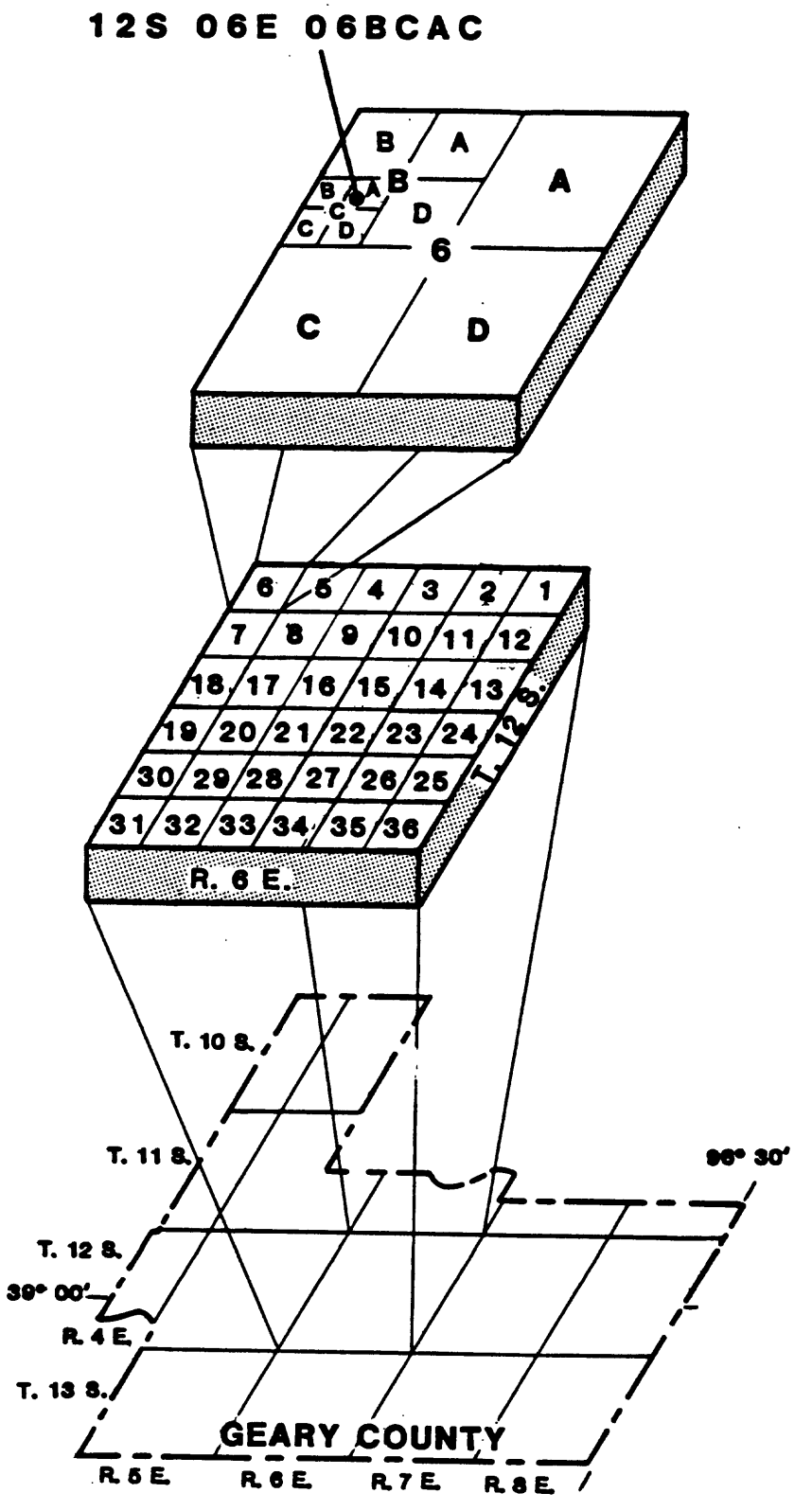


Figure 10.--Well-numbering system.

Table 1.--Complete-record surface-water gaging stations, 1984 water year

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
		Missouri River Basin					
06-							
8140	Turkey Cr. nr Seneca	C,F,L,P	20	1S	12E	BDR	KWO
8447	S. Fk. Sappa Cr. nr Brewster	H,L	9	9S	37W	BDRDp	KWO
8449	S. Fk. Sappa Cr. nr Achilles	H,L	29	4S	30W	BDRDp	KWO
8465	Beaver Cr. at Cedar Bluffs	C,I,L,P	10	1S	29W	BDR	CBR
8479	Prairie Dog Cr. ab Keith Sebelius Lake	C,L,P	23	3S	25W	BCDRDpW	KC-CE
84795	Keith Sebelius Lake nr Norton		8	3S	23W	BR	KWO
8480	Prairie Dog Cr. at Norton	C,R	9	3S	23W	BDRW	KWO
8485	Prairie Dog Cr. nr Woodruff	C,I,L,R	9	1S	19W	BDR	CBR
8535	Republican R. nr Hardy, Nebr.	C,I,R	6	1S	5W	BDRT	CBR
8538	White Rock Cr. nr Burr Oak	C,L,P	7	2S	8W	BCDRW	KC-CE
8539	Lovewell Res. nr Lovewell		6	2S	6W	BR	KWO
8540	White Rock Cr. at Lovewell	C,R	17	2S	6W	BDRW	KWO
8558	Buffalo Cr. nr Jamestown	C,F	14	5S	5W	BDR	KWO
8560	Republican R. at Concordia	C,R	28	5S	3W	BDRT	KC-CE
8566	Republican R. at Clay Center	C,R	17	8S	3E	BDRT	CBR
85705	Milford Lake nr Junction City		20	11S	5E	RT	KC-CE
8571	Republican R. bl Milford Dam	C,R	--	--	--	BCDRT	KC-CE
8585	N. Fk. Smoky Hill R. nr McAllaster	F,P	17	12S	36W	BDRDp	KWO
8600	Smoky Hill R. at Elkader	C,L,P	34	14S	32W	BDRDp	KWO
8610	Smoky Hill R. nr Arnold	C,P	29	14S	24W	BDR	KC-CE
8615	Cedar Bluff Res. nr Ellis		36	14S	22W	BR	KWO
8620	Smoky Hill R. at Cedar Bluff Dam	C,R	1	15S	22W	BCRTW	KWO
8627	Smoky Hill R. nr Schoenchen	C,F,R	25	15S	19W	BDR	KWO
86285	Smoky Hill R. bl Schoenchen	C,R	27	15S	18W	BDR	HAYS
8635	Big Cr. nr Hays	C,F,L	30	14S	17W	BDR	KWO
8639	N. Fk. Big Cr. nr Victoria	C,L	27	13S	17W	BR	KWO
86405	Smoky Hill R. nr Bunker Hill	C,R	33	14S	13W	BDR	KC-CE
8645	Smoky Hill R. at Ellsworth	C,R	20	15S	8W	BDR	KC-CE
8650	Kanopolis Lake nr Kanopolis		3	17S	6W	BR	KC-CE
8655	Smoky Hill R. nr Langley	C,R	35	16S	6W	BDRT	KC-CE
8665	Smoky Hill R. nr Mentor	C,R	29	14S	2W	BDRT	KC-CE
8669	Saline R. nr WaKeeney	H,P	10	11S	23W	BDR	KWO
8670	Saline R. nr Russell	C,F,L	34	12S	14W	BDR	KWO
8681	Wilson Lake nr Wilson		36	12S	11W	RT	KC-CE
8682	Saline R. at Wilson Dam	C,R	25	12S	11W	BDRT	KC-CE

Table 1.--Complete-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
06-							
8695	Saline R. at Tescott	C,F,R	16	12S	5W	BDRT	KWO
8702	Smoky Hill R. at New Cambria	C,R	1	14S	2W	BDR	MRB
8710	N. Fk. Solomon R. at Glade	C,P	25	4S	18W	BDR	KC-CE
8715	Bow Cr. nr Stockton	C,F,L	1	6S	18W	BDR	KWO
8717	Kirwin Res. at Kirwin		33	4S	16W	BR	KWO
8718	N. Fk. Solomon R. at Kirwin	C,R	33	4S	16W	R	KWO
8725	N. Fk. Solomon R. at Portis	C,R	5	6S	12W	BDR	KC-CE
8730	S. Fk. Solomon R. ab Webster Res.	C,P	8	8S	20W	BDR	KC-CE
8731	Webster Res. nr Stockton		27	7S	19W	BR	KWO
8732	S. Fk. Solomon R. bl Webster Res.	C,R	26	7S	19W	BCDR	KWO
87346	S. Fk. Solomon R. at Woodston	C,R	16	7S	16W	BDR	MRB
8740	S. Fk. Solomon R. at Osborne	C,F,R	20	7S	12W	BDR	KWO
8742	Waconda Lake at Glen Elder		27	6S	9W	BR	USBR
8759	Solomon R. nr Glen Elder	C,F,R	2	7S	9W	BCDRW	KWO
8767	Salt Cr. nr Ada	C,F	36	10S	5W	BDR	KWO
8769	Solomon R. at Niles	C,R	31	12S	1W	BDRT	KC-CE
8776	Smoky Hill R. at Enterprise	C,R	20	13S	3E	BDRT	KC-CE
8780	Chapman Cr. nr Chapman	F,L	1	12S	3E	BDR	KWO
8791	Kansas R. at Ft. Riley	C,R	33	11S	6E	BDRT	KC-CE
87965	Kings Cr. nr Manhattan	B	18	11S	8E	BCDRDp	CBR
8842	Mill Cr. at Washington	F,H	1	3S	3E	BDR	KWO
8844	Little Blue R. nr Barnes	C,P	22	3S	5E	BDR	KC-CE
8855	Black Vermillion R. nr Frankfort	C,P	20	4S	9E	BDR	KC-CE
8869	Tuttle Creek Lake nr Manhattan		24	9S	7E	BR	KC-CE
8870	Big Blue R. nr Manhattan	C,R	30	9S	8E	BDRT	KC-CE
8875	Kansas R. at Wamego	C,R	9	10S	10E	BDRT	KC-CE
88835	Kansas R. nr Belvue	C	13	10S	11E	BDRT	DWR
8885	Mill Cr. nr Paxico	C,F,L	27	11S	11E	BDRT	KWO
8890	Kansas R. at Topeka	C,R	28	11S	16E	BDRT	KC-CE
8891	Soldier Cr. nr Goff	C,H	16	5S	13E	BDRDp	KWO
88912	Soldier Cr. nr Bancroft	C,H	28	5S	13E	BDRDp	KWO
88914	Soldier Cr. nr Soldier	C,H	4	6S	13E	BDRDp	KWO
88916	Soldier Cr. nr Circleville	C,H	10	7S	13E	BDRDp	KWO
8892	Soldier Cr. nr Delia	C,H	8	10S	14E	BDR	KWO
8895	Soldier Cr. nr Topeka	C,P	14	11S	15E	BDR	KC-CE

Table 1.--Complete-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
06-							
8901	Delaware R. nr Muscotah	C,L	16	6S	17E	BDRT	KC-CE
890898	Perry Lake nr Perry		9	11S	18E	R	KC-CE
8909	Delaware R. bl Perry Dam	C,R	9	11S	18E	CR	KC-CE
8910	Kansas R. at Lecompton	C,R	35	11S	18E	BDRT	KC-CE
891478	Clinton Lake nr Lawrence		8	13S	19E	BR	KC-CE
8915	Wakarusa R. nr Lawrence	C,R	23	13S	19E	BDRT	KC-CE
8920	Stranger Cr. nr Tonganoxie	C,L	7	11S	22E	BDRT	KC-CE
89235	Kansas R. at DeSoto	C,F,R	28	12S	22E	BDRT	KWO/ KC-CE
89308	Blue R. nr Stanley	C,H	19	14S	25E	BDR	KWO
8933	Indian Cr. at Overland Park	C,H	6	13S	25E	BDR	KWO
89335	Tomahawk Cr. nr Overland Park	C,H	21	13S	25E	BDR	KWO
9108	Marais des Cygnes R. nr Reading	C,P	15	17S	13E	BDR	KC-CE
910997	Melvern Lake nr Melvern		1	18S	15E	R	KC-CE
9115	Salt Cr. nr Lyndon	C,F,L	34	16S	16E	BDR	KWO
9119	Dragoon Cr. nr Burlingame	C,H	27	15S	14E	BDR	KC-CE
91249	Pomona Lake nr Quenemo		19	16S	17E	R	KC-CE
9125	Hundred and Ten Mile Cr. nr Quenemo	C,R	20	16S	17E	BCDRT	KC-CE
9130	Marais des Cygnes R. nr Pomona	C,R	7	17S	18E	BDRT	KC-CE
9135	Marais des Cygnes R. nr Ottawa	C,R	36	16S	19E	BDRT	KC-CE
9140	Pottawatomie Cr. nr Garnett	C,F,L	6	20S	20E	BDR	KWO
914995	Hillsdale Lake nr Hillsdale		17	16S	23E	BR	KC-CE
9150	Big Bull Cr. nr Hillsdale	C,R	20	16S	23E	BCDR	KC-CE
9166	Marais des Cygnes R. nr Kansas-Missouri State Line	C,F,R	16	21S	25E	BDRT	KWO
9170	Little Osage R. at Fulton	C,F,L	25	23S	24E	BDRT	KWO
91738	Marmaton R. nr Marmaton	C,F,L	4	26S	24E	BCDR	KC-CE
	Arkansas River Basin						
07-							
1370	Frontier Ditch nr Coolidge	C,I	21	23S	43W	BDRTW	CBR
1375	Arkansas R. nr Syracuse	C,I,R	26	23S	43W	BDRT	CBR
1380	Arkansas R. at Syracuse	C,F,R	18	24S	40W	BDRDpT	KWO
13865	Whitewoman Cr. nr Leoti	C,H	23	18S	38W	BRDp	KWO
1395	Arkansas R. at Dodge City	C,R	35	26S	25W	BDRT	T-CE/ CBR

Table 1.--Complete-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
07-							
1398	Mulberry Cr. nr Dodge City	C,H,L,P	24	28S	25W	BDR	KWO
1400	Arkansas R. nr Kinsley	C,R	26	24S	19W	BDRT	T-CE
14085	Pawnee R. nr Burdett	H,L,P	21	21S	21W	BDR	KWO
1412	Pawnee R. nr Larned	C,F,L,P	30	21S	18W	BDRW	KWO
1413	Arkansas R. at Great Bend	C,R	33	19S	13W	BDRT	T-CE
14178	Walnut Cr. nr Rush Center	C,H,P	24	18S	19W	BDR	KWO
1419	Walnut Cr. at Albert	C,L,P	29	18S	15W	R	KWO
1423	Rattlesnake Cr. nr Macksville	H,P	16	25S	14W	BDR	KWO
142575	Rattlesnake Cr. nr Zenith	H,P	26	22S	11W	BDR	KWO
14262	Rattlesnake Cr. nr Raymond	H,P	15	21S	10W	BDR	KWO
1433	Cow Creek nr Lyons	C,F,L,R	15	20S	8W	BDRT	KWO
14333	Arkansas R. nr Hutchinson	C,F,R	21	24S	4W	BDR	KWO
143665	Little Ark. R. at Alta Mills	H,P	30	22S	2W	BDR	KWO
1442	Little Ark. R. Floodway at Valley Center		34	25S	1W	BR	WICH-ITA
1442	Little Ark. R. at Valley Center (main stem)	C,L	36	25S	1W	BDR	KWO
1443	Arkansas R. Floodway at Wichita		11	27S	1W	BR	WICH-ITA
1443	Arkansas R. at Wichita (main stem)	C,F,P	5	28S	1E	BDRT	KWO
14455	Arkansas R. at Derby	C,P	12	29S	1E	BDRT	T-CE
14478	N. Fk. Ninnescah R. ab Cheney Reservoir	C,P	25	25S	6W	BDR	WICH-ITA
14479	Cheney Reservoir nr Cheney		6	27S	4W	BR	WICH-ITA
144795	N. Fk. Ninnescah R. at Cheney Dam	C,R	6	27S	4W	DW	WICH-ITA
14491	S. Fk. Ninnescah R. nr Pratt	H,P	2	28S	13W	BDR	KWO
1452	S. Fk. Ninnescah R. nr Murdock	C,F,L	34	28S	5W	BDR	KWO
1455	Ninnescah R. nr Peck	C,R	10	30S	1W	BDRT	T-CE
1457	Slate Creek at Wellington	H,P	23	32S	1W	BDR	KWO
1465	Arkansas R. at Arkansas City	C,L,P	35	34S	3E	BDRT	CBR
146622	El Dorado Lake nr El Dorado		30	25S	6E	RT	T-CE
146623	Walnut R. bl El Dorado Lake	C,R	25	25S	5E		T-CE
14683	Walnut R. at Hwy. 54 east of El Dorado	C,R	1	26S	5E	BDRT	T-CE
146895	Walnut R. at Augusta	C,R	27	27S	4E	BDRT	T-CE

Table 1.--Complete-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
07-							
14707	Whitewater R. at Towanda	C,F,P	8	26S	4E	BDRT	KWO
1478	Walnut R. at Winfield	C,L	33	32S	4E	BDRT	T-CE
1490	Medicine Lodge R. nr Kiowa	L,P	36	34S	11W	BDR	KWO
1515	Chikaskia R. nr Corbin	F,P	36	33S	3W	BDR	KWO
15559	Cimarron R. nr Elkhart	H	4	34S	42W	BDR	KWO
15601	N. Fk. Cimarron R. at Richfield	H	16	32S	41W	BR	KWO
1561	Sand Arroyo Cr. nr Johnson	H	25	29S	41W	BDRDp	KWO
15622	Bear Cr. nr Johnson	H	12	28S	41W	BDR	KWO
1575	Crooked Cr. nr Nye	F,L	1	35S	27W	BDR	KWO
1659	Toronto Lake nr Toronto		36	26S	13E	R	T-CE
1660	Verdigris R. nr Coyville	C,R	8	27S	14E	DR	T-CE
1665	Verdigris R. nr Altoona	C,R	29	29S	16E	BDRT	T-CE
1675	Otter Cr. at Climax	H,L	8	27S	11E	BDR	KWO
1680	Fall River Lake nr Fall River		3	28S	12E	BR	T-CE
1685	Fall R. nr Fall River	C,R	2	28S	12E	DRT	T-CE
1695	Fall R. at Fredonia	C,R	24	29S	14E	BDRT	T-CE
1698	Elk R. at Elk Falls	C,H	3	31S	11E	BDR	KWO
17005	Elk City Lake nr Independence		9	32S	15E	BR	T-CE
17006	Elk R. bl Elk City Lake	C,R	9	32S	15E	BDR	T-CE
1705	Verdigris R. at Independence	C,R	32	32S	16E	BDRT	T-CE
170695	Big Hill Lake nr Cherryvale		7	32S	18E	BR	T-CE
1707	Big Hill Cr. nr Cherryvale	C,H	7	32S	18E	BDRT	T-CE
1720	Caney R. nr Elgin	C,L	16	35S	10E	BDR	KWO
1794	Council Grove Lake nr Council Grove		10	16S	8E	BR	T-CE
1795	Neosho R. at Council Grove	C,R	14	16S	8E	DR	T-CE
17973	Neosho R. nr Americus	C,R	24	18S	10E	BDRT	T-CE
179794	Marion Lake nr Marion		27	19S	3E	BR	T-CE
179795	Cottonwood R. bl Marion Lake	C,R	27	19S	3E	BCDR	T-CE
1804	Cottonwood R. nr Florence	C,R	10	21S	5E	BDRT	T-CE
1805	Cedar Cr. nr Cedar Point	C,L	25	21S	5E	DR	KWO
18225	Cottonwood R. nr Plymouth	C,R	13	19S	9E	BDRT	T-CE
18245	John Redmond Res. nr Burlington		9	21S	15E	BRT	T-CE
18251	Neosho R. at Burlington	C,R	26	21S	15E	BDRT	T-CE
1830	Neosho R. nr Iola	C,L,R	9	25S	18E	BCDRT	T-CE
1835	Neosho R. nr Parsons	C,F,L,R	33	31S	21E	BDRTW	KWO
1840	Lightning Cr. nr McCune	H,L,P	7	32S	22E	BDR	KWO

Table 2.--Partial-record surface-water gaging stations, 1984 water year

High Flow

Ident. no.	Station name	Location Sec.	T.	R.	Coop or support
	Missouri River Basin				
06-					
8137	Tennessee Cr. trib. nr Seneca	2	3S	12E	KDOT
8157	Buttermilk Cr. nr Willis	30	3S	18E	KDOT
81826	White Clay Cr. at Atchison	1	6S	20E	KC-CE
8448	S. Fk. Sappa Cr. trib. nr Goodland	36	8S	39W	KDOT
8451	Long Branch Draw nr Norcatur	6	2S	25W	KDOT
8460	Beaver Cr. at Ludell	30	2S	32W	KWO
8462	Beaver Cr. trib. nr Ludell	2	3S	32W	KDOT
8476	Prairie Dog Cr. trib. at Colby	6	8S	33W	KDOT
8482	Prairie Dog Cr. trib. nr Norton	26	2S	23W	KDOT
8561	West Cr. nr Talmo	36	4S	3W	KDOT
85632	Elk Cr. at Clyde	26	5S	1W	KC-CE
8568	Moll Cr. nr Green	8	8S	4E	KDOT
8605	Hackberry Cr. nr Gove	1	13S	29W	KWO
8630	Smoky Hill R. at Pfeifer	30	15S	16W	KC-CE
8634	Big Cr. trib. nr Ogallah	11	13S	22W	KDOT
8637	Big Cr. trib. nr Hays	7	14S	17W	KDOT
8643	Smoky Hill R. trib. at Dorrance	12	14S	12W	KDOT
8647	Spring Cr. nr Kanopolis	24	15S	8W	KDOT
86649	Dry Cr. at Mentor	24	15S	3W	KC-CE
8668	Saline R. trib. at Collyer	32	11S	25W	KDOT
8683	Coon Cr. trib. nr Luray	19	10S	12W	KDOT
8684	Wolf Cr. nr Lucas	33	11S	11W	KWO
8689	Bullfoot Cr. trib. nr Lincoln	30	12S	7W	KDOT
86995	Mulberry Cr. nr Salina	9	14S	3W	KC-CE
8703	Gypsum Cr. nr Gypsum	15	16S	1W	KWO
8726	Oak Cr. at Bellaire	15	3S	12W	KDOT
8733	Ash Cr. trib. nr Stockton	18	7S	18W	KDOT
8745	East Limestone Cr. nr Ionia	21	4S	9W	KDOT
8758	Limestone Cr. nr Glen Elder	15	6S	9W	KWO
87712	Mud Cr. at Abilene	17	13S	2E	KC-CE

Table 2.--Partial-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop or support
06-					
8775	Turkey Cr. nr Abilene	26	14S	2E	KWO
8792	Clark Cr. nr Junction City	14	12S	6E	KWO
879815	Wildcat Cr. at Manhattan	14	10S	7E	KWO
8841	Mulberry Cr. trib. nr Haddam	10	3S	1E	KDOT
8843	Mill Cr. trib. nr Washington	5	3S	4E	KDOT
8849	Robidoux Cr. at Beattie	20	2S	9E	KDOT
88549	Black Vermillion R. at Frankfort (Hwy 99)	16	4S	9E	KC-CE
8865	Fancy Cr. at Winkler	2	7S	5E	KWO
8872	Cedar Cr. nr Manhattan	19	9S	8E	KDOT
8876	Kansas R. trib. nr Wamego	14	10S	10E	KDOT
8880	Vermillion Cr. nr Wamego	20	8S	11E	KC-CE
88803	Vermillion Cr. nr Louisville	12	9S	10E	KC-CE
8883	Rock Cr. nr Louisville	14	9S	9E	KWO
8889	Blacksmith Cr. trib. nr Valencia	11	12S	14E	KDOT
88955	Indian Cr. nr Topeka	5	11S	16E	KC-CE
88963	Shunganunga Cr. at Topeka	6	12S	16E	KC-CE
89105	Stone House Cr. at Williamstown	30	11S	19E	KDOT
89165	Naismith Cr. at Lawrence	12	13S	19E	KWO
89185	Stranger Cr. at Easton	19	8S	21E	KC-CE
8928	Turkey Cr. at Merriam	13	12S	24E	KWO
89294	Turkey Cr. at Kansas City	27	11S	25E	KWO
9123	Dragoon Cr. trib. nr Lyndon	6	16S	16E	KDOT
9137	Middle Cr. nr Princeton	13	18S	19E	KDOT
91425	S. Fk. Pottawatomie Cr. trib. nr Garnett	7	21S	20E	KDOT
9145	Pottawatomie Cr. at Lane	34	18S	21E	KC-CE
9151	Big Bull Cr. at Paola	17	17S	23E	KC-CE
9167	Middle Cr. nr Kincaid	11	23S	20E	KDOT
9171	Marmaton R. nr Bronson	3	25S	21E	KDOT
9174	Marmaton R. trib. nr Fort Scott	9	26S	24E	KDOT

Table 2.--Partial-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop or support
	Arkansas River Basin				
07-					
1386	White Woman Cr. trib. nr Selkirk	34	17S	39W	KDOT
1390	Arkansas R. at Garden City	19	24S	32W	KWO
1397	Arkansas R. trib. nr Dodge City	11	27S	25W	KDOT
1403	Whitewoman Cr. nr Bellefont	33	24S	21W	KDOT
1406	Pawnee R. trib. nr Kalvesta	12	23S	28W	KDOT
1416	Long Branch Cr. nr Ness City	32	18S	23W	KDOT
1418	Otter Cr. nr Rush Center	15	19S	18W	KDOT
1421	Rattlesnake Cr. trib. nr Mullinville	20	28S	19W	KDOT
1427	Salt Cr. nr Partridge	22	23S	7W	KDOT
14286	Cow Cr. nr Claflin	6	18S	11W	KWO
1429	Blood Cr. nr Boyd	34	17S	14W	KWO
1431	Cheyenne Cr. trib. nr Claflin	28	18S	11W	KDOT
1436	Little Arkansas R. nr Little River	8	19S	6W	KWO
1449	S. Fk. Ninnescah R. trib. nr Pratt	27	27S	13W	KDOT
1453	Clear Cr. nr Garden Plain	33	27S	3W	KDOT
1458	Antelope Cr. trib. nr Dalton	11	32S	1E	KDOT
14702	Whitewater R. trib. nr Towanda	26	25S	3E	KDOT
14799	Cedar Cr. trib. nr Cambridge	26	31S	7E	KDOT
1481	Grouse Cr. nr Dexter	31	32S	7E	KWO
1516	Rush Cr. nr Harper	21	32S	7W	KDOT
1559	N. Fk. Cimarron R. trib. nr Elkhart	9	33S	42W	KDOT
1566	Cimarron R. trib. nr Moscow	20	31S	34W	KDOT
1567	Cimarron R. trib. nr Satanta	17	32S	33W	KDOT
1571	Crooked Cr. nr Copeland	36	28S	30W	KDOT
1574	Crooked Cr. trib. at Meade	2	32S	28W	KDOT
1577	Kiger Cr. nr Ashland	3	33S	24W	KDOT
1579	Cavalry Cr. at Coldwater	14	32S	19W	KWO
1662	Sandy Cr. nr Yates Center	26	25S	14E	KDOT
1708	Mud Cr. nr Mound Valley	9	33S	18E	KDOT
1717	Spring Branch nr Cedar Vale	7	34S	9E	KDOT

Table 2.--Partial-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop or support
07-					
1718	Cedar Cr. trib. nr Hooser	7	34S	8E	KDOT
1803	Spring Cr. trib. nr Florence	32	21S	5E	KDOT
1815	Middle Cr. nr Elmdale	13	19S	6E	KWO
1826	N. Big Cr. nr Burlington	27	22S	15E	KDOT
1838	Limestone Cr. nr Beulah	28	30S	23E	KDOT
1845	Labette Cr. nr Oswego	11	33S	20E	KWO
	Flood Hydrograph				
	Missouri River Basin				
06-					
8703	Gypsum Cr. nr Gypsum	15	16S	1W	KWO
	Arkansas River Basin				
07-					
1390	Arkansas R. at Garden City	19	24S	32W	KWO
	Rating Forecast				
	Missouri River Basin				
06-					
8884	Kansas R. at Maple Hill	1	11S	12E	KC-CE
89185	Stranger Cr. at Easton	19	8S	21E	KC-CE
	Low Flow				
	Arkansas River Basin				
07-					
14257	Rattlesnake Cr. ab. Little Salt Marsh nr Hudson	31	22S	11W	KWO
14265	Peace Cr. nr Sylvia	4	23S	10W	KWO
14267	Peace Cr. nr Sterling	7	22S	8W	KWO
14274	Salt Cr. nr Hutchinson	1	23S	7W	KWO
14459	N. Fk. Ninnescah R. nr Sylvia	27	24S	10W	KWO

Table 2.--Partial-record surface-water gaging stations, 1984 water year--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop or support
07-					
14462	N. Fk. Ninnescah R. ab Silver Cr. nr Arlington	25	25S	8W	KWO
14464	Silver Cr. nr Landon	8	26S	9W	KWO
14489	S. Fk. Ninnescah R. at Pratt	3	28S	13W	KWO
14513	S. Fk. Ninnescah R. nr Calista	1	27S	9W	KWO
	Continuous Stage				
	Missouri River Basin				
06-					
8785	Lyon Cr. nr Woodbine	31	13S	5E	KC-CE
87982	Kansas R. at Manhattan	27	10S	8E	KC-CE
8847	Big Blue R. nr Blue Rapids	21	4S	7E	KC-CE
89295	Kansas R. at Kansas City	14	11S	25E	KC-CE
9114	Marais des Cygnes R. at Quenemo	22	17S	17E	KC-CE
	Arkansas River Basin				
07-					
1832	Neosho R. nr Chanute	4	27S	18E	T-CE

Table 3.--Precipitation-record gaging stations, 1984 water year

Ident. no.	Station name	Location Sec.	T.	R.	Coop or support
	Missouri River Basin				
06-					
8447	S. Fk. Sappa Cr. nr Brewster	9	9S	37W	KWO
8449	S. Fk. Sappa Cr. nr Achilles	29	4S	30W	KWO
84568	Little Beaver Cr. nr Goodland	28	5S	39W	KWO
8460	Beaver Cr. at Ludell	30	2S	32W	KWO
8479	Prairie Dog Cr. ab Keith Sebelius Lake	23	3S	25W	KWO
8585	N. Fk. Smoky Hill R. nr McAllaster	17	12S	36W	KWO
8600	Smoky Hill R. at Elkader	34	14S	32W	KWO
8605	Hackberry Cr. nr Gove	1	13S	29W	KWO
8668	Saline R. trib. at Collyer	32	11S	25W	KWO
87965	Kings Cr. nr Manhattan	18	11S	8E	CBR
8891	Soldier Cr. nr Goff	16	5S	13E	KWO
88912	Soldier Cr. nr Bancroft	28	5S	13E	KWO
88914	Soldier Cr. nr Soldier	4	6S	13E	KWO
88916	Soldier Cr. nr Circleville	10	7S	13E	KWO
01450700	Ladder Cr. nr Tribune	5	16S	40W	KWO
	Arkansas River Basin				
07-					
1380	Arkansas R. nr Syracuse	18	24S	40W	KWO
1386	White Woman Cr. trib. nr Selkirk	34	17S	39W	KWO
13865	White Woman Cr. nr Leoti	23	18S	38W	KWO
1388	Lion Cr. trib. nr Modoc	22	18S	34W	KWO
1406	Pawnee R. trib. nr Kalvesta	12	23S	28W	KWO
1414	S. Fk. Walnut Cr. trib. nr Dighton	16	18S	28W	KWO
1416	Long Branch Cr. nr Ness City	32	18S	23W	KWO
144325	Gypsum Cr. at Oliver St., Wichita	2	28S	1E	WICHITA
14434	Dry Cr. at Pawnee Ave., Wichita	2	28S	1E	WICHITA
144494	Cowskin Cr. trib. at Westfield Drive, Wichita	20	27S	1W	WICHITA
1561	Sand Arroyo Cr. nr Johnson	25	29S	41W	KWO
15625	Bear Cr. nr Big Bow	14	27S	39W	KWO
1571	Crooked Cr. nr Copeland	36	28S	30W	KWO
011603	James Draw nr Lakin	10	22S	36W	KWO
012222	Cimarron R. trib. nr Hugoton	17	33S	37W	KWO
002822	Gray Co. landfill nr Ingalls	10	26S	29W	KWO
010518	Playa Lake nr Satanta	19	28S	34W	KWO

Table 4.--Ground-water-level observation wells, 1984 water year

County	Well number	Water-level notes
Allen	24S 18E 28CDD	Q
Barber	31S 15W 19BDB	A
	32S 11W 30BBA	Q
	32S 12W 04DBC	Q
	33S 11W 28CBB	Q
	34S 15W 17ADA	A
	35S 15W 11CB	A
Barton	18S 15W 28CCC3	Q
Bourbon	25S 24E 36AAC	Q
Cherokee	34S 25E 13BAC	Q
Cheyenne	03S 37W 19BBC	Q
	03S 39W 32BDB	Q
	05S 38W 22ACB	Q
	05S 40W 14BCD	Q
	05S 42W 14CBC	Q
Clark	30S 23W 06AAA	Q
	33S 22W 30CBC	Q
Clay	06S 01E 02BCD	Q
	06S 02E 29DAC	Q
	08S 02E 02CCA	Q
Cloud	05S 02W 01BAC	Q
Comanche	31S 18W 19ACB	Q
Crawford	29S 23E 24DBA	Q
	30S 24E 19ADD	Q
Decatur	01S 29W 19BDD	Q
	02S 30W 26DCC	Q
	03S 29W 12BBA	Q
	04S 26W 08DDD	Q
Douglas	12S 19E 13ADA	Q
	12S 20E 07CBC	Q
	12S 20E 17CCB	R
	15S 19E 15AAD	Q
Edwards	23S 19W 22CCC	Q
	24S 17W 24DDD	Q
	24S 18W 36DDC	Q
	24S 19W 34ADD	Q
	25S 16W 31DCC	Q
	25S 18W 09AAA	Q
	25S 18W 33CDC	Q
	26S 19W 12ABB2	Q
Ellis	14S 18W 12AAD	Q
	14S 18W 12ABB	Q
Ellsworth	17S 09W 20BCD	Q
	17S 09W 21BCC	Q
	17S 09W 21BCC2	Q
	17S 09W 28CBB	Q
	17S 09W 28CBB2	Q
	17S 09W 31AAB	Q
	17S 09W 31AAB2	Q
	17S 09W 31ADC	Q
Finney	21S 32W 20CBD	Q
	21S 34W 14DBB	Q
	22S 27W 14ADC	Q
	22S 33W 22BAA	Q
	22S 33W 36AAA2	Q
	22S 34W 26ADD	Q
	23S 27W 12CCC	Q
	23S 33W 17BBB	Q
	23S 33W 28CDC	Q
	23S 34W 21DDC	R
	24S 31W 27CCB	Q
	24S 32W 03DAC	Q
	24S 33W 09CCD	R
	24S 33W 09CCD2	R
	24S 33W 22BCC	Q
	24S 33W 22DCA	Q
	24S 33W 28DAA	Q
	25S 32W 31DD	Q
	25S 33W 03BCC	Q
	25S 33W 05ABD	Q

Table 4.--Ground-water-level observation wells, 1984 water year--Continued

County	Well number	Water-level notes
Finney (continued)	25S 33W 09ABD	Q
	25S 33W 15DAC	Q
	25S 33W 16DCC	Q
	25S 33W 17DBD	Q
	25S 33W 35DBD	Q
	25S 34W 06AAA	Q
	25S 34W 10ABB	Q
	25S 34W 34DBD	Q
	26S 33W 26ABB	Q
Ford	25S 22W 20AAA	Q
	25S 22W 27CCD	Q
	25S 23W 11CCC	Q
	25S 23W 12BBB	Q
	25S 23W 14ADD	Q
	26S 21W 17DBC	Q
	26S 21W 23ADA	Q
	26S 23W 10DAD	Q
	26S 24W 29DDD	Q
	26S 24W 31DDA	Q
	26S 24W 32CBA	Q
	26S 24W 32DDA	Q
	26S 24W 33CDA	Q
	26S 25W 34BBB	Q
	26S 26W 32DCC	Q
	27S 23W 24BCB	Q
	27S 24W 03BBD	Q
	27S 24W 03CDD	R
	27S 24W 04BBC	Q
	27S 24W 09AAD	M
	27S 24W 16BDB	Q
	28S 24W 08DCC	Q
	28S 25W 06ABB	Q
	28S 26W 13CAA	Q
	29S 21W 05BBB	Q
	29S 26W 29ABB	Q
Geary	11S 06E 27CBB	Q
Gove	11S 26W 04CDC	Q
	11S 27W 36BCC	Q
	11S 29W 04DAD	Q
	11S 30W 27ABB	Q
Graham	6S 24W 28BAB	Q
	6S 24W 35DDD	Q
	6S 25W 28CBC	Q
Grant	27S 35W 17ADD	Q
	27S 37W 04ABB	Q
	27S 38W 15BBB	Q
	27S 38W 23CB	Q
	27S 38W 32BCC	R
	28S 36W 21CDD	Q
	28S 37W 02BBB3	Q
	28S 38W 07BBB	Q
	28S 38W 12DDD	Q
	28S 38W 17AAA	Q
	29S 35W 06BAA	Q
	29S 35W 07CBD	Q
	29S 38W 35CCD	Q
	30S 36W 01BBB	Q
	30S 36W 32BBC	Q
	30S 37W 03DBA	Q
	30S 37W 20CBC	Q
Gray	24S 28W 36ACA	Q
	24S 30W 15CCC	Q
	26S 29W 35CCC	Q
	27S 27W 25CCD	Q
	27S 30W 23BB	Q
	28S 30W 17BBA	Q
	28S 30W 24BAB	Q
	29S 28W 28CDC	Q
	29S 29W 10ABB	Q
Greeley	16S 39W 02BDC	Q
	16S 39W 22DCB	Q
	16S 40W 18DBA	Q
	16S 41W 20BAD	Q
	17S 39W 02BAA	Q
	17S 39W 22ABB	Q
	17S 40W 15CCB	Q
	17S 40W 31BBA	Q
	17S 42W 27CBB	Q

Table 4.--Ground-water-level observation wells, 1984 water year--Continued

County	Well number	Water-level notes
Hamilton	24S 40W 17BBB	Q
	26S 42W 17CB	Q
	26S 42W 22CDB	Q
Harvey	24S 02W 16BAA	Q
Haskell	27S 33W 29DAA	Q
	27S 34W 16DDD	Q
	28S 32W 18BBB	Q
	28S 32W 24BCC	Q
	28S 33W 21BCB	Q
	28S 34W 15DAB	A
	29S 32W 26CBB2	Q
	29S 33W 28BCB	Q
	30S 32W 11BBB	Q
	30S 32W 31BAB	Q
	30S 33W 30CBD	Q
	30S 34W 05BBB	Q
	30S 34W 30ADD2	Q
Hodgeman	21S 22W 12BCB	Q
	22S 22W 13CCC	Q
	22S 23W 31ADD	Q
	22S 24W 14BBC	Q
	22S 24W 16ADB2	Q
	22S 24W 24DDD	A
	22S 24W 25DDC	Q
	22S 24W 26DDA	A
	22S 24W 35DAC	Q
	23S 22W 07DAA	Q
	23S 23W 04AAD	Q
	23S 23W 04DCA	A
	23S 23W 12ABD	A
	23S 24W 11DAA	Q
	23S 25W 22DBB	Q
	23S 26W 07CCC	Q
Jackson	06S 15E 27BAB	Q
Jefferson	11S 16E 25CBA	Q
	11S 17E 21ADA	Q
	11S 17E 27BBC	Q
	11S 18E 08DAC	Q
	11S 19E 27BCC	Q
	11S 19E 29CCA	Q
Johnson	11S 23E 33BDD	Q
	12S 22E 21CCC	Q
	12S 22E 25BCCB	Q
	12S 22E 29BBD	Q
Kearny	23S 35W 12CCC	Q
	23S 37W 04ABC	Q
	24S 35W 13CCC2	Q
	25S 35W 02BAA	Q
	25S 35W 17AAA	Q
	25S 35W 26BAB	Q
	25S 36W 28BBD	Q
	25S 37W 15ABA2	Q
	26S 36W 04BDA	Q
Kingman	27S 10W 03DDD	Q
	28S 07W 29CDD	Q
	30S 05W 12CCA	Q
Kiowa	27S 17W 21ADC	Q
	27S 18W 13AAA	Q
	27S 18W 18DDC	Q
	27S 20W 26ABD	Q
	28S 19W 10AAC	Q
	29S 18W 02ACC	Q
Labette	31S 21E 15CCC2	Q
Lane	17S 28W 26ABB	Q
	17S 30W 13CBB	Q
	18S 27W 13CCC	Q
	18S 30W 02AAA	Q

Table 4.--Ground-water-level observation wells, 1984 water year--Continued

County	Well number	Water-level notes
Leavenworth	12S 22E 21BCD	Q
	12S 22E 22CAA	Q
Logan	11S 32W 04ACD	Q
	11S 32W 19AAB	Q
	11S 36W 06ADD2	Q
McPherson	17S 03W 04BBB	Q
	17S 04W 25DDD	Q
	17S 05W 07CBB	Q
	17S 05W 22BAA	Q
Meade	30S 27W 22CDD	Q
	30S 27W 32DDD	Q
	30S 30W 28ABB	Q
	32S 28W 04ADD	Q
	33S 28W 29BCB	Q
	33S 30W 35CB	Q
Morton	31S 39W 33BCC	Q
	31S 40W 29ABB	Q
	31S 43W 14DDC	Q
	32S 42W 21BCC	Q
	33S 40W 27CCC	Q
	33S 41W 03AAD	Q
	35S 40W 03BBB	Q
Ness	18S 21W 31CAA	Q
	19S 23W 01CCB	Q
	19S 23W 08CBB	Q
	20S 22W 20CCC	Q
	20S 23W 32CDA	Q
Osborne	06S 12W 23CDC	Q
	07S 12W 28ABA	Q
	07S 15W 10CCC	Q
Pawnee	21S 18W 32DAA	Q
	21S 19W 30BCC	Q
	21S 20W 29BBB	Q
	22S 15W 03AAA	Q
	22S 15W 03AAA2	Q
Pawnee (continued)	22S 16W 06BBA	Q
	22S 16W 23AAA	Q
	22S 17W 18AAD	Q
	22S 19W 07AAA	Q
	22S 19W 10BBA	Q
	23S 16W 35CDD2	Q
	23S 18W 28DAD	Q
Phillips	04S 18W 23CDC	Q
Pottawatomie	09S 11E 19CDB	Q
	09S 11E 27CAA	Q
	09S 11E 31DCC	Q
	09S 11E 32ADC	Q
	09S 11E 34CAB	R
	09S 11E 35DDD	Q
	10S 08E 12CBB	Q
	10S 08E 14CBA	Q
	10S 10E 10DBC	Q
	10S 11E 01CBC	R
	10S 11E 03BCA	Q
	10S 11E 04ACB	Q
	10S 12E 07BBC	Q
Pratt	26S 12W 34CDC	Q
	26S 12W 34CDC2	Q
	26S 13W 34BCB	Q
	26S 14W 17DCB	Q
	27S 12W 12DAA	Q
	27S 14W 12DDD	Q
	29S 12W 20CCD	Q
Rawlins	03S 33W 03DCC	Q
	03S 36W 17CCC	Q
	04S 36W 06BBB	Q
	05S 33W 29BDA	Q
Reno	22S 06W 29DAB	Q
	23S 06W 31DCB	Q
	23S 09W 35CCC	Q
	26S 10W 18CDC	Q

Table 4.--Ground-water-level observation wells, 1984 water year--Continued

County	Well number	Water-level notes
Republic	01S 03W 01CCA	Q
	01S 03W 09C	Q
	01S 04W 15AAA	Q
Rice	18S 09W 04BCC	Q
	18S 09W 04BCC2	Q
	18S 10W 24BBB	Q
	20S 08W 22AAA	Q
	20S 09W 12DDA	Q
	21S 08W 09CBD	Q
	21S 08W 25ABB	Q
Riley	10S 07E 34BAA2	Q
	10S 07E 35DBB	Q
	10S 08E 23CDC	Q
	10S 09E 17BDD	Q
	10S 09E 19BBA	Q
	11S 07E 01BCC	Q
Rooks	07S 17W 24BBB	Q
	07S 19W 23CDB	Q
Rush	18S 17W 14BCC	A
	18S 17W 14CCC	Q
	18S 17W 14CDC	A
	18S 17W 15DAA	Q
	18S 17W 22AAD	Q
	18S 17W 23BCC	Q
	18S 18W 22DDD	A
	18S 18W 27AAC	Q
	18S 18W 27CCB	A
	18S 19W 20ADD	Q
	18S 20W 14CCC	Q
	18S 20W 19AAD	Q
Saline	16S 02W 18BBB	Q
Scott	16S 33W 19CBB	Q
	17S 32W 27BBB	Q
	17S 34W 06BCB	Q
	18S 32W 17ABA2	Q
	18S 33W 05CCC	Q
Scott (continued)	18S 33W 26DAD2	Q
	18S 34W 25BBD	Q
	19S 32W 06CCB	Q
	19S 32W 32ACB	Q
	19S 33W 15DBD	Q
	19S 33W 29CBB2	Q
	20S 32W 07CBA	Q
	20S 33W 09BBB	R
	20S 33W 21ABD	Q
Sedgwick	25S 01W 26DBD	Q
	26S 01W 19ABA	Q
	26S 01W 31CCC	Q
	26S 01W 31CCC2	Q
	26S 02W 02DDD	Q
	26S 02W 02DDD2	Q
	26S 02W 07AAA	Q
	26S 02W 07AAA2	Q
	26S 02W 10BBB	Q
	26S 02W 10DAA	Q
	26S 02W 14BAA	Q
	26S 02W 14DDD	Q
	26S 02W 15CBC	Q
	26S 02W 15DBB	Q
	26S 02W 22ABA	Q
	26S 02W 23CCC	Q
	26S 02W 24DDD	Q
	26S 02W 29AAA	Q
	28S 01W 11BCB	Q
	28S 01S 11CCD	Q
	28S 01W 15ACA2	Q
Seward	31S 31W 08BCC	Q
	32S 32W 14BBB	Q
	32S 33W 21CDB	Q
	34S 33W 07CCB	Q
	35S 34W 10BBB	Q

Table 4.--Ground-water-level observation wells, 1984 water year--Continued

County	Well number	Water-level notes
Shawnee	11S 12E 01ABA	Q
	11S 13E 04ADA	Q
	11S 14E 13BBB	Q
	11S 14E 15ABB	Q
	11S 14E 18CBB	Q
	11S 14E 22CCC	Q
	11S 14E 24BBB	Q
	11S 15E 13DBC	Q
	11S 15E 14ADB	Q
	11S 15E 16DCA	R
	11S 15E 23DBD2	Q
	11S 15E 24DBD	Q
	11S 16E 19DDD	Q
	11S 16E 29ACA	Q
Sheridan	06S 30W 13BAA	Q
	07S 26W 19BBC	Q
	07S 28W 08BDC	Q
	07S 29W 27CCC	Q
	08S 30W 13DAA	Q
	09S 30W 35BBB	Q
	10S 30W 08DDD	Q
Sherman	06S 42W 02AAA	Q
	07S 37W 04BBC	Q
	07S 40W 36BAB	Q
	08S 39W 15CCC	Q
	08S 40W 12DBA	Q
	08S 40W 20CCC	Q
	08S 40W 25AAC	Q
	08S 42W 31DCD	Q
	09S 39W 19CCC	Q
	09S 40W 29BBB	Q
	09S 42W 08AAA	Q
	09S 42W 14AAA	Q
Stafford	21S 13W 27DDD2	Q
	22S 13W 29DAD	Q
	23S 13W 08CCB	Q
	23S 14W 30BBB	Q
	24S 13W 30BCB	Q
Stafford (continued)	24S 13W 36DDD	Q
	25S 11W 23DDD	Q
	25S 13W 03BBB	Q
	25S 13W 16ACC	Q
Stanton	27S 39W 27BBA	Q
	27S 40W 21DAA	Q
	27S 42W 31CCC	Q
	28S 39W 14BBC	Q
	28S 39W 36ABB	Q
	28S 40W 12DDD2	Q
	29S 41W 13ACC	Q
	29S 42W 24CCC	Q
	30S 40W 24CDC	Q
	30S 43W 34BBB	Q
Stevens	31S 35W 19CCC	Q
	31S 36W 02CDD	Q
	31S 37W 22BCC	Q
	32S 35W 08DDD	Q
	33S 38W 20DDB	Q
	34S 38W 02CAC	Q
Thomas	06S 32W 29CDC	Q
	06S 34W 01DDD	Q
	06S 34W 17CBC	Q
	06S 35W 26ACB	Q
	07S 36W 17CCC	Q
	08S 31W 03CDD	Q
	08S 32W 27DAB	Q
	08S 33W 34BBC	Q
	08S 34W 01BAC	R
	08S 36W 18ABA2	Q
	09S 32W 27BCD	Q
	09S 33W 26DAD	Q
	10S 33W 06BBC	Q
Trego	12S 23W 20CCC	Q
Wabaunsee	10S 10E 15DCC	Q
	10S 12E 29ADD	Q

Table 4.--Ground-water-level observation wells, 1984 water year--Continued

County	Well number	Water-level notes	County	Well number	Water-level notes
Wallace	11S 38W 35CCC2	Q			
	11S 42W 08DDC	Q			
	13S 39W 33BBB	Q			
	13S 42W 10BAC	Q			
	14S 42W 14DBD	Q			
	15S 38W 28DBB	Q			
	15S 39W 02BCD	Q			
	15S 39W 08ACC	Q			
	15S 39W 26ACC	Q			
	15S 40W 03BAB	Q			
	15S 40W 26CAB	Q			
	15S 41W 10BAB	Q			
	15S 41W 36DDB2	Q			
Washington	01S 05E 05ADA	Q			
	04S 02E 14CCC	Q			
	05S 01E 20ADA	Q			
	05S 01E 31DDD	Q			
Wichita	16S 35W 20CCC	Q			
	16S 37W 13BBC	Q			
	16S 37W 30ACB	Q			
	16S 38W 10ABB	Q			
	17S 35W 30CBB	Q			
	17S 36W 33BCB	Q			
	17S 37W 28CCC	Q			
	17S 38W 21BBB	Q			
	18S 35W 14DCD	Q			
	18S 37W 21BBB	Q			
	18S 38W 20ACC2	Q			
Wyandotte	11S 24E 14BDA	Q			
	11S 24E 32ABA2	Q			
	11S 25E 20BAB2	Q			

Table 5.--Surface-water-quality stations, 1984 water year

Ident. no.	Station name	Sampling purpose	Coop. or support
	Missouri River Basin		
06-			
8447	S. Fk. Sappa Cr. nr Brewster	SED	KWO
8465	Beaver Cr. at Cedar Bluffs	SED, BED	KWO
8479	Prairie Dog Cr. ab Keith Sebelius Lake	SED	KWO
8538	White Rock Cr. nr Burr Oak	SED	KWO
8566	Republican R. at Clay Center	CHEM, BIOL, TOC, METAL, COLI, FIELD, SED	CBR
8585	N. Fk. Smoky Hill R. nr McAllaster	SED	KWO
8635	Big Cr. nr Hays	SED	KWO
8639	N. Fk. Big Cr. nr Victoria	SED	KWO
8670	Saline R. nr Russell	SED	KWO
8695	Saline R. at Tescott	SED, BED	KWO
8710	N. Fk. Solomon R. at Glade	SED	KWO
8725	N. Fk. Solomon R. at Portis	CHEM, FIELD	MRB
8730	S. Fk. Solomon R. ab Webster Res.	SED	KWO
8740	S. Fk. Solomon R. at Osborne	CHEM, FIELD	MRB
8759	Solomon R. nr Glen Elder	CHEM, COLI, FIELD	MRB
8769	Solomon R. at Niles	SED, BED, OBS	KDHE
8776	Smoky Hill R. at Enterprise	CHEM, BIOL, TOC, METAL, SED, BED, COLI, FIELD OBS, PEST	CBR/KWO
87965	Kings Cr. nr Manhattan	CHEM, METAL, TOC, RAD, FIELD, SED	CBR
8844	Little Blue R. nr Barnes	SED	KWO
8870	Big Blue R. nr Manhattan	CHEM, BIOL, TOC, METAL, SED, COLI, FIELD	CBR
8875	Kansas R. at Wamego	SED, BED	KWO
8920	Stranger Cr. nr Tonganoxie	SED	KWO
89235	Kansas R. at DeSoto	CHEM, BIOL, TOC, METAL, SED, BED, COLI, FIELD, PEST	CBR
9119	Dragoon Cr. nr Burlingame	SED	KWO
9140	Pottawatomie Cr. nr Garnett	SED	KWO
9166	Marais des Cygnes R. nr Ks.-Mo. State line	SED	KC-CE
9170	Little Osage R. at Fulton	SED	KC-CE

Table 5.--Surface-water-quality stations, 1984 water year--Continued

Ident. no.	Station name	Sampling purpose	Coop. or support
		Arkansas River Basin	
07-			
1375	Arkansas R. nr Coolidge	CHEM, BIOL, TOC, METAL, PEST, COLI, FIELD, SED	CBR
1380	Arkansas R. at Syracuse	SED, BED,	KWO
13865	White Woman Cr. nr Leoti	SED, BED	KWO
1398	Mulberry Cr. nr Dodge City	SED	KWO
1400	Arkansas R. nr Kinsley	SED, BED	KWO
1412	Pawnee R. nr Larned	SED	KWO
1419	Walnut Cr. at Albert	SED, BED	KWO
1423	Rattlesnake Cr. nr Macksville	SED	KWO
14286	Cow Cr. nr Claflin	SED	KWO
1433	Cow Cr. nr Lyons	SED	KWO
14333	Arkansas R. nr Hutchinson	SED, BED	KWO
143665	Little Ark. R. at Alta Mills	SED	KWO
1442	Little Ark. R. at Valley Ctr.	SED	T-CE
14478	N. Fk. Ninnescah R. ab Cheney Res.	SED, BED	KWO
14491	S. Fk. Ninnescah R. nr Pratt	SED	KWO
1452	S. Fk. Ninnescah R. nr Murdock	SED, BED	KWO
1455	Ninnescah R. nr Peck	SED, BED	KWO
1457	Slate Creek at Wellington	SED	KWO
1465	Arkansas R. at Arkansas City	CHEM, BIOL, TOC, METAL, RAD, PEST, SED, BED, COLI, FIELD	CBR/ T-CE/ KWO
14707	Whitewater R. at Towanda	SED	KWO
1478	Walnut R. at Winfield	SED	KWO
15601	N. Fk. Cimarron R. at Richfield	SED	KWO
15622	Bear Cr. nr Johnson	SED, BED	KWO
1575	Crooked Cr. nr Nye	SED	KWO
1579	Cavalry Cr. at Coldwater	SED, BED	KWO
1675	Otter Cr. at Climax	SED	T-CE
1698	Elk R. at Elk Falls	SED	T-CE
1707	Big Hill Cr. nr Cherryvale	SED	T-CE
1795	Neosho R. at Council Grove	SED	T-CE
17973	Neosho R. nr Americus	SED	T-CE
179795	Cottonwood R. nr Plymouth	SED	T-CE
18225	Cottonwood R. bl Marion Lake	SED	T-CE
1835	Neosho R. nr Parsons	CHEM, BIOL, TOC, METAL, SED, COLI, FIELD	CBR/ KWO
1840	Lightning Cr. nr McCune	SED	KWO

Table 6.--Ground-water-quality observation wells, 1984 water year

County	Well number
Atchison	05S 20E 18CDC
	06S 18E 22BCD
Barber	30S 11W 34BBC
	31S 12W 24BDD
	32S 10W 21BBA
	33S 11W 33ABB
Barton	19S 11W 31C
	20S 14W 27BCA
Brown	01S 17E 07CBC
	02S 17E 31DDC
Butler	24S 03E 17CAB
	29S 03E 20BAB
	29S 07E 07DDA
Chase	19S 07E 27CBC
	19S 08E 20AAA
	22S 08E 05CCA
Cherokee	32S 23E 06AD
	33S 23E 13ABB
	33S 25E 18DAA
	34S 24E 17DCC
	34S 24E 26DB
	34S 25E 23AAC
Cheyenne	05S 38W 22ACB
Clark	30S 25W 14A
	31S 23W 07BBA
	32S 23W 26DDD
	33S 23W 01DBB
	34S 25W 36DC
Clay	06S 01E 02BAC
	07S 02E 03CDC
	07S 04E 20ADC
	08S 02E 11ADB
	10S 01E 17CDC
Cloud	05S 01W 26ABD
	05S 03W 32ADA
	08S 01W 17DBC
	08S 05W 14ACD
Comanche	32S 18W 07C
	33S 20W 03BAC
Cowley	32S 03E 07DDD
	32S 03E 25BBC
	34S 03E 26BDA
	34S 04E 35CDC
Crawford	29S 23E 24ACD
	29S 25E 01ACB
	30S 25E 28DDA
Decatur	04S 27W 17DAC
Dickinson	12S 04E 31AAD
	13S 01E 18DCA
	14S 03E 35ABA
Doniphan	02S 19E 27CBC
	03S 21E 06BCC
Douglas	11S 18E 34BDA
	12S 20E 19AAA
	13S 21E 05DBB
Edwards	24S 18W 25BDC
	25S 20W 07CAA
Ellis	13S 18W 03CCD
	14S 18W 25AAB
	15S 18W 28CAC
Ellsworth	15S 08W 19BCD
	17S 09W 16DAB
Finney	21S 32W 08ABD
	23S 31W 03DCC
	23S 33W 17BBB
	24S 33W 07ACA
Ford	26S 24W 29ACA
Geary	12S 05E 01BBA
Gove	11S 26W 04DCA
	15S 29W 13CAB

Table 6.--Ground-water-quality observation wells, 1984 water year--Continued

County	Well number
Graham	07S 21W 02BCC
	08S 21W 17ACB
	08S 25W 14DCC
Grant	28S 37W 30BBD
Gray	24S 29W 19BBB
	27S 28W 05AAA
	29S 28W 28CDC
Greeley	17S 40W 15CCB
Hamilton	23S 42W 19CBB
	23S 42W 25CCB
	24S 39W 30BBD
	24S 40W 19BBC
Harper	32S 07W 02CDA
	32S 08W 20BCB
Harvey	22S 01W 15AA
	23S 01W 32BBC
	23S 03W 29DBD
	24S 03W 26ADA
Haskell	27S 32W 06CBB
Hodgeman	21S 23W 04BDD
	23S 23W 06CAB
Jackson	05S 16E 10BBA
Jefferson	07S 19E 29BBD
	08S 19E 26CDA
	11S 16E 13CBD
Jewell	02S 09W 23BAC
	03S 06W 21CAB
Johnson	12S 22E 25BBC
Kearny	21S 37W 02CDC
	23S 25W 24CCB
	24S 35W 23BCC
	24S 36W 16BAD
	25S 36W 28BBD
Kingman	27S 10W 32DCC
	30S 05W 12DDC
	30S 09W 10ADC
Kiowa	28S 18W 19CCB
Lane	18S 29W 13DBA
Leavenworth	08S 21E 19BAA
Lincoln	10S 07W 12ACA
	12S 06W 15AAC
	12S 07W 06AAA
	12S 10W 21DDD
Logan	11S 32W 03ADB
	11S 36W 06DBB
	13S 35W 23ACD
	13S 36W 20CCB
McPherson	17S 03W 17DBD
	17S 05W 23DAB
	18S 03W 14BDD
	19S 03W 29DBA
	20S 01W 11CCB
Marion	19S 01E 04ACC
	22S 03E 04AA
Marshall	04S 06E 16DDD
	04S 09E 16AAB
Meade	32S 28W 11BA
	35S 30W 10CDB
Mitchell	06S 09W 26CAD
Morris	14S 06E 34AAC
	14S 08E 07DAC
Morton	32S 42W 14CCC
	33S 43W 27CDC
Nemaha	02S 12E 26CAD
	04S 12E 18ADD
	04S 13E 35BAA
	05S 14E 11ACC

Table 6.--Ground-water-quality observation wells, 1984 water year--Continued

County	Well number
Ness	19S 23W 05CCD
	20S 23W 29DBB
Norton	02S 21W 08ADD
	05S 24W 14CCA
Osborne	06S 11W 28ACD
	06S 12W 06CBB
	07S 15W 11ADD
	10S 15W 18AAA
Ottawa	09S 04W 10BBC
	12S 03W 01DBA
	12S 05W 15ADD
Pawnee	21S 16W 29ABA
Phillips	01S 20W 23DDD
	04S 16W 27CCA
	04S 18W 23DCA
	04S 20W 34CAB
Pottawatomie	07S 07E 23BBA
	10S 09E 09CDC
	10S 10E 09BDB
	10S 12E 09ADB
Pratt	26S 11W 30ADD
	26S 14W 18CCD
	27S 13W 08DDC
	29S 14W 23BBA
Rawlins	03S 36W 18DCC
Reno	22S 04W 12DDD
	22S 07W 10CAA
	23S 06W 13BBA
	24S 10W 15CAB
	25S 04W 05DAD
	25S 08W 10BAD
	26S 10W 05DD
Republic	01S 02W 33DCD
	01S 03W 02CCB
	01S 04W 31BCC
	03S 04W 17DAD
Rice	19S 06W 29CCD
	19S 09W 31DAB
	20S 08W 16AA
	21S 08W 21BAC
Riley	07S 06E 21CDD
	09S 05E 01BCB
	10S 07E 32DBD
	11S 06E 12ADB
Rooks	07S 18W 24BAD
	09S 18W 35CCD
	09S 19W 34BBD
Rush	16S 17W 16DCD
	18S 20W 20CDA
Russell	11S 12W 07DDB
	11S 14W 07CAA
Saline	14S 03W 25BAD
	15S 02W 26DDD
	15S 05W 04ABB
Scott	18S 33W 24A
Sedgwick	25S 01W 07BAA
	25S 01W 30ABB
	25S 01W 36ACB
	26S 01E 17AAB
	27S 02W 36BBB
	29S 01E 05CAA
	29S 01E 08CBB
	29S 02W 23DDA
Seward	31S 32W 03DAD
	34S 33W 32AA
Shawnee	11S 15E 13BBC
Sheridan	08S 28W 09ABC
	08S 28W 15BBA
Sherman	08S 39W 19DCA
	08S 42W 20CAC

Table 6.--Ground-water-quality observation wells, 1984 water year--Continued

County	Well number	County	Well number
Smith	03S 15W 20DCC	Thomas	07S 33W 31DBB
			07S 36W 15DBB
Stafford	23S 13W 33BDB		
	24S 15W 15CDA	Trego	12S 22W 08BAB
Stanton	28S 41W 36DB	Washington	02S 03E 32ABB
	30S 39W 23BBB		04S 05E 09CAA
			05S 02E 12CBA
Stevens	33S 37W 16AC		
		Wichita	18S 37W 13CAC
Sumner	30S 02E 06CAB		
	31S 01E 04BDC	Wyandotte	10S 25E 27DBD
	31S 02E 02BBB		11S 23E 28CCA
	31S 03W 05ACA		11S 25E 20ABA
	32S 02W 06BDD		
	33S 02E 06BBA		
	34S 02W 21DAB		