WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1987 AND 1988

Compiled by L.J. Combs

U.S. GEOLOGICAL SURVEY
Open-File Report 89-592

Lawrence, Kansas
1989

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CONVERSIONS FACTORS

For those readers who may prefer metric units (International System), the inch-pound units in this report may be converted using the following factors:

Multiply inch-pound	*By*	*To obtain metric unit*
foot	0.3048	meter
mile	1.609	kilometer
acre	0.4047	hectare
square mile	2.590	square kilometer
pound	0.4536	kilogram

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1987 AND 1988

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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 water 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 types of studies: (1) data-collection programs, (2) statewide or regional investigations, (3) local or areal investigations, and (4) research. These studies are funded through cooperative agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds.

Thirty-six water-related studies were ongoing during fiscal years 1987 and 1988 in Kansas. This report describes for each study the problem that initiated the study, the objectives of the study, the approach designed to achieve the objectives, and significant milestones and publications that resulted during fiscal years 1987 and 1988. Information on more than 2,100 data-collection stations in Kansas is presented in maps and tables. A list of 46 reports and abstracts published or released by the U.S. Geological Survey, its cooperators, or technical and scientific organizations during 1987 and 1988 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 established the first streamflow-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 field office in Garden City (fig. 1), investigates the occurrence, quantity, quality, distribution, and movement of surface and ground water. 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 and organic geochemistry research laboratories, computer applications, and the scientific publications section are located at the District office in Lawrence. The fiscal year (FY) 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.

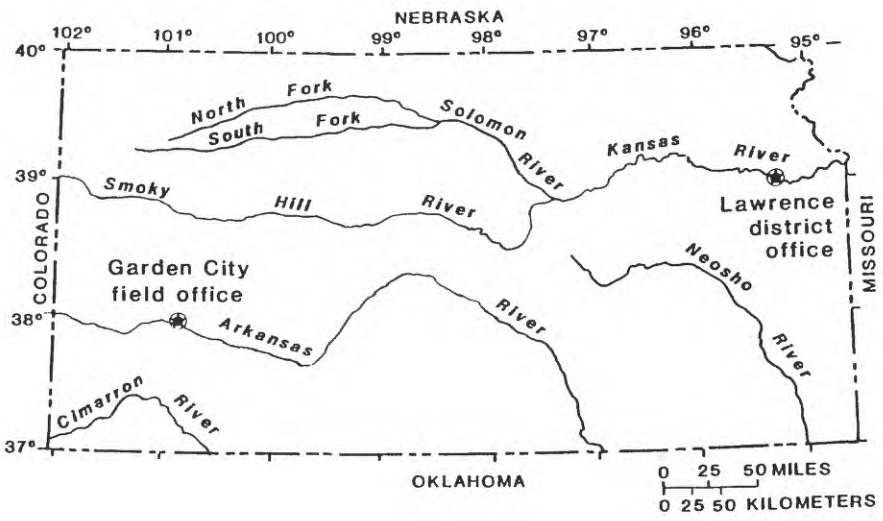

Figure 1. Location of offices of the U.S. Geological Survey in Kansas.

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 FY87-88 is illustrated in figure 2. Those agencies cooperating with the U.S. Geological Survey in Kansas during the 1987 and 1988 fiscal years were:

State and local agencies

Arkansas River Compact Administration
City of Emporia
City of Hays
City of Olathe
City of Wichita
Equus Beds Groundwater Management District No. 2
Geary County
Kansas Department of Health and Environment
Kansas Department of Transportation
Kansas Geological Survey
Kansas State Board of Agriculture, Division of Water Resources
Kansas State University
Kansas Water Office
Linn County
Sedgwick County
Western Kansas Groundwater Management District No. 1

Federal agencies

U.S. Bureau of Indian Affairs
U.S. Bureau of Reclamation
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Army, Corps of Engineers
U.S. Department of Housing and Urban Development, Federal Emergency Management Agency
U.S. Environmental Protection Agency

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:

U. S. GEOLOGICAL SURVEY
SUMMARY OF KANSAS DISTRICT PROGRAM

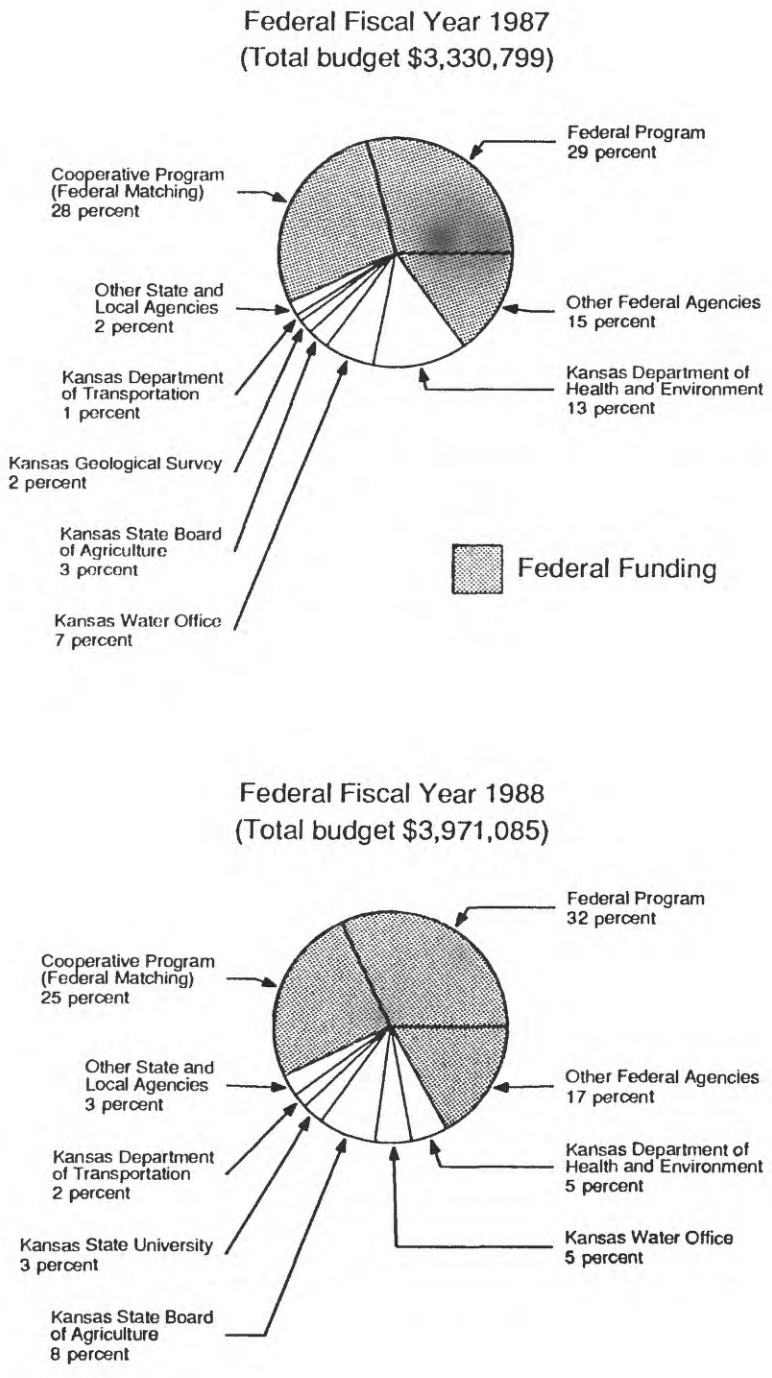

Figure 2. Distribution of funding for the water-resources program of the U.S. Geological Survey in Kansas, fiscal years 1987 and 1988.

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Denver, Colorado 80225
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During 1987-88, personnel of the U.S. Geological Survey in Kansas authored or coauthored 46 water-related reports and abstracts. This total included 32 interpretive reports, 7 data reports, and 7 abstracts. A complete listing of these reports and abstracts begins on page 54.

The U.S. Geological Survey has also conducted an extensive mapping program in Kansas from its regional office in Rolla, Missouri. Standard topographic quadrangle maps published in the 7 1/2- and 15-minute series provide coverage for the entire State. Land-use and land-cover maps and associated map digital data are also available at a scale of 1:250,000. County-wide metric topographic maps (1:50,000 and 1:100,000 scale) and 7 1/2-minute slope maps are available only for selected areas. To obtain an index or to purchase these maps, contact:

Kansas Geological Survey
Publications Sales
1930 Constant Avenue - Campus West
Lawrence, Kansas 66046
Telephone (913) 864-3965

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

Mid-Continent National Cartographic
Information Center
U.S. Geological Survey
1400 Independence Road
Rolla, Missouri 65401
Telephone (314) 341-0851

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.

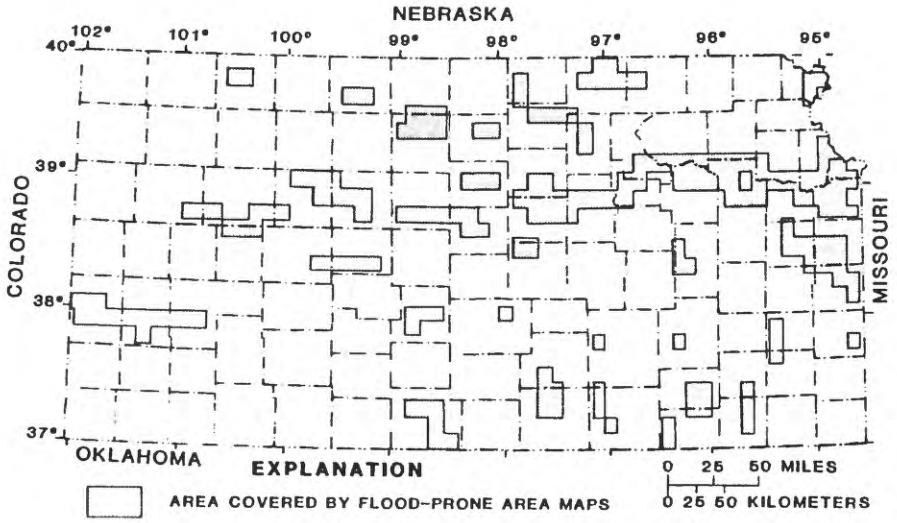


Figure 3. Availability of flood-prone maps.

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.

Systematically and routinely, the U.S. Geological Survey gathers data from more than 2,100 hydrologic stations in Kansas. The backbone of the system is a network of 167 automated streamflow-gaging stations. Measurements taken at most automated data-collection stations are punched on paper tapes that are retrieved during visits to each site at intervals of 4 weeks or more. Although the measurements are recorded at the hydrologic station in a timely manner, the manual retrieval of data generally means a timelag of 4 weeks or more in the dissemination of data.

A major objective of the U.S. Geological Survey in Kansas is to decrease the amount of time between the collection and dissemination of hydrologic data. Of the 167 automated streamflow-gaging stations in Kansas, 18 are linked via telephone lines for immediate retrieval of current stream stages. Even more detailed, real-time data are available from 89 hydrologic stations via satellite transmission to

computer-receiving stations. Those hydrologic stations equipped with satellite-transmission facilities are shown in figure 4.

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 1987 water year is identified as "U.S. Geological Survey Water-Data Report KS-87-1." 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, 5285 Port Royal Road, 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.

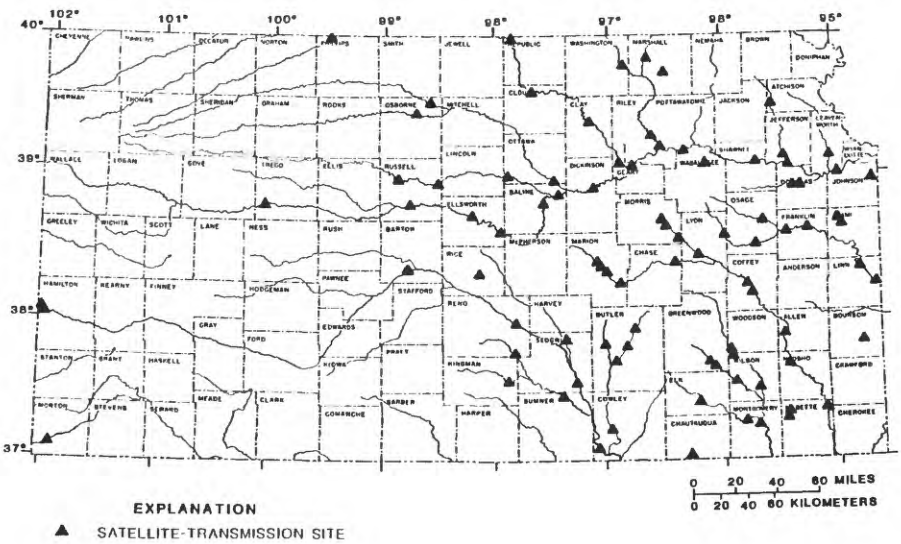
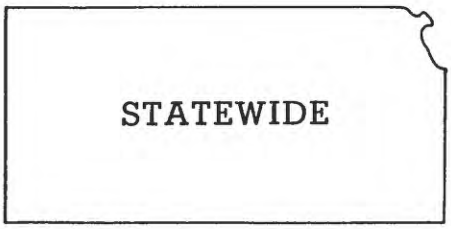


Figure 4. Location of satellite-transmission sites for 1988 water year.



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, flood-plain 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 uses, such as (1) assessment of water resources, (2) operation of reservoirs or for industrial supplies, (3) forecasting, (4) pollution control 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. 5, 6, 7 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, and content of lakes and reservoirs, and on precipitation. The network of stations is reviewed periodically to ensure the collection of meaningful and worthwhile data.

Significant milestones -- During the 1988 water year, 138 complete-record streamflow-gaging stations, 106 partial-record stations, and 1 precipitation station provided surface-water data throughout the State. Data on stage, surface area, and content of 24 lakes and reservoirs also were collected.

Reports

Geiger, C.O., Lacock, D.L., Putnam, J.E., Merry, C.E., and Schneider, D.R, 1987, Water resources data, Kansas, water year 1986: U.S. Geological Survey Water-Data Report KS-86-1, 482 p.

____1988, Water resources data, Kansas, water year 1987: U.S. Geological Survey Water-Data Report KS-87-1, 492 p.

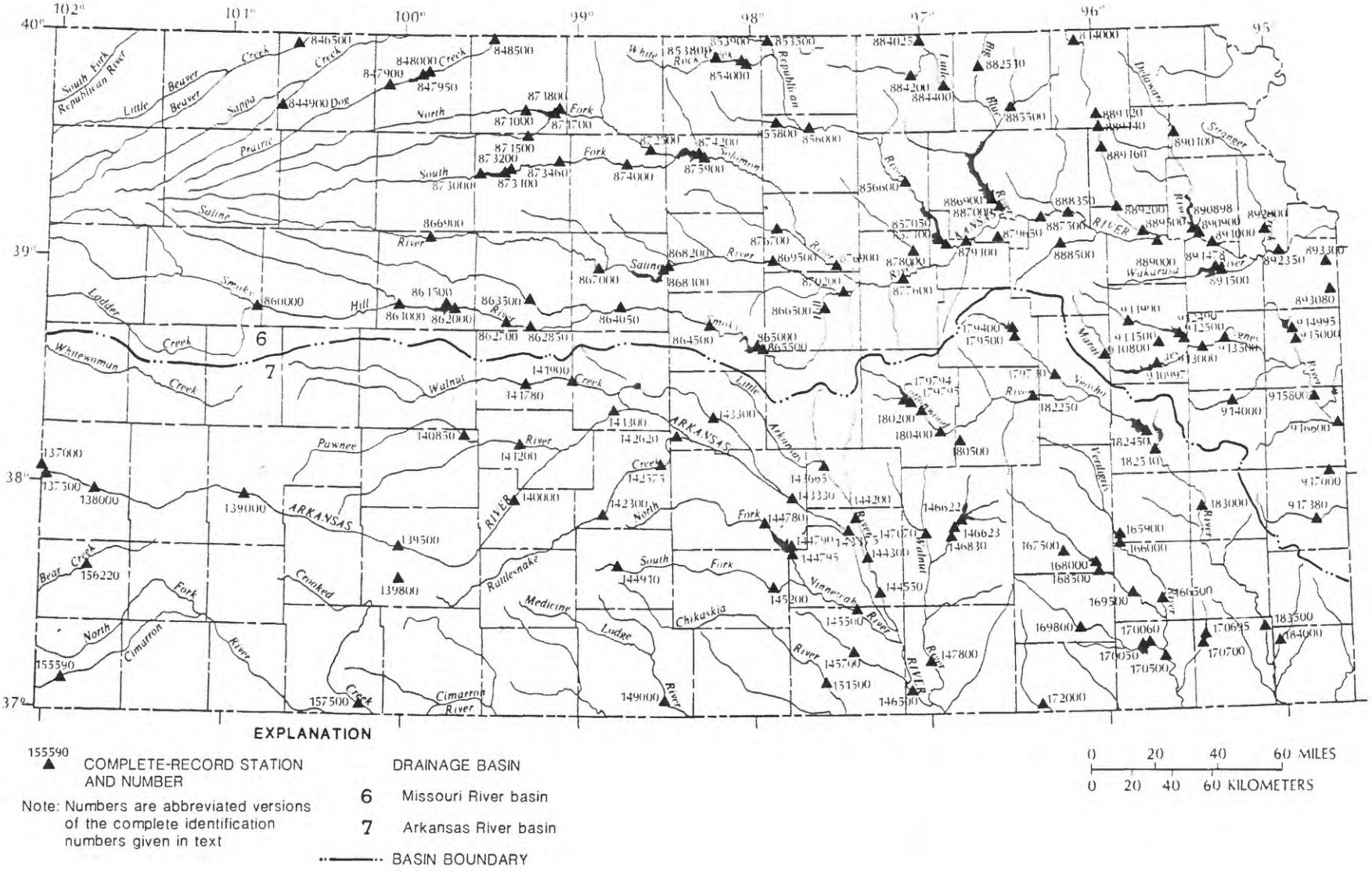


Figure 5. Location of complete-record streamflow-gaging stations, 1988 water year.

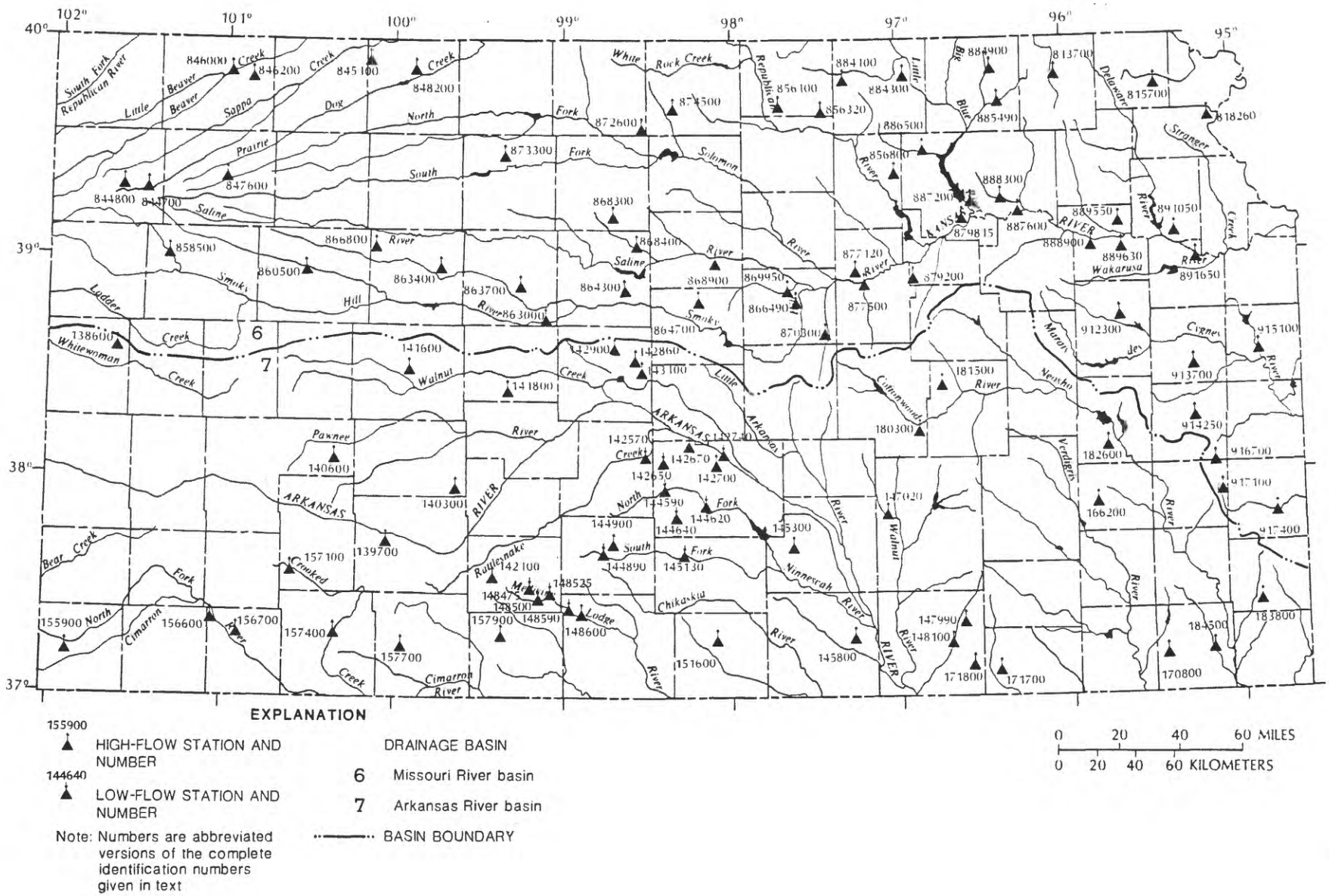


Figure 6. Location of partial-record streamflow-gaging stations, 1988 water year.

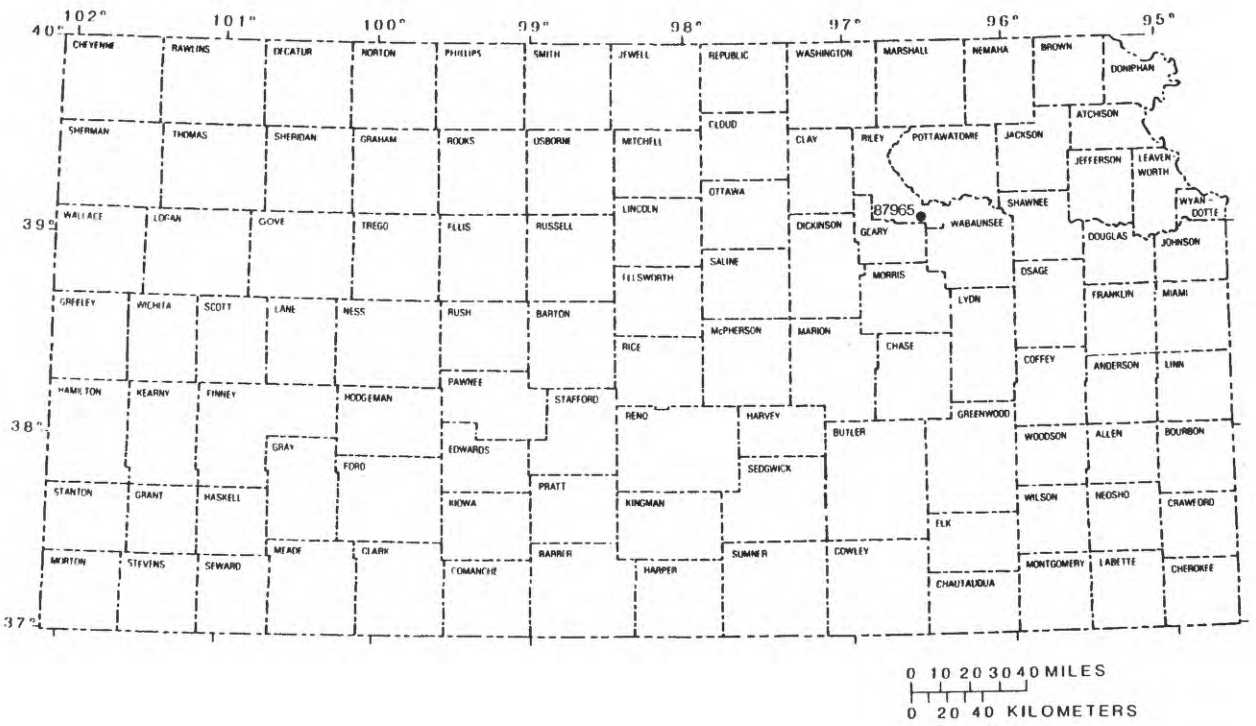
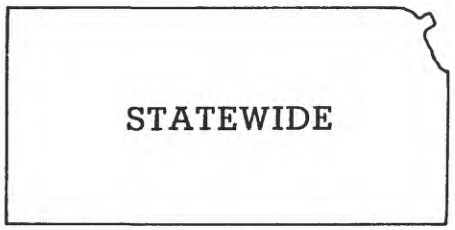


Figure 7. Location of recording precipitation station, 1988 water year.



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

Reports

Dague, B.J., 1986, Percentage change in saturated thickness of the High Plains aquifer, west-central Kansas, 1950 to average 1984-86: U.S. Geological Survey Water-Resources Investigations Report 86-4365, scale 1:125,000, 1 sheet.

____1987a, January 1987 water levels, and data related to water-level changes, western and south-central Kansas: U.S. Geological Survey Open-File Report 87-241, 161 p.

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. 8 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 hydrologic system, provides data for proper planning and management, and for scientific investigations.

Significant milestones -- Ground-water levels were measured in approximately 1,590 observation wells during the 1988 water year.

Reports--Continued

____1987b, Percentage change in saturated thickness of the High Plains aquifer, west-central Kansas, 1950 to average 1985-87: U.S. Geological Survey Water-Resources Investigations Report 87-4252, scale 1:125,000, 1 sheet.

Pabst, B.J., 1988, January 1988 water levels, and data related to water-level changes, western and south-central Kansas: U.S. Geological Survey Open-File Report 88-342, 158 p.

Stullken, L.E., 1988a, Hydrologic maps of the High Plains aquifer, southwestern Kansas, January 1986: U.S. Geological Survey Water-Resources Investigations Report 88-4039, scale 1:250,000, 4 sheets.

____1988b, Summary of water data for the Janzen recharge investigation, Scott County, Kansas, 1980-86: U.S. Geological Survey Open-File Report 88-83, 38 p.

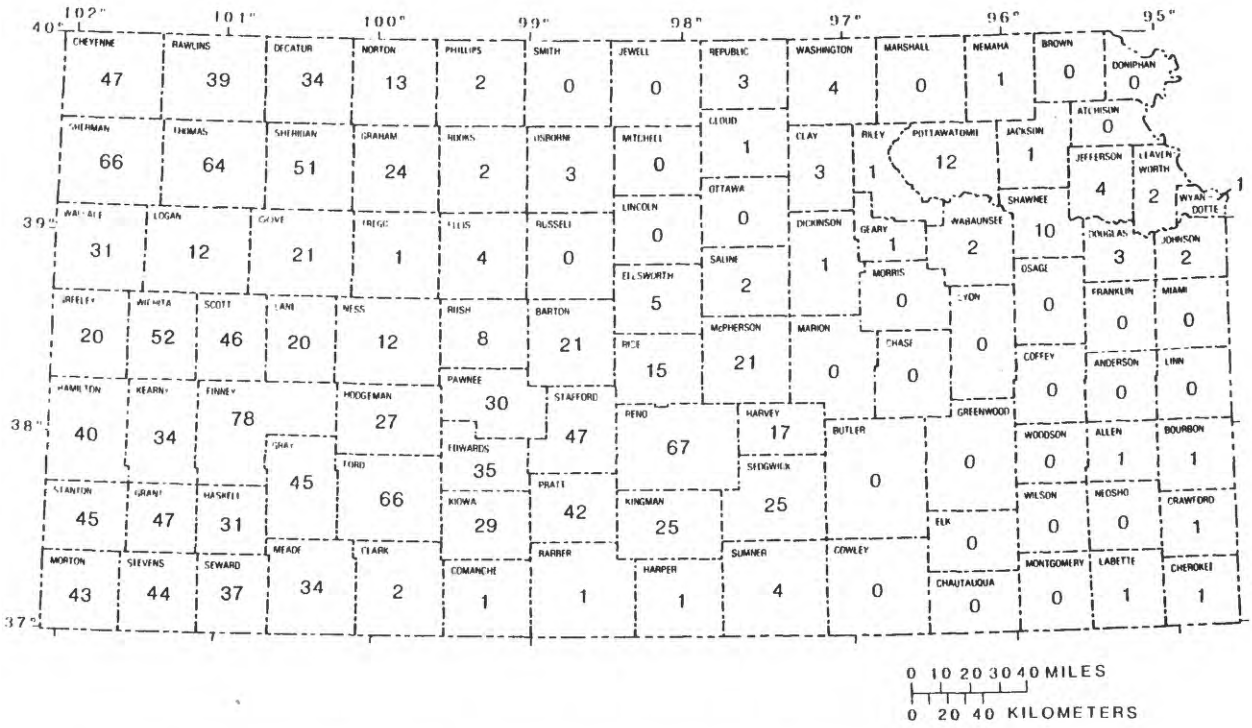
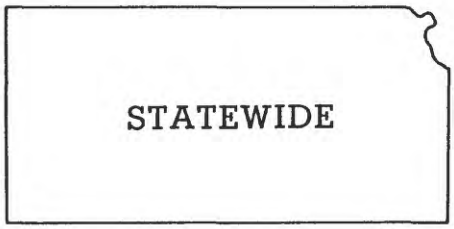


Figure 8. Number of ground-water-level observation wells per county, 1988 water year.



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 systems, must be defined and monitored.

Objectives -- To provide a national data base of water-quality information for State, local, or Federal planning and action programs. 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. 9 and table 5 at the end of this report) are maintained 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 the concentration and distribution of pesticides in streams where potential contamination could result from continued or future application of the commonly used insecticides and herbicides.

Water-quality samples also are collected from a network of wells (fig. 10 and table 6 at the end of this report) to determine the chemical characteristics of 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, 1974. Other samples of water from various geologic formations at selected locations are analyzed for interpretive hydrologic investigations.

Significant milestones -- During the 1988 fiscal year, water-quality data were collected at 7 complete-record streamflow-gaging stations and 10 partial-record stations on a regularly scheduled basis. Five of these stations were in the National Stream Quality Accounting Network, and one station was in the Hydrologic Benchmark Network. Chemical analyses were determined on samples from approximately 220 wells.

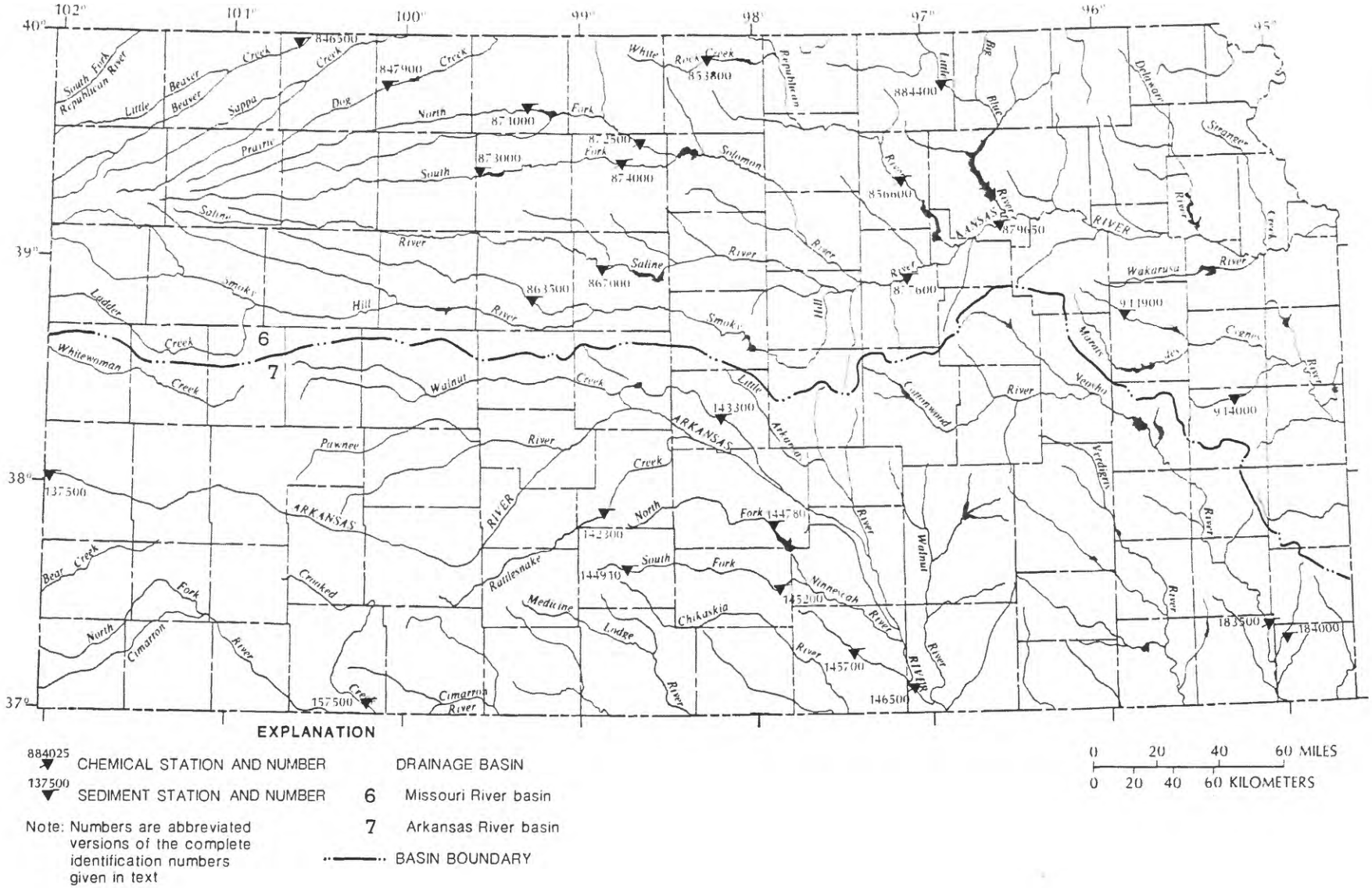


Figure 9. Location of surface-water-quality gaging stations, 1988 water year.

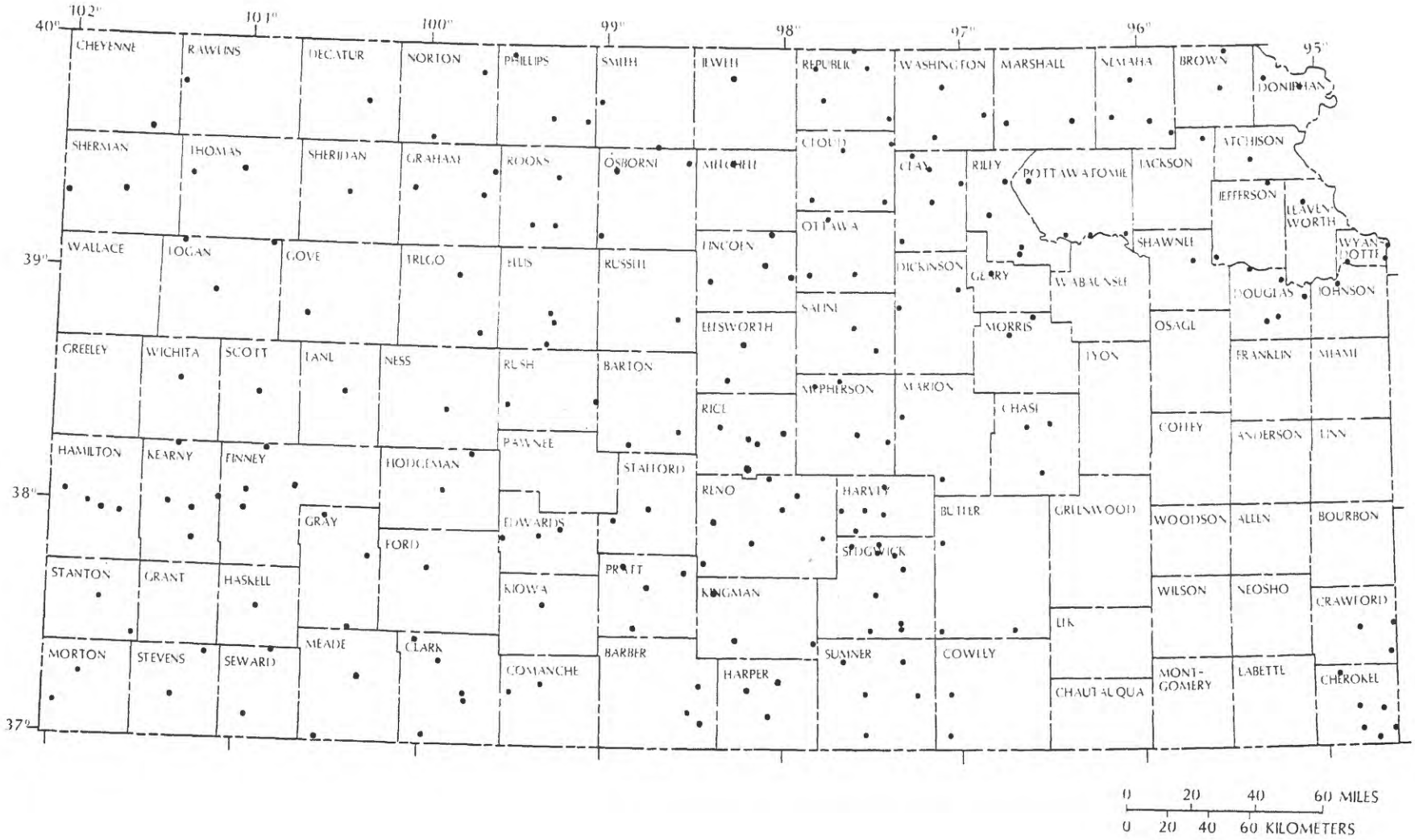
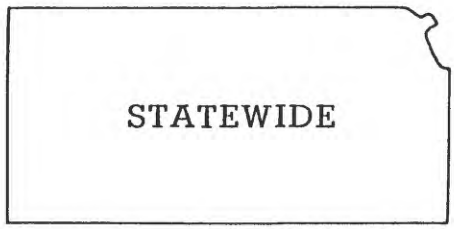


Figure 10. Location of ground-water-quality sampling sites, 1988 water year.



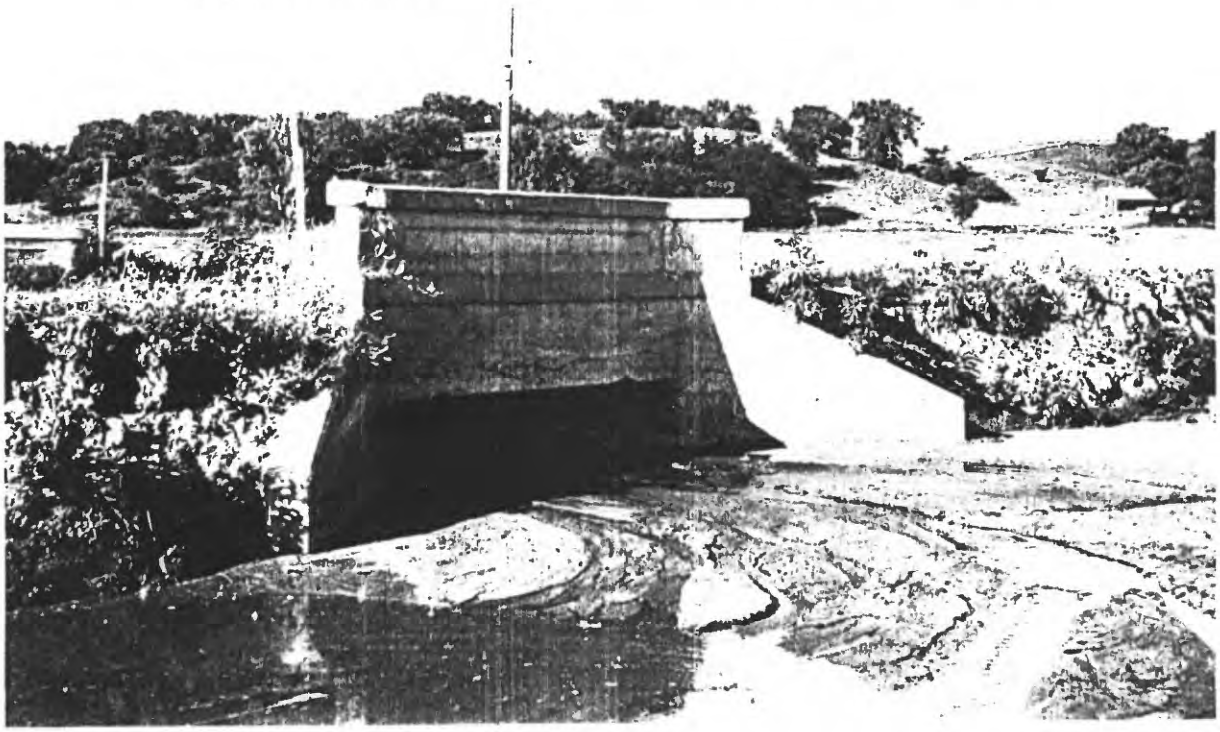
PROJECT TITLE: Sediment data program
PROJECT NUMBER: KS-004
COOPERATING AGENCY: Multi-agency
PROJECT CHIEF: C. O. Geiger

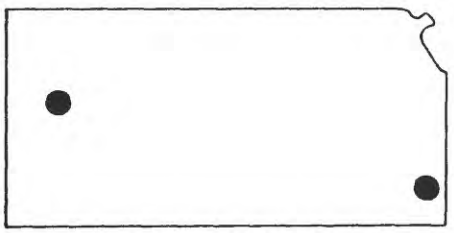
Problem -- Sediment concentrations and discharges in rivers and streams must be defined and monitored in order to make a comprehensive water-quality assessment of the Nation's water resources.

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

Approach -- A network of sediment stations (as shown in figure 9 and 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. In addition, periodic measurements are made of the particle-size distribution of suspended sediment and bed material.

Significant milestones -- During the 1988 fiscal year, water samples were collected at 30 sites for analysis and determination of suspended-sediment discharge.





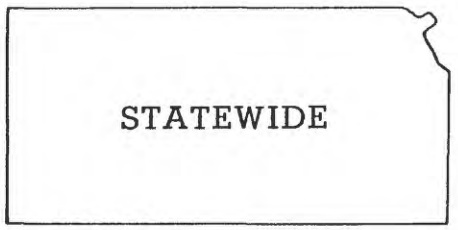
PROJECT TITLE: National Atmospheric Deposition Program
PROJECT NUMBER: KS-005
COOPERATING AGENCY: Federal
PROJECT CHIEF: C. O. Geiger

Problem -- In recent decades human activities have greatly increased both the abundance of substances dispersed in the atmosphere and their effect 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) emissions 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.

Approach -- Sites in Kansas, located on the index map above, are equipped with identical collectors of wet/dry deposition, a recording rain gage, and pH and specific-conductance 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 specific conductance, pH, acidity or alkalinity, calcium, magnesium, potassium, sulfate, chloride, nitrate, ammonia, and phosphate. Later certain additional analyses will be added, including boron, bromide, cadmium, copper, fluoride, iodide, iron, lead, manganese, mercury, molybdenum, nickel, vanadium, and zinc. Pesticides and radioactive materials will also be added. To ensure that the data are of sufficient quality to provide maximum credibility for a wide variety of fundamental research and mission-oriented purposes, a Quality Assurance Committee oversees the operations.

Significant milestones -- During the 1988 water year, data were collected at two sites as part of the National Trends Network and National Atmospheric Deposition Programs (NTN and NADP).



PROJECT TITLE: Water use
PROJECT NUMBER: KS-007
COOPERATING AGENCY: Division of Water Resources, Kansas State Boardof Agriculture
PROJECT CHIEF: J. F. Kenny

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 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 been brought to the immediate forefront by a growing concern within the State for automated handling of water-use/water-rights data. 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.

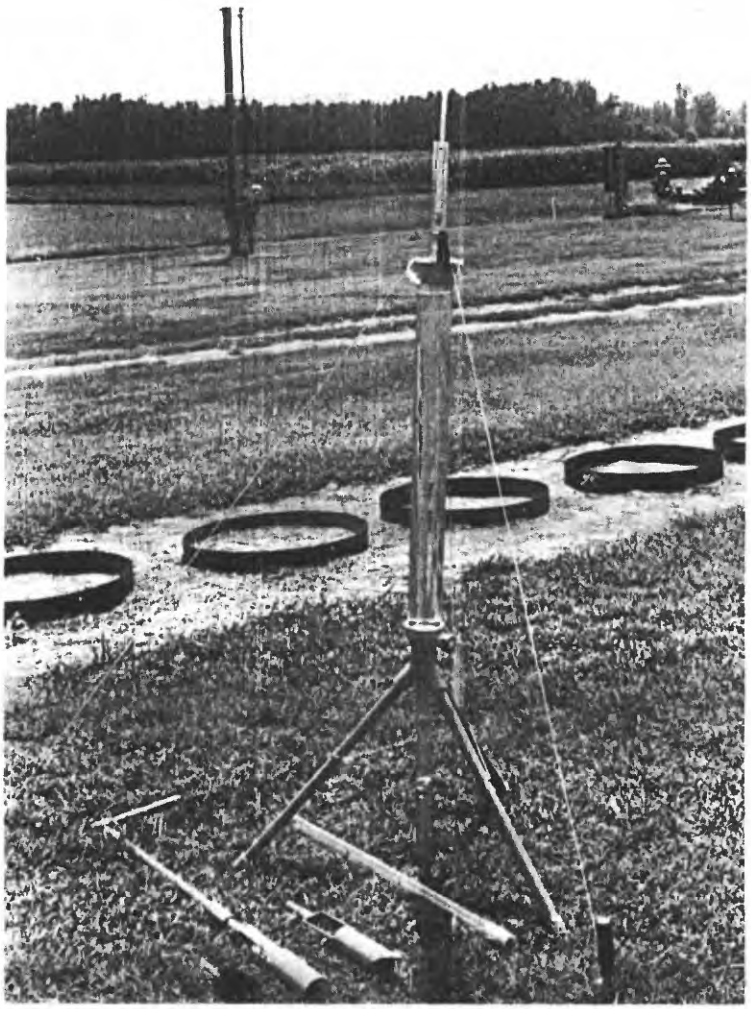
Objective -- To design, implement, load, and evaluate an automated State water-use/water-rights data base. The data base will serve the dual functions of a management tool for administering water rights within the State and of acting as a repository for water-use data to meet National and State needs.

Approach -- The data base was developed by the Kansas Department of Administration, Division of Information Systems and Computing. Data capture, preparation, and input are handled by the Division of Water Resources, Kansas State Board of Agriculture. U.S. Geological Survey personnel work closely with both State agencies to ensure 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.

Significant milestones -- Representatives from the U.S. Geological Survey, the Division of Water Resources, and the Kansas Water Office have formed a Water-Use Committee, which meets regularly to discuss the water-use report program and quality control of the data. Increased editing of municipal and industrial water-use reports has yielded more reliable data for 1987 and 1988. Geographic Information System technology (ARC/INFO) is being used for water-use related maps showing State water-management areas, location of water rights, and water-use data summaries. The U.S. Geological Survey, the Division of Water Resources, and the Kansas Water Office were represented at the National American Water Resources Association conference "Water Use Data for Water Resources Management," held in Tuscon, Arizona, in August 1988. Two papers and two poster sessions were presented by the Kansas representatives.

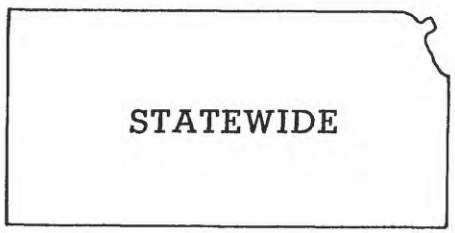
HYDROLOGIC INVESTIGATIONS

Hydrologic investigations provide water-resources information that is valuable for a 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 warnings 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.



Equipment used to determine soil permeability at Kansas River valley experiment field

Statewide or Regional Investigations



PROJECT TITLE: Evaluation of the Ground-Water-Quality Monitoring Network
PROJECT NUMBER: KS-00201
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 water quality in the principal aquifers of the State. These data are necessary for effective management decisions regarding the State's water resources.

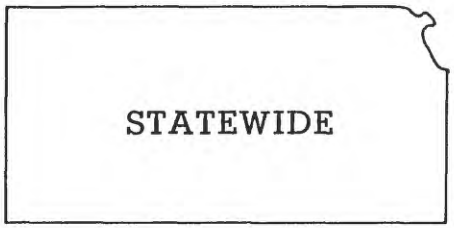
Objective -- Evaluate the chemical-quality data to determine the adequacy of the network for describing baseline ground-water quality, to detect pollution of the principal aquifers in the State, and to determine the significance of the data with respect to State and Federal water-quality standards imposed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

Approach -- Collect water samples for chemical analysis from a statewide network of about 250 wells. The wells will be sampled to provide baseline data for determining the general chemical quality of water in the principal aquifers and to provide a basis for detecting possible long-term changes in regional ground-water quality. Interpret sampled data and evaluate adequacy of the data for detecting changes in chemical quality and regional occurrence of pollution.

Significant milestones -- Data from network wells were collected and analyzed. A report, "Monitoring regional ground-water quality--Statistical considerations and description of the monitoring network in Kansas," is currently in review.

Reports

Spruill, T.B., 1987, A proposed method for design of a network to describe non-normally distributed ground-water-quality characteristics: EOS, Transactions of the American Geophysical Union, v. 68, no. 16, April 21, 1987, p. 313.



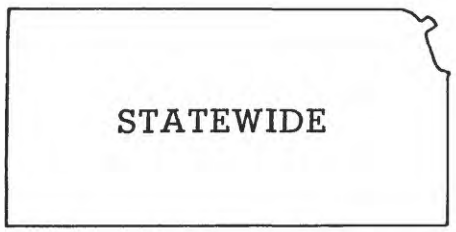
PROJECT TITLE: Flood insurance studies for Federal Emergency Management Agency
PROJECT NUMBER: KS-006
COOPERATING AGENCY: Federal Emergency Management Agency
PROJECT CHIEF: K.D. Medina

Problem -- The Flood Insurance Act of 1968 provides that the U.S. Department of Housing and Urban Development operate a flood insurance program through the Federal Emergency Management Agency. Flood studies in selected areas of Kansas are needed to determine applicable flood-insurance premium rates.

Objectives -- To conduct the necessary hydrologic and hydraulic studies of the areas assigned by the Federal Insurance Administration and to develop procedures to attain the accuracy specified in the appropriate format.

Approach -- Conduct necessary surveys by ground and photogrammetric methods, prepare computer models of drainage networks, compute magnitudes and profiles of floods of specified frequencies, and furnish the results in reports prepared to Federal Insurance Administration specifications.

Significant milestones -- Computation of flood magnitudes and flood profiles for selected areas in Jefferson County have been completed. Flood-prone area maps are in preparation.



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 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.

Streamflow records, including records of annual peak discharges, have been collected on Kansas streams since 1895. The current peak-discharge gaging network includes continuous-record and partial-record (crest-stage gage) stations that are operated by the U.S. Geological Survey in cooperation with the State and other Federal agencies. Included in the peak-discharge network is a subnetwork of 60 crest-stage gage stations that collect only peak-discharge data. The subnetwork, established in 1957, is operated in cooperation with the Kansas Department of Transportation. Regional peak-discharge information is contributed by the network with each additional year of operation. However, the incremental amount of additional information contributed by existing stations decreases annually; therefore, some stations that are operated solely for peak-discharge information should be either eliminated from the network or relocated.

Objectives -- Evaluate the peak-discharge network to assess its ability to contribute regional flood-frequency information and design a cost-effective subnetwork of crest-stage gages operated in cooperation with the Kansas Department of Transportation. The goal was to reduce the size of the network by about 50 percent, while maintaining or increasing the amount of additional regional flood-frequency information contributed by the subnetwork.

Approach -- Flood-frequency characteristics, developed by Clement (1987), for stations in the current peak-discharge network are evaluated to assess the network's ability to contribute

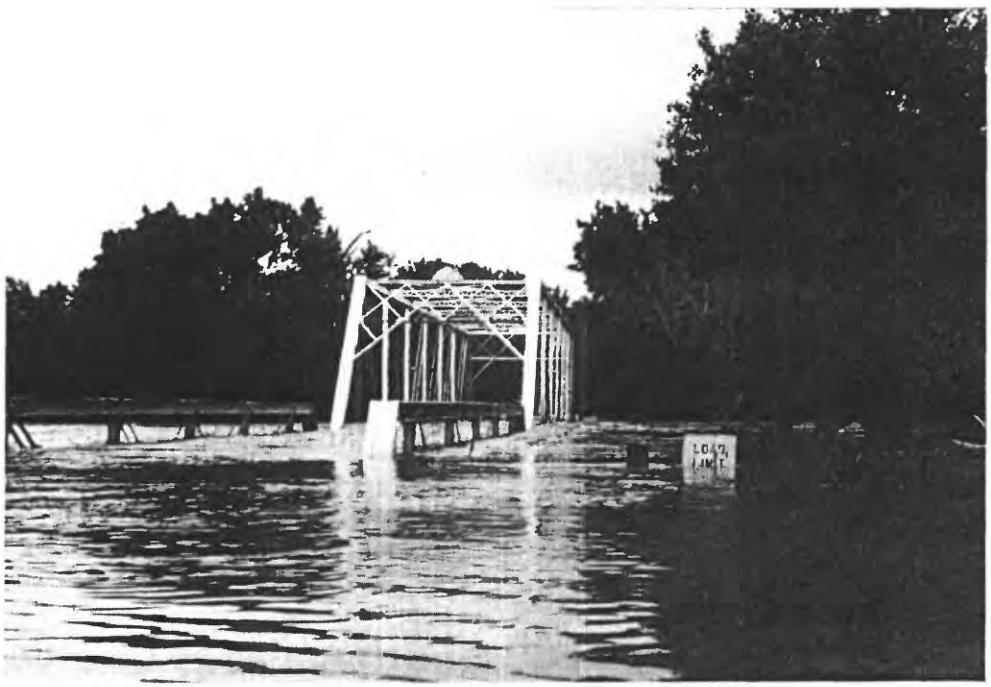
Reports

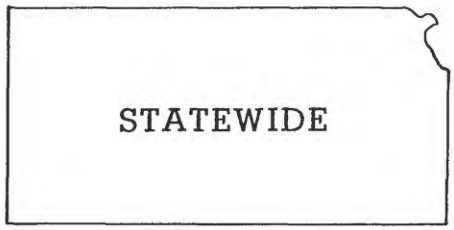
Clement, R.W., 1987, Floods in Kansas and techniques for estimating their magnitude and frequency on unregulated streams: U.S. Geological Survey Water-Resources Investigations Report 87-4008, 50 p.

Medina, K.D., 1987, Floodflow characteristics at proposed bridge site for State Highway 99, Kansas River at Wamego, Kansas: U.S. Geological Survey Open-File Report 87-470, 13 p.

regional flood-frequency information. A generalized least-square (GLS) regression model is used to evaluate each station's contribution of information under current and alternate network configurations. The alternate configuration includes relocation of some stations to the subnetwork of crest-stage-gage stations operated in cooperation with the Kansas Department of Transportation. Planning considerations include operating the subnetwork for an additional 5 and 20 years, respectively.

Significant milestones -- The analysis of the peak-discharge gaging network has been completed, and the Kansas Department of Transportation subnetwork of crest-stage-gage stations has been redesigned. The resulting subnetwork will consist of 32 stations, including 23 existing stations and 9 new or relocated stations. Five existing stations, strategically located, will be converted to long-term trend stations to monitor future time trends in peak-discharge data.





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 through Early Cretaceous age is not well defined. Because of the increased demand for water from the overlying High Plains aquifer 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 through Early Cretaceous age. 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.

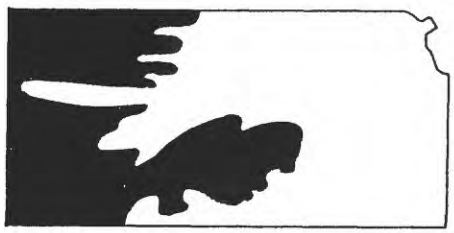
Approach -- A search of the available literature was made to determine the extent of geologic interpretations and available data. Data were compiled to establish a data base of regional significance that includes detailed lithologic descriptions for selected wells, water-quality information, hydraulic characteristics of the rock systems, and information on water use, waste disposal, and brine injection. Appropriate maps were 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.

Significant milestones -- Eight of nine chapters in a U.S. Geological Survey Hydrologic Atlas describing the physical framework and geohydrology of Cambrian through Lower Cretaceous rocks in Kansas have been approved by the Director and are in preparation. An index to selected machine-readable geohydrologic data for Precambrian through Cretaceous rocks in Kansas has been published.

Project is complete, except for report preparation.

Reports

Spinazola, J.M., Hansen, C.V., Underwood, E.J., Kenny, J.F., and Wolf, R.J., 1987, Index to selected machine-readable geohydrologic data for Precambrian through Cretaceous rocks in Kansas: U.S. Geological Survey Open-File Report 87-396, 31 p.



PROJECT TITLE: Water quality in High Plains aquifer, western Kansas, related to irrigated and nonirrigated agricultural land use and petroleum production
PROJECT NUMBER: KS-135
COOPERATING AGENCY: Federal
PROJECT CHIEF: J.O. Helgesen

Problem -- Little is known about the contamination of the High Plains aquifer by organic compounds. Agricultural chemicals applied at land surface to control weeds and insects are potentially hazardous to human 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 in ground water to agricultural use and oilfield brines are needed.

Objectives -- To provide the water samples and analyses needed to describe the current quality of water associated with major types of land use in the High Plains of Kansas (irrigated and dryland farming and petroleum production). Special attention to analysis of 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 -- An initial reconnaissance phase will involve selection of study areas and some collection and analysis of samples. More intensive areal sampling and (or) site-specific experimental sampling will follow, depending on results of the reconnaissance phase. Statistical techniques will be employed for network design and for analysis and interpretation of results. Site-specific experiments may examine hydrologic controls on water quality to better guide sampling and definition of regional conditions. Observation wells will be installed to the extent necessary to provide optimum sampling locations. Results will be described in interim and final reports.

Significant milestones -- An experiment to compare water quality in samples from irrigation wells with samples from shallow observation wells in the same field demonstrated nonuniform

Reports

Helgesen, J.O., and Thurman, E.M., 1988, Trace organic compounds in ground water in south-central Kansas as inferred from gas chromatography with flame-ionization detection: American Chemical Society, Division of Environmental Chemistry, v. 28, no. 2, p. 9-12.

Huntzinger, T.L., and Stullken, L.E., 1988, An experiment in representative ground-water sampling for water-quality analysis: U.S. Geological Survey Water-Resources Invest-igations Report 88-4178, 12 p.

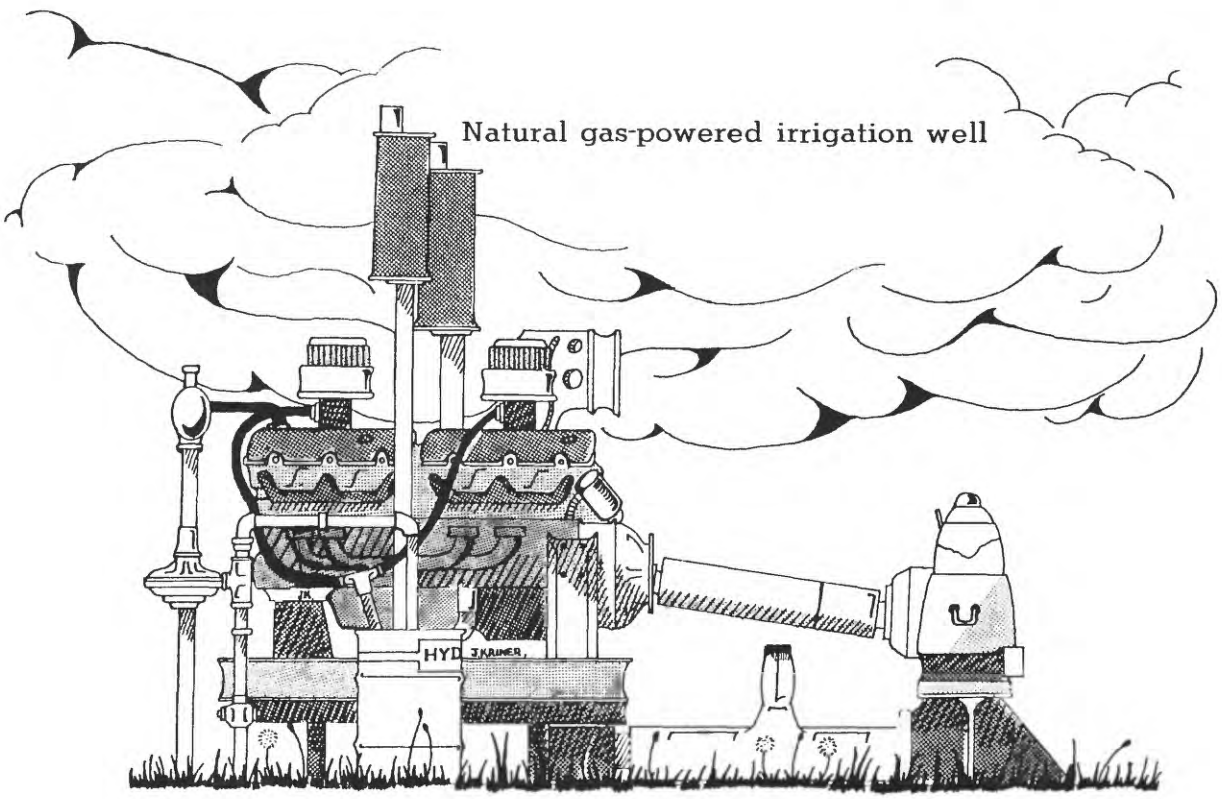
occurrence of nitrate and some other constituents within the aquifer. A reconnaissance of the Great Plains and *Equus* beds areas showed relations between ground-water quality and land use (rangeland, irrigated agriculture, and petroleum-production lands). Detection of pesticides in the aquifer were infrequent and at small concentrations. A simple mathematical model was used to estimate sensitivity of pesticide transport through the unsaturated zone to selected variables.

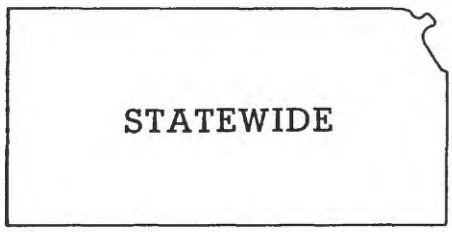
Two articles for Proceedings of the Fourth Technical Meeting of U.S. Geological Survey Toxic-Substances Hydrology Program have been approved by the Director and are in press.

Reports--Continued

Rutledge, A.T., 1988, An axisymmetric model to simulate drawdown within and around a pumping well, *in* Program of International Conference on Advances in Ground-Water Hydrology: American Institute of Hydrology, Tampa, Florida, November 16-18, 1988, p. 15.

Stullken, L.E., Stamer, J.K., and Carr, J.E., 1987, Reconnaissance of water quality in the High Plains aquifer beneath agricultural lands, south-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 87-4003, 25 p.





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 public health and the 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. A need exists to document which of the remaining sites in Kansas have contaminated ground and surface water 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 (county, municipal, industrial, and so forth) in specific areas of the State; (3) determine principal geochemical and hydrogeologic factors that affect the mobility of major chemical contaminants from hazardous-waste sites in selected areas 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 elements, total organic carbon, and specific organic compounds. Principal contaminants associated with each waste-site category will be identified.

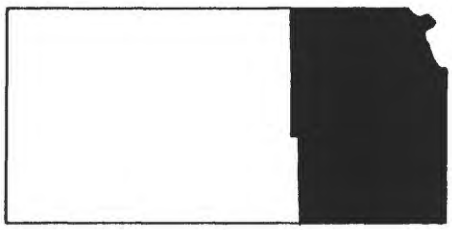
Significant milestones -- Results of a hydrogeologic evaluation of nine hazardous-waste sites in Kansas was published. Field data were collected at two additional industrial sites in Kansas. Information from these investigations was provided to the Kansas Department of Health and Environment and entered into WATSTORE.

Reports

Hart, R.J., and Spruill, T.B., 1988, Description and hydrogeologic evaluation of nine hazardous-waste sites in Kansas, 1984-86: U.S. Geological Survey Water-Resources Investigations Report 88-4015, 73 p.

Perry, C.A., and Hart, R.J., 1985a, Installation of observation wells on hazardous-waste sites in Kansas using a hollow-stem auger: Ground Water Monitoring Review, Fall 1985, v. 5, no. 4, p. 70-73.

__1985b, Installation of observation wells on hazardous-waste sites in Kansas using a hollow-stem auger: Proceedings of the Southern Regional Ground Water Conference, San Antonio, Texas, p. 173-179.



PROJECT TITLE: Relation of trihalomethane-formation potential to physical, chemical, and biological characteristics of water-supply lakes in eastern Kansas
PROJECT NUMBER: KS-139
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: L.M. Pope

Problem -- The formation of trihalomethanes as by-products of the chlorination process in the treatment of drinking water is a potentially serious environmental problem. Evidence from epidemiologic and toxicologic investigations has shown that trihalomethanes pose potential health risks to humans. The potential for trihalomethane formation in drinking water that originates from lakes may be influenced by characteristics of the lakes, such as concentrations of organic substances and nutrients, composition of the phytoplankton population, turbidity, transparency, surface area, depth, volume, and watershed area and land use.

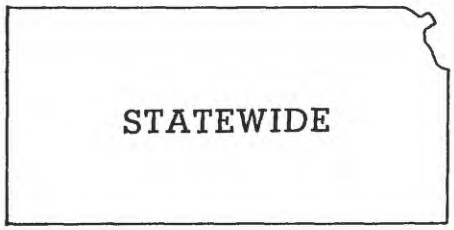
Objectives -- To define the relation among trihalomethane-formation potential and physical and water-quality characteristics of water-supply lakes. Specific objectives of the investigation are to: (1) Rank the trophic state of the lakes on the basis of concentrations of organic nitrogen, ortho- and total phosphorous, nitrate as nitrogen, total and dissolved organic carbon, chlorophyll-*a*, and dissolved oxygen, light penetration, composition of phytoplankton populations, and primary productivity; and (2) determine the potential for trihalomethane formation of each lake and relate it to the trophic state of the lake.

Approach -- Six water-supply lakes were selected to represent a variety of lake and water-quality characteristics. Lake water quality was determined semimonthly from April to October by in-situ measurements of temperature and dissolved oxygen and by lake-water samples collected for determinations of total and dissolved organic carbon, total and dissolved phosphorous, dissolved nitrite plus nitrate nitrogen and ammonia nitrogen, total suspended solids, major cations and anions, alkalinity, total iron and manganese, chlorophyll-*a*, phytoplankton, and trihalomethane-formation potential. Trihalomethane formation was related to lake and watershed characteristics and results of sample analyses using multiple linear regression.

Significant milestones -- Project completed.

Reports

Pope, L.M., Arruda, J.A., and Fromm, C.H., 1988, Relation of trihalomethane-formation pontential to water-quality and physical characteristics of small water-supply lakes, eastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 88-4161, 46 p.



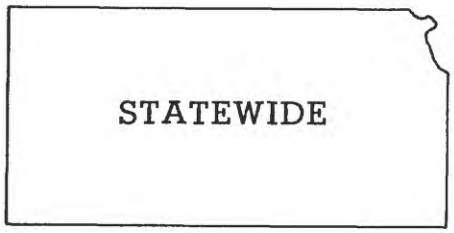
PROJECT TITLE: Estimation of total ground-water storage and natural recharge
PROJECT NUMBER: KS-144
COOPERATIVE AGENCY: Kansas Water Office
PROJECT CHIEF: C.V. Hansen

Problem -- An analysis of the ground-water supply in Kansas, particularly related to its ability to provide consistent supplies into the future, requires defining the amount of ground water in storage and the amount of natural recharge to the principal aquifers in the State. A recent compilation or summary of quantitative estimates of these amounts is not available.

Objective -- The study will provide estimates of total ground-water storage in and natural recharge to the major aquifers in Kansas. Estimates will be based on existing information available from past studies.

Approach -- Ground water in storage and natural recharge to ground water were estimated from information obtained from model studies, studies of precipitation and evapotranspiration, and some studies specifically addressing natural recharge. A compilation of storage and natural-recharge determinations that have been made in the past was used as a guide in making current estimates of natural recharge.

Significant milestones -- Estimates of storage and recharge were made for the principal aquifers in the State. Maps showing potential natural recharge, saturated thickness, and specific yield in principal aquifers were prepared. A report summarizing the results of this study has been approved by the Director and is being prepared for publication.



PROJECT TITLE: Assessment of agricultural pesticides in the saturated and unsaturated zones in Kansas
PROJECT NUMBER: KS-145
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: C.A. Perry

Problem -- Intrusion of agricultural pesticides into the subsurface environment occurs, and residues of these toxic organics are now being detected in shallow aquifers within the State. To better understand the dynamics and fate of pesticides in hydrologic settings, a preliminary assessment of pesticides currently in use in Kansas and hydrologic factors involved is needed. Also, preliminary chemical analyses of soil profiles and ground water are needed to determine the extent of the contamination.

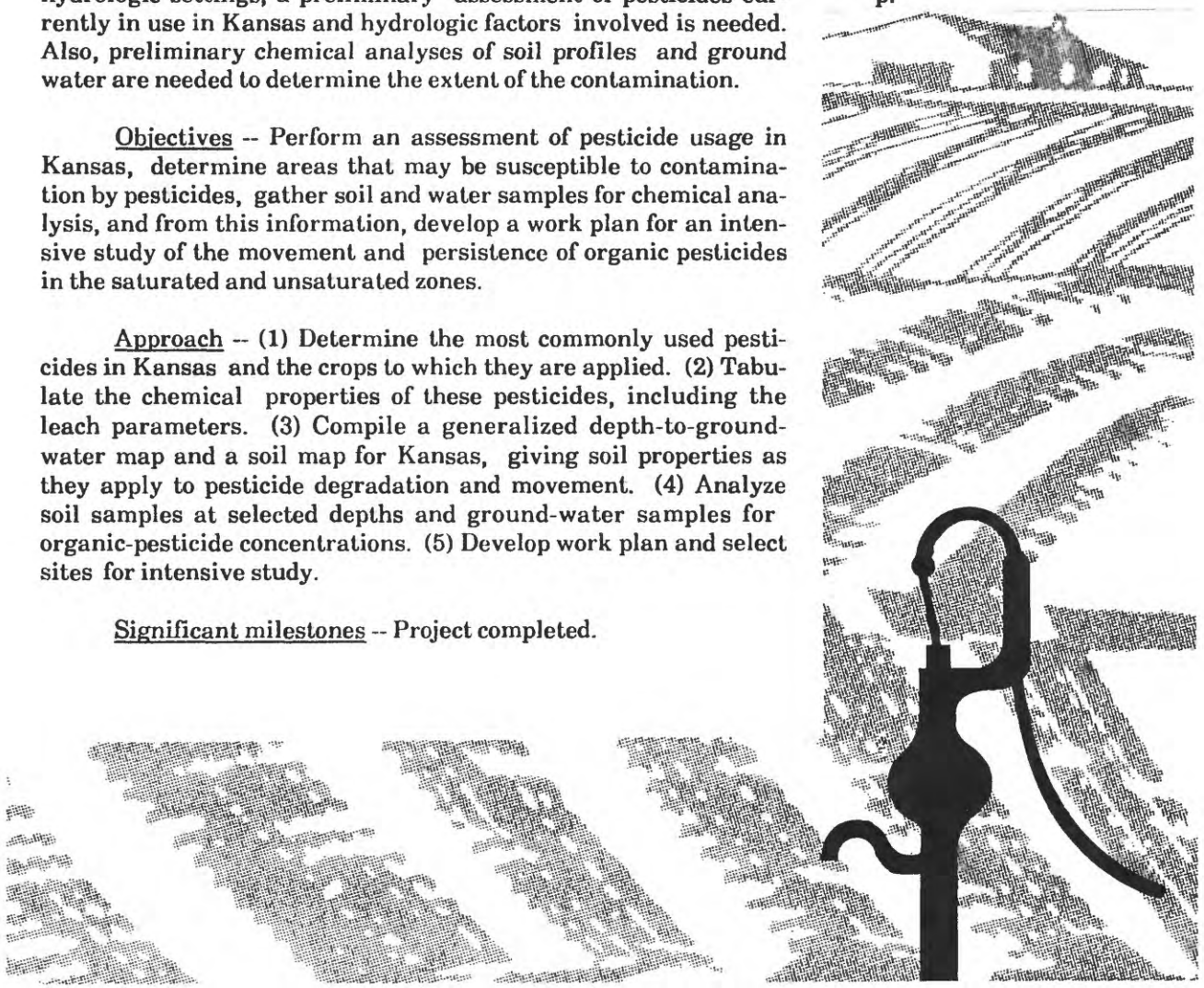
Objectives -- Perform an assessment of pesticide usage in Kansas, determine areas that may be susceptible to contamination by pesticides, gather soil and water samples for chemical analysis, and from this information, develop a work plan for an intensive study of the movement and persistence of organic pesticides in the saturated and unsaturated zones.

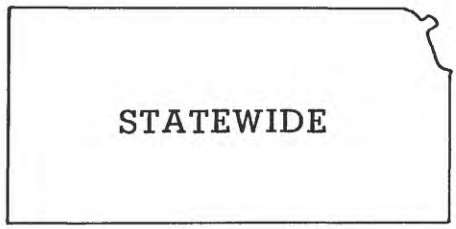
Approach -- (1) Determine the most commonly used pesticides in Kansas and the crops to which they are applied. (2) Tabulate the chemical properties of these pesticides, including the leach parameters. (3) Compile a generalized depth-to-ground-water map and a soil map for Kansas, giving soil properties as they apply to pesticide degradation and movement. (4) Analyze soil samples at selected depths and ground-water samples for organic-pesticide concentrations. (5) Develop work plan and select sites for intensive study.

Significant milestones -- Project completed.

Reports

Perry, C.A., Robbins, Victor, and Barnes, P.L., 1988, Factors affecting leaching in agricultural areas and an assessment of agricultural chemicals in the ground water of Kansas: U.S. Geological Survey Water-Resources Investigations Report 88-4104, 55 p.





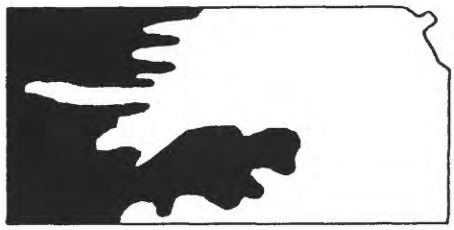
PROJECT TITLE: Movement and persistence of agricultural pesticides in the saturated and unsaturated zones in Kansas
PROJECT NUMBER: KS-151
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: C.A. Perry

Problem -- Intrusion of agricultural pesticides into the subsurface environment is occurring, and residues of these toxic organics have been detected in some aquifers in Kansas. The extent of this problem is unknown, and the physical processes involved in the movement and persistence of the pesticides are not defined. To better understand the dynamics and fate of pesticides in the field, a research study is needed.

Objectives -- Define the movement and persistence of pesticides from the land surface down into the ground-water system for major agricultural areas within the State, determine current pesticide distribution, determine infiltration and recharge rates of pesticide leaching, determine actual field-decay rates, and compare these findings with estimates from the U.S. Environmental Protection Agency's pesticide root zone model (PRZM) and "Leaching Evaluation of Agricultural Chemicals Handbook."

Approach -- As a direct result of project KS-145, several sites were selected for intensive study of the movement and persistence of pesticides in Kansas. Pertinent data will be collected from several Kansas State University Agronomy Farms and Experimental Stations. Soil and ground-water samples will be analyzed for pesticides and degradation products, and these analyses will be related to the physical characteristics of the sampling sites, including climate, infiltration of water, soil temperature, particle size, pH, clay type, and moisture, and application rates. Actual measurements of pesticide movement and persistence will be compared with theoretical estimates.

Significant milestones -- Calibration of the PRZM model with field data has been completed, and degradation half-lifes for five herbicides under saturated conditions have been determined for a shallow aquifer near Hesston, Kansas. Four reports describing the results of this investigation are currently in preparation or are in review.



PROJECT TITLE: Monitoring ground-water conditions in the High Plains aquifer in Kansas
PROJECT NUMBER: KS-160
COOPERATING AGENCY: Federal
PROJECT CHIEF: J.B. Gillespie

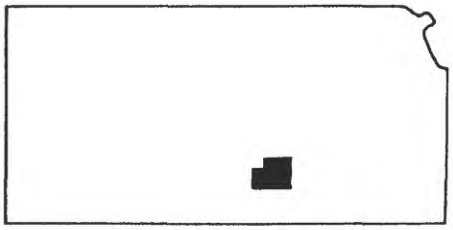
Problem -- In response to concern about ground-water-level declines in the High Plains aquifer, Congress has directed the U.S. Geological Survey to expand its capability of monitoring ground-water levels in the aquifer and to make the information available in annual reports.

Objectives -- To develop the capability of more adequately monitoring water levels in the High Plains aquifer in Kansas and to provide the regional staff with water-level data and other information necessary for their preparation of the Congressionally mandated annual report about ground-water conditions in the High Plains aquifer.

Approach -- Review data from U.S. Geological Survey and local agency observation-well networks to determine if data obtained is adequate for defining areal and temporal water-level changes. Work with local agencies to expand the U.S. Geological Survey's capability of monitoring water-level changes in the High Plains aquifer. Evaluate, analyze, and interpret water-level data so that the information can be made readily available to the public.

Significant milestones -- About 500 observation wells and subsequent annual ground-water-level data were added to the Kansas ground-water network and provided to the regional staff for compilation of the annual report.

Areal or Local Investigations



PROJECT TITLE: Water resources 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 assess future effects.

Objectives -- This study will be directed towards: (1) Inventorying the current quantity and quality of surface- and groundwater 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 during the past 20 years to assess future effects.

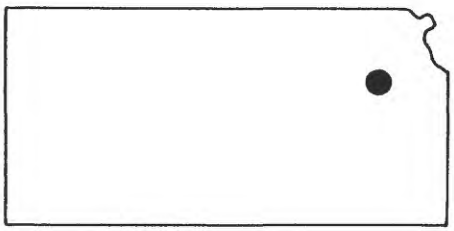
Approach -- A thorough review of available data and literature was used to establish a frame of reference for determining trends in county water resources and to determine additional data needs. Hydrologic data were collected for developing a water-table contour map, describing water-quality characteristics of ground and surface water, quantifying ground- and surface-water resources available for county supplies, and determining trends by comparisons to historical data.

Significant milestones -- Project completed.

Reports

Bevans, H.E., 1988, Water supply and demand in Sedgwick County, Kansas: U.S. Geological Survey Open-File Report 88-711 (FACT SHEET), 2 p.

__ 1989, Water resources of Sedgwick County, Kansas: U.S. Geological Survey Water-Resources Investigations Report 88-4225, 119 p.



PROJECT TITLE: Instrumentation of a dry-pond detention structure for determining effects on the quality of urban runoff
PROJECT NUMBER: KS-142
COOPERATING AGENCY: Federal
PROJECT CHIEF: L. M. Pope

Problem -- Temporary storage of urban runoff in dry-pond detention structures is known to be an effective method of controlling flooding in urban areas; however, the effect that "dry-pond" detention has on urban-runoff water quality is poorly understood. Flow-monitoring and sampling instrumentation of "dry-pond" inflows and outflows require sophistication and state-of-the-art technology, particularly for in-pipe flows. Monitoring and sampling flows in storm-sewer pipes require custom design, installation, maintenance of flumes, constrictions, velocity meters, and automatic equipment, all of which are time consuming and expensive.

Objective -- To instrument, operate, and maintain the necessary flumes, constrictions, velocity meters, and automatic-sampling equipment to monitor and sample flows in two inflow and one outflow storm-sewer pipes to a dry-pond detention structure in Topeka, Kansas.

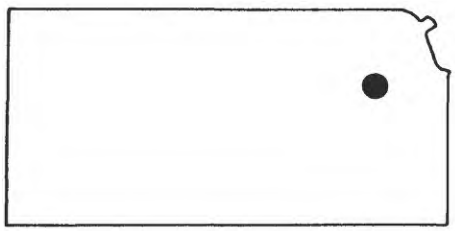
Approach -- All necessary pipe diameters, lengths, and slopes will be measured at the study site. Instrumentation will be fabricated by the the U.S. Geological Survey's Hydrologic Instrumentation Facility in Stennis Space Center, Mississippi. Instrumentation will be installed and operated in conjunction with a rainfall- and urban-runoff study for 2.5 years.

Necessary and preventive maintenance will be performed throughout the duration of the study.

Significant milestones -- Flow monitoring and sampling equipment continue in operation in support of project KS-143 (Evaluation of the effects of dry-pond detention storage on the quality of runoff from urban areas).

Reports

Pope, L.M., Jennings, M.E., and Thibodeaux, K.G., 1988, Instrumentation for a dry-pond detention study, *in* Proceedings of 1988 National Conference on Hydraulic Engineering: American Society of Civil Engineers, Colorado Springs, Colo., August 8-12, 1988, p. 84-89.



PROJECT TITLE: Evaluation of the effects of dry-pond detention storage on the quality of runoff from urban areas
PROJECT NUMBER: KS-143
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: L. M. Pope

Problem -- Runoff from urban areas may contain relatively large concentrations of trace elements, such as cadmium, chromium, copper, lead, mercury, and zinc, as well as other water-quality constituents, such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), various nutrients, and suspended sediment. Temporary storage of urban runoff in dry-pond detention structures is known to be an effective method of controlling flooding in urban areas; however, the effects that the ponds have on decreasing the concentrations and loads of undesirable water-quality constituents are less clear and in need of further research.

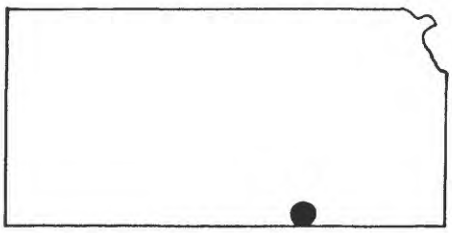
Objectives -- The primary objective of this study is to evaluate the effects of dry-pond detention storage on the quality of storm runoff from urban areas in the Topeka metropolitan area. A secondary objective is to evaluate procedures for predicting loads of selected water-quality constituents in storm runoff from storm-related characteristics.

Approach -- Discharge and water-quality data will be collected at sites on the inflows and outflow of a selected "dry pond." Each of these sites will be instrumented with continuously recording flow- and automatic-sampling equipment as described in project KS-142. Also, physiographic, land-use, climatic, and storm-characteristic data will be collected at the study location. Total loads of selected constituents will be compared graphically and statistically to determine the effects of detention storage. Multiple regression analysis will be used to define relations between storm loads and storm characteristics.

Significant milestones -- Evaluation of detention efficiencies for the pond under "as-built" conditions was completed. In late summer 1988, the pond was modified with an inflow-diverting baffle fence in an attempt to increase detention efficiencies. A pond-modification evaluation will be made in fiscal year 1989.

Reports

Pope, L.M., and Hess, L.G., 1989, Load detention efficiencies in a dry-pond basin, *in* Roesner, L.A., Urbonas, Ben, and Sonnen, M.B. eds., Design of urban runoff quality controls: Proceedings of Engineering Foundation Conference on Current Practice and Design Criteria for Urban Quality Control, American Society of Civil Engineers, July 10-15, 1988, Potosi, Mo., p. 258-267.



PROJECT TITLE: Reconnaissance of Arkansas City Dump Site, Arkansas City, Kansas
PROJECT NUMBER: KS-147
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: T. B. Spruill

Problem -- The Arkansas City Dump Site has been used as a city landfill as well as for disposal of wastes from an oil refinery. Carcinogenic polyaromatic hydrocarbons and large concentrations of chloride, sulfate, nitrate, and lead have been detected in soil and ground-water samples onsite. Available information is inadequate to define the source and extent of soil and water contamination. Before environmental hazards may be fully evaluated, composition, quantity, and mobility of the wastes need to be characterized. In addition, the relation between the aquifer and the Arkansas River needs to be determined, and initial estimates of soil and water contamination made.

Objectives -- (1) To identify the location, extent, and volume of the principal sources of waste on the site. (2) To define the chemical and physical characteristics of the wastes. (3) To evaluate possible alternatives regarding remedial action for known waste sites. (4) To obtain preliminary information on the extent of soil and ground-water contamination on and adjacent to the site. (5) To define the hydrology of the immediate vicinity. (6) To determine possible effects of seepage from the site on the Arkansas River.

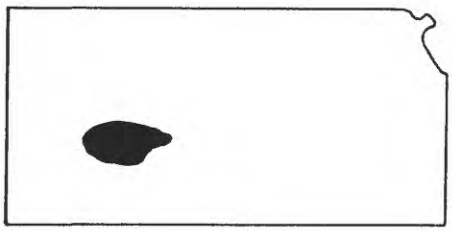
Approach -- Locate the surface and subsurface waste boundaries by magnetometer surveys and test-hole drilling. Determine the chemical and physical characteristics of wastes from the site and of soil and water samples. Determine source and extent of contamination and factors governing contaminant mobility. Collect samples from the Arkansas River up- and downstream from the waste site to determine the effect of the site on river-water quality.

Significant milestones -- A report, "Preliminary evaluation of the effects of an abandoned oil refinery on chemical quality of water in the Arkansas River valley, Arkansas City, Kansas, 1985-86," is in review. Field data and additional information have been entered into WATSTORE and submitted to the Kansas Department of Health and Environment.

Reports

Spruill, T.B., 1987, Effects of wastes from an abandoned oil refinery on ground-water quality in an alluvial aquifer: Proceedings of the 1987 Hazardous Waste Research Conference, Manhattan, Kansas, May 20, 1987.

____1988, Use of total organic carbon as an indicator of contamination from an oil refinery, south-central Kansas: Ground-Water Monitoring Review, v. 8, no. 3, p. 76-82.



PROJECT TITLE: Recharge from floodflows along the Pawnee River and its tributaries
PROJECT NUMBER: KS-148 and 149
COOPERATING AGENCY: U.S. Soil Conservation Service, Pawnee Watershed District No. 81, Southwest Kansas Groundwater Management District No. 3
PROJECT CHIEF: J. B. Gillespie

Problem -- Information on natural recharge to alluvial aquifers along ephemeral streams during periods of peak discharge when the channel and part of the flood plain are inundated is needed. The benefits of flood-retarding structures on ground-water resources need to be determined for the Pawnee Watershed District. Information concerning infiltration, unsaturated and saturated flow of water to the water table, and aquifer properties along the Pawnee River and its tributaries in west-central Kansas is needed by Groundwater Management Districts 3 and 4.

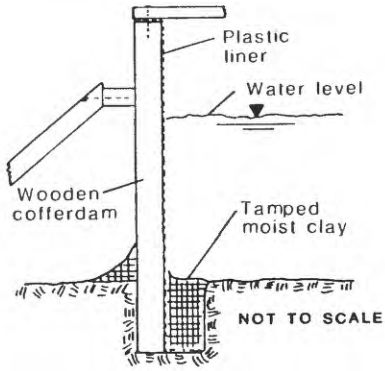
Objectives -- The volume of water entering the alluvial ground-water system during controlled and uncontrolled floodflows was determined by simulating various streamflow hydrographs at points within the Pawnee River basin. The recharge process along the alluvial channels was described, and factors affecting recharge were measured.

Approach -- Channel and flood-plain infiltration was measured at sites in the Pawnee River watershed. A 10- to 15-foot section of the ephemeral stream channel was isolated by two cofferdams. Discharge hydrographs were simulated by pumping water into and out of that section and measuring the loss of water volume due to infiltration. Duration curves for hydraulic gradient versus vertical infiltration were developed, and from these curves, the volume of infiltration for the different hydrographs was estimated. A computer model was calibrated, and simulations of recharge were performed.

Significant milestones -- Project completed.

Reports

Gillespie, J.B., and Perry, C.A., 1988, Channel infiltration from floodflows along the Pawnee River and its tributaries, west-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 88-4055, 30 p.



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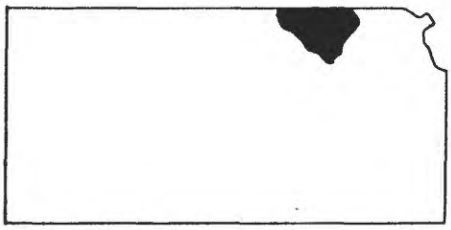


PROJECT TITLE: Occurrence of agricultural pesticides in the Tuttle Creek Lake-stream system, Kansas
PROJECT NUMBER: KS-150
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: H. E. Bevans

Problem -- Pesticides have been detected in Kansas lakes and streams that are current or future sources of public-water supplies. Atrazine, the most extensively used agricultural pesticide in Kansas, has been reported to occur in concentrations as large as 27 micrograms per liter in Tuttle Creek Lake. Although the long-term effects of atrazine and other pesticides on human health have not been fully determined, these pesticides pose a potential threat to the quality of water in lakes that provide public-water supplies. Additionally, the presence of pesticides in lake water may affect phytoplankton productivity.

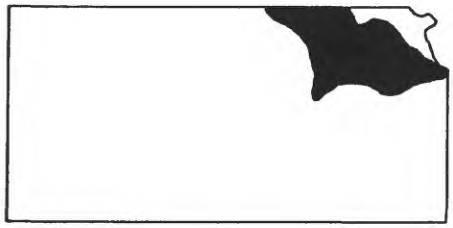
Objectives -- This investigation of the occurrence of agricultural pesticides in the Tuttle Creek Lake-stream system will be directed towards (1) documenting the occurrence of pesticides in the lake-stream system, (2) describing the transport of pesticides through the lake-stream system, and (3) determining the effects of atrazine on photosynthesis and carbon uptake of lake phytoplankton.

Approach -- Samples of water-sediment mixture were collected during a 1-year period from Tuttle Creek Lake, lake tributaries, and the lake outflow. Concentrations of total pesticides, total organic carbon, and suspended sediment were determined for all samples. Dissolved concentrations of pesticides and organic carbon also were determined for the Big Blue River, the principal lake tributary. Experiments were conducted using Tuttle Creek Lake samples and samples from a control lake, where pesticides were not detected, to determine the effects of atrazine on lake phytoplankton. Interpretations of these data were used to meet study objectives.

Significant milestones -- Project complete except for final report.

Reports

Bevans, H.E., 1987, Occurrence of agricultural pesticides in Tuttle Creek Lake, Kansas, *in* Program of Regional Symposium on Lake and Reservoir Management: The Ohio Lake Management Society and the North American Lake Management Society, Columbus, Ohio, May 4-5, 1987, p. 11.



PROJECT TITLE: Surface-water-quality assessment of the lower Kansas River basin, Kansas and Nebraska
PROJECT NUMBER: KS-152
COOPERATING AGENCY: Federal
PROJECT CHIEF: J. K. Stamer

Problem -- Protecting and increasing the supply of good quality water is a national priority. The Nation's Midwest is a very productive agricultural grain belt. The lower Kansas River drainage is typical of this midwestern agricultural region that includes irrigated and nonirrigated land. The basin is also representative of water use-principally for irrigation, municipal, and industrial purposes. An assessment of the water quality and quantity of water in the lower Kansas River basin, which includes the Big Blue River basin in Nebraska and Kansas, is important.

Objectives -- (1) To define the existing water quality of the lower Kansas River basin, its major tributaries, and selected reservoirs. (2) To determine trends in water quality of the lower Kansas River basin, its major tributaries, and selected reservoirs. (3) To define cause-effect relations for a selected subbasin or river reach. (4) To identify existing or potential water-quality problems.

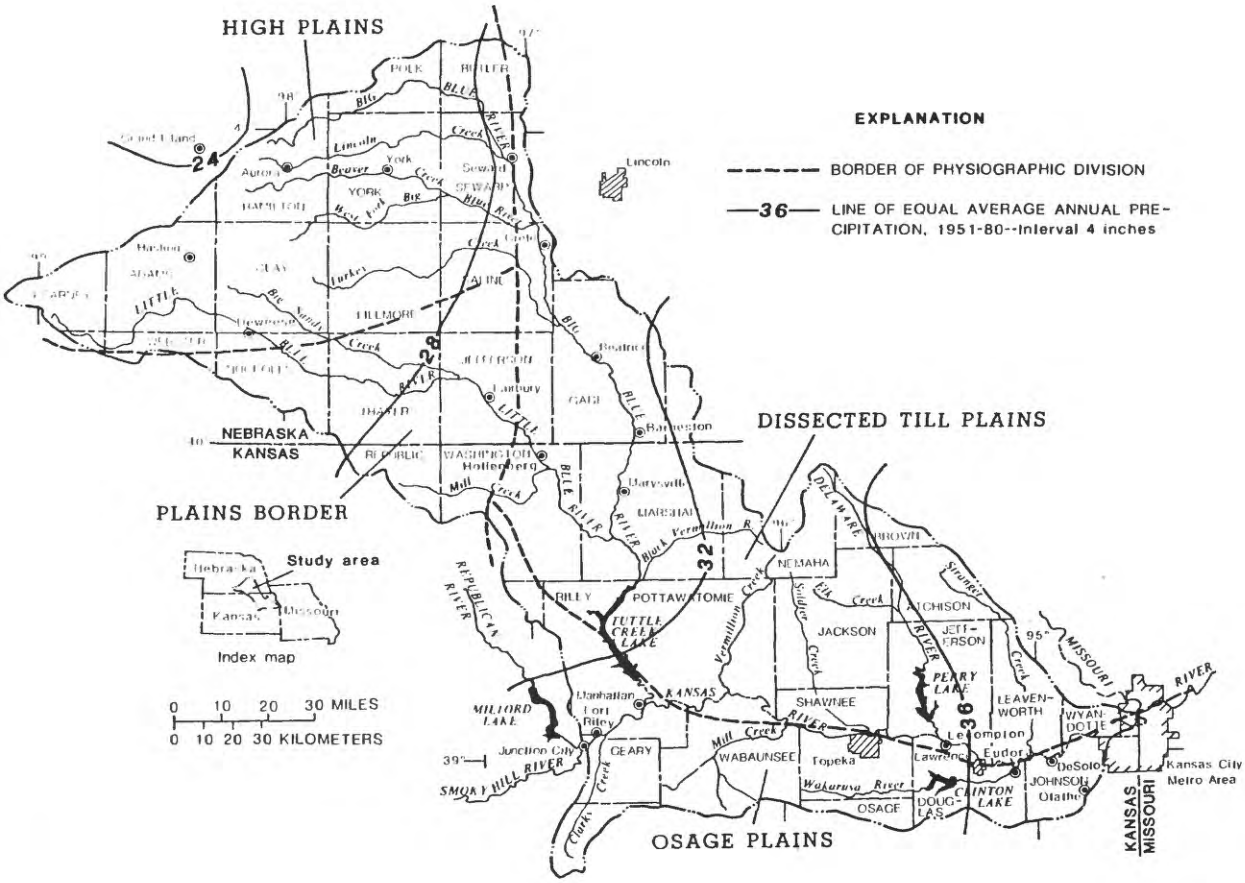
Approach -- The approach is divided into three elements: (1) Fixed-station studies to assess average annual constituent transport and water-quality trends; (2) synoptic studies to determine the surface-water quantity and quality during low flows, to determine trace elements and organic residues in the streambed sediments during low flows, and to calculate constituent transport at the fixed stations during high flows; and (3) intensive subbasin or river-reach studies to define cause-effect relations, depending on time and resource constraints.

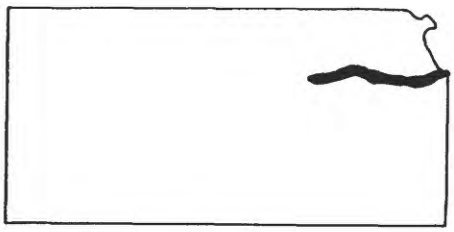
Significant milestones -- (1) Analysis of available surface-water-quality data is nearly complete. (2) Fixed-station sampling at 13 sites will be ongoing for 2 years. (3) Three low-flow synoptic sampling surveys were completed that related to the occurrence and distribution of triazine and nitrogen-containing herbicides, nutrients and dissolved oxygen, major ions, and suspended sediment. During the synoptic survey in July 1988, sanitary quality of streams was assessed using E-coli bacteria. (4) Personnel from the U.S. Geological Survey, Geologic Division, completed their

Reports

Stamer, J.K., Jordan, P.R., Engberg, R.A., and Dugan, J.T., 1987, Surface water-quality assessment of the lower Kansas River basin, Kansas and Nebraska--Project description: U.S. Geological Survey Open-File Report 87-105, 36 p.

sampling of trace elements in streambed sediments in the first- and second-order streams to define the occurrence and distribution of trace elements, and personnel of the Water Resources Division completed their sampling of trace elements in higher order streams and at 50-mile intervals on the main stem of the Big Blue, Little Blue, and Kansas Rivers. (5) A draft of the work plan was revised as of August 1988. The plan is and will be an evolving process. The work plan addresses the various elements of the study, which include: the analysis of of existing surface-water-quality data; the purpose, selection, and operation of the 13 fixed stations; and the purpose, approach, and products of synoptic surveys of inorganic and organic target constituents.





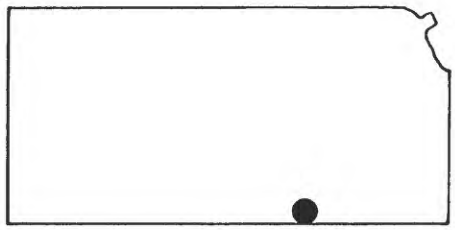
PROJECT TITLE: Ground-water and surface-water relations in the Kansas River alluvium
PROJECT NUMBER: KS-153
COOPERATING AGENCY: U.S. Bureau of Reclamation
PROJECT CHIEF: R. J. Wolf

Problem -- The State of Kansas is developing a water-management plan for the Kansas River as a part of the purchase of water stored in Federal reservoirs. The effect of pumpage from the river valley alluvium on releases from the reservoir in time of drought needs to be determined. The area of study will be the valley alluvium along the main stem of the Kansas River.

Objectives -- The study will provide information needed to anticipate the effects of ground-water pumpage on reservoir releases. The primary objective of the study is to determine the effects of pumping on streamflows during low-flow periods and transit losses and traveltimes of reservoir releases.

Approach -- Documentation of ground-water levels and streamflows will be used to determine the interaction between the river and the alluvial aquifer. Various analytical and digital-modeling techniques will be used to quantify the effects of pumpage on the river during low-flow periods. Synoptic studies of stream discharge along the river will be conducted to determine the transit losses and traveltimes during reservoir releases at low flow.

Significant milestones -- A preliminary finite-element model was divided into four separate workable segments between Kansas main-stem gaging stations. Individual input files for each of about 40 calendar years of data were assembled for each of the four segments of the river and its associated alluvium. Data included both aquifer-node and river-node parameters. Preliminary model setups were completed, and a water-level map was constructed for the spring 1986 mass measurement of wells.



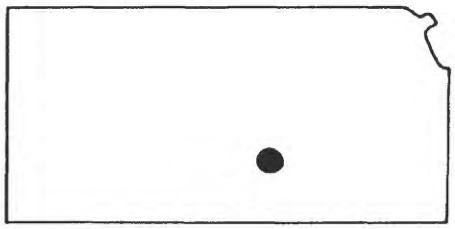
PROJECT TITLE: Processes affecting movement of leachate from oil-refinery wastes in an alluvial-aquifer system
PROJECT NUMBER: KS-154
COOPERATING AGENCY: Kansas Department of Health and Environment
PROJECT CHIEF: T.B. Spruill

Problem -- Kansas has approximately 45 of the more than 900 operating and abandoned oil-refinery sites in the Nation. Many are located over alluvial aquifers near water supplies. Lax environmental restrictions in the past have allowed disposal of acid sludge composed of organic compounds in open pits. Preliminary investigations at some sites in Kansas indicate extensive surface-water, ground-water, and soil contamination, which result in significant health risks.

Objectives -- Determine the major environmental and geochemical factors that affect the movement of refinery wastes. Define the characteristics of contamination and the relative persistence of selected organic compounds. Describe potential hydraulic and geochemical processes that may be taking place.

Approach -- Document the types of compounds and their relative locations on a site near Arkansas City, Kansas. Data will be obtained on organic-compound concentrations in the water and on the soil and aquifer materials. Anticipated geochemical and transport processes will be verified from interpetation of data and hydrologic knowledge of the area.

Significant milestones -- Data collection was completed. All soil, water, and waste samples have been analyzed, and data were entered into WATSTORE. Information on the site was provided to the Kansas Department of Health and Environment and the U.S. Environmental Protection Agency. A journal article addressing factors affecting contaminant transport is being prepared.



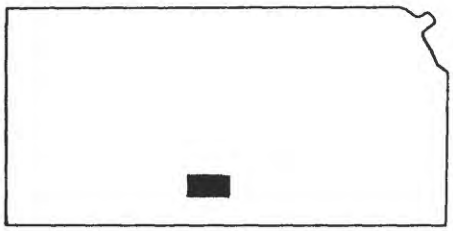
PROJECT TITLE: Example demonstration of procedures for delineating wellhead-protection areas around a Midwest public ground-water supply site
PROJECT NUMBER: KS-155
COOPERATING AGENCY: U.S. Environmental Protection Agency
PROJECT CHIEF: C.V. Hansen

Problem -- Many of the public-water supplies in the Midwest use water from relatively shallow aquifers that are particularly vulnerable to contamination. The U.S. Environmental Protection Agency is involved in defining strategies that will delineate those areas around public-supply wells to be protected from contamination. Application of these strategies needs to be demonstrated at a real site.

Objectives -- The study will outline appropriate methods and data required to delineate the wellhead-protection area around a Midwest public ground-water supply site. Additionally, the utility of a geographic information system (GIS) in the delineation and display of the wellhead-protection area and associated information will be demonstrated.

Approach -- Methods described by the U.S. Environmental Protection Agency in "Guidelines for Delineation of Wellhead Protection Areas" and other sources for delineating the wellhead-protection areas around public-supply wells were evaluated for their appropriateness to the Mt. Hope, Kansas, example. Information from recent studies around Mt. Hope was used. The information compiled and each selected method's resulting wellhead-protection areas were displayed through the use of ARC/INFO, a geographic information system.

Significant milestones -- Methods of wellhead-protection delineation were selected and tested. Test results were displayed through ARC/INFO. A report describing the results of this investigation has been written and is in review.



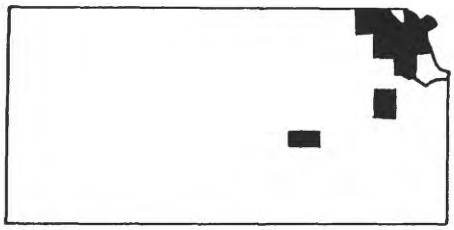
PROJECT TITLE: Saline ground-water discharge to the South Fork Ninnescah River in Pratt and Kingman Counties, south-central Kansas
PROJECT NUMBER: KS-162
COOPERATING AGENCY: City of Wichita, Sedgwick County
PROJECT CHIEF: J.B. Gillespie

Problem -- The Wichita metropolitan area has some concern about future water supplies. One potential source of supply is the South Fork Ninnescah River. However, between Pratt and Kingman, saline ground water is discharged to the river. Chloride concentrations downstream in the river are more than 250 milligrams per liter for 70 percent of the time and commonly exceed 500 milligrams per liter. The source of the saline water is rocks of Permian age that underlie about 50 to 250 feet of alluvium in the area.

Objectives -- Determine the location and extent of saline ground-water discharge to the river, (2) identify the source and approximate flow rates of the saline water, (3) define the characteristics of movement and mixing of the freshwater and saline water, and (4) provide a comparative evaluation of selected measures that might be taken to abate the salinity problem.

Approach -- The literature and data bases will be searched for all pertinent information. Low flows will be measured, and water-quality samples collected to determine the reach in which saline ground water is discharging to the river. Existing wells will be used, and additional wells will be drilled in the area of saline ground-water discharge. Aquifer tests will be conducted to determine aquifer properties, and ground-water samples will be analyzed to determine the distribution and location of the saline water. Water-quality modeling or analytical techniques will be used to estimate saline-water discharge and the effects of various pumping alternatives that could potentially intercept the saline water before it enters the river.

Significant milestones -- Water-quality samples have been collected from the South Fork Ninnescah River, adjacent marshes, and ponds to determine the area in which saline ground water is discharged to the river. Maps were compiled showing the alluvium-bedrock contact, top of the Stone Corral Formation, and the thickness of the saltbed in the underlying Ninnescah Shale, both of Early Permian age.



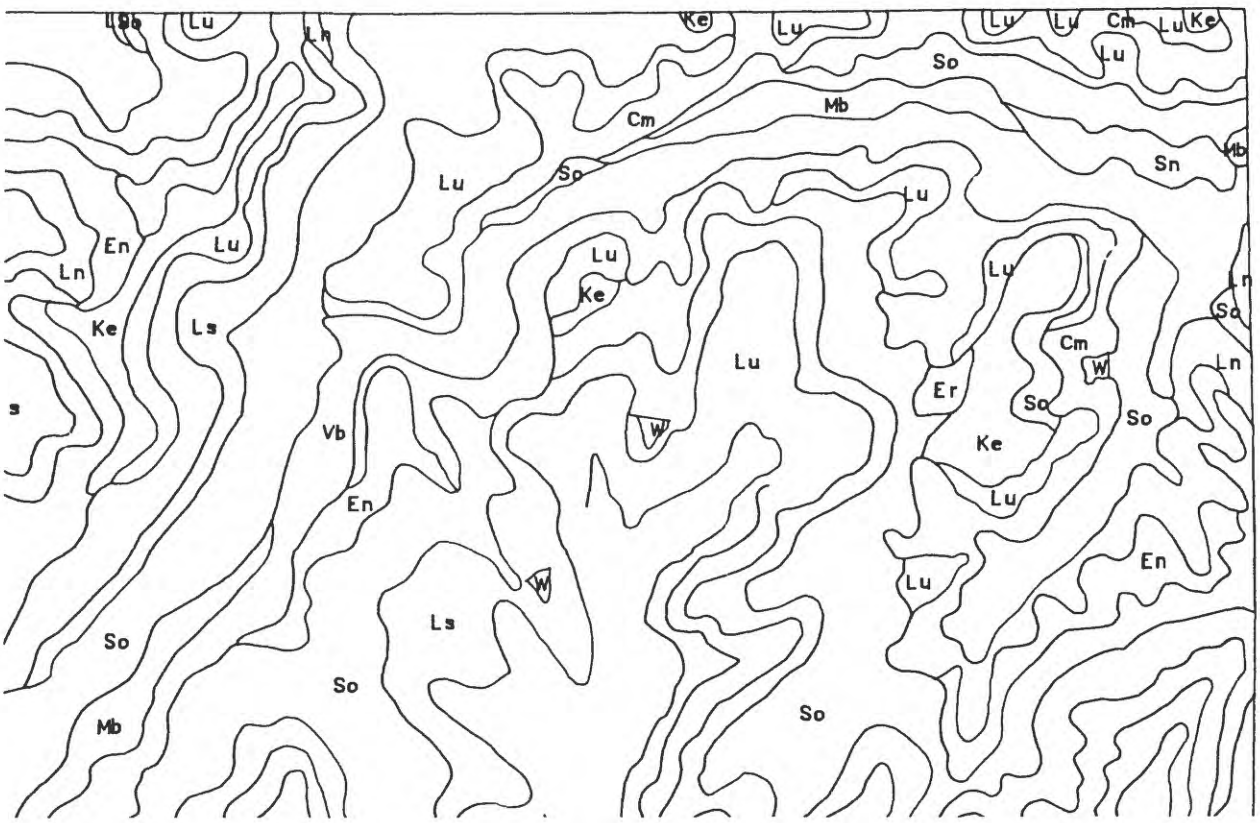
PROJECT TITLE: Soils data base for part of northeast Kansas
PROJECT NUMBER: KS-163
COOPERATING AGENCY: U.S. Soil Conservation Service
PROJECT CHIEF: C.V. Hansen

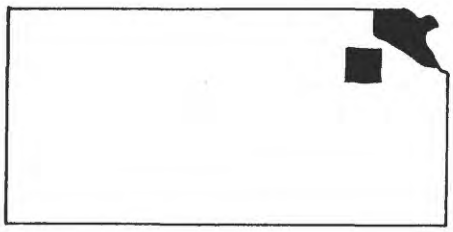
Problem -- Part of the mission of the U.S. Soil Conservation Service is to protect the Nation's soils for future generations. To develop and implement a program to accomplish this goal requires spatial data relating to crops, soils, topography, climate, and water resources. At present, these data are not available in an automated form that will allow rapid access and facilitate decision making. The soils in northeast Kansas in Atchison, Doniphan, Jackson, Jefferson, Nemaha, Osage, and parts of Brown and Marion Counties are of special concern to the U.S. Soil Conservation Service.

Objectives -- Soils data, both in map and tabular forms, will be automated through the use of the ARC/INFO geographic information system for Atchison, Doniphan, Jackson, Jefferson, Nemaha, Osage, and parts of Brown and Marion Counties.

Approach -- The soil maps will be digitized using ARC/INFO. The associated soil attributes will be brought into ARC/INFO and linked to the digitized soil maps.

Significant milestones -- Soil maps were digitized, and associated soil attributes were designated for four 7 1/2-minute topographic quadrangles.





PROJECT TITLE: Water resources of northeast Kansas
PROJECT NUMBER: KS-165
COOPERATING AGENCY: U.S. Bureau of Indian Affairs
PROJECT CHIEF: J.F. Kenny

Problem -- Water-related data for the Kickapoo, Pottawatomie, Iowa and Sac and Fox Indian tribes in northeast Kansas are needed for water-resources management. An assessment of water resources would include descriptions of surface and ground water; summaries of existing information on quantity, quality, and use of the water; and collection of additional information as needed to supplement existing data. This information will be useful to the tribal councils, the U.S. Bureau of Indian Affairs, and other State and Federal agencies.

Objectives -- (1) To compile and evaluate existing information on the extent of water resources. (2) To identify deficiencies in data on surface- and ground-water resources and water use. (3) To acquire additional data needed to describe the predevelopment water resources of these areas and to define current water uses and availability.

Approach -- Water-resources-related information will be mapped, and available water data within the study area will be retrieved using automated data aquisition and processing system (ADAPS) programs. Current and historic data on streamflows, well measurements, and water quality will be evaluated for consistency of coverage and data needs. Additional data will be collected by Kansas District personnel to supplement data on surface water, ground water, water quality, and water use. The water resources will be appraised for availability, suitability, and dependability.

Significant milestones -- A literature review of published water-related information and water issues on Indian lands was conducted. Meetings between tribal representatives, Bureau of Indian Affairs officials, and U.S. Geological Survey personnel were held. Water-quality and low-flow data are scheduled for collection on streams in the study area during a seepage investigation.

Research

PROJECT TITLE: Organic geochemistry of natural and polluted water-- Nonpoint-source contamination
PROJECT NUMBER: KS-156
COOPERATING AGENCY: Federal
PROJECT CHIEF: E.M. Thurman

Problem -- The midcontinent, especially Kansas, Nebraska, and Iowa, use many herbicides to control weeds that affect corn, sorghum, and soybean production. The result is that large quantities of herbicides (2 to 5 pounds per acre) are used annually in these states. Numerous reports indicate the contamination of rivers, reservoirs, and ground water by herbicides. To assess the effect of nonpoint-source pollution on surface and ground water and to develop management strategies, the compounds that cause nonpoint-source contamination need to be determined and linked to both geochemical and hydrologic processes.

Objectives -- The objectives of this research are to: (1) investigate the amount, distribution, geochemistry, and transport of nonpoint-source pollutants (herbicides, degradation products, adjuvants, and fertilizers) at field scales in the midcontinent, where problems are most acute, and to tie research with modeling efforts of other agencies, using computer models such as GLEAMS and PRZM; and (2) identify "fingerprint" compounds that indicate agricultural and urban sources of nonpoint-source pollution and to link this research with hydrologic information and management models of nonpoint-source pollution, such as large-scale (regional) data bases, which then could be used to abate nonpoint-source pollution.

Approach -- The approach consists of three parts that will be implemented initially at two sites--the Kansas River that drains both eastern Nebraska and Kansas and the Cedar River in Iowa:

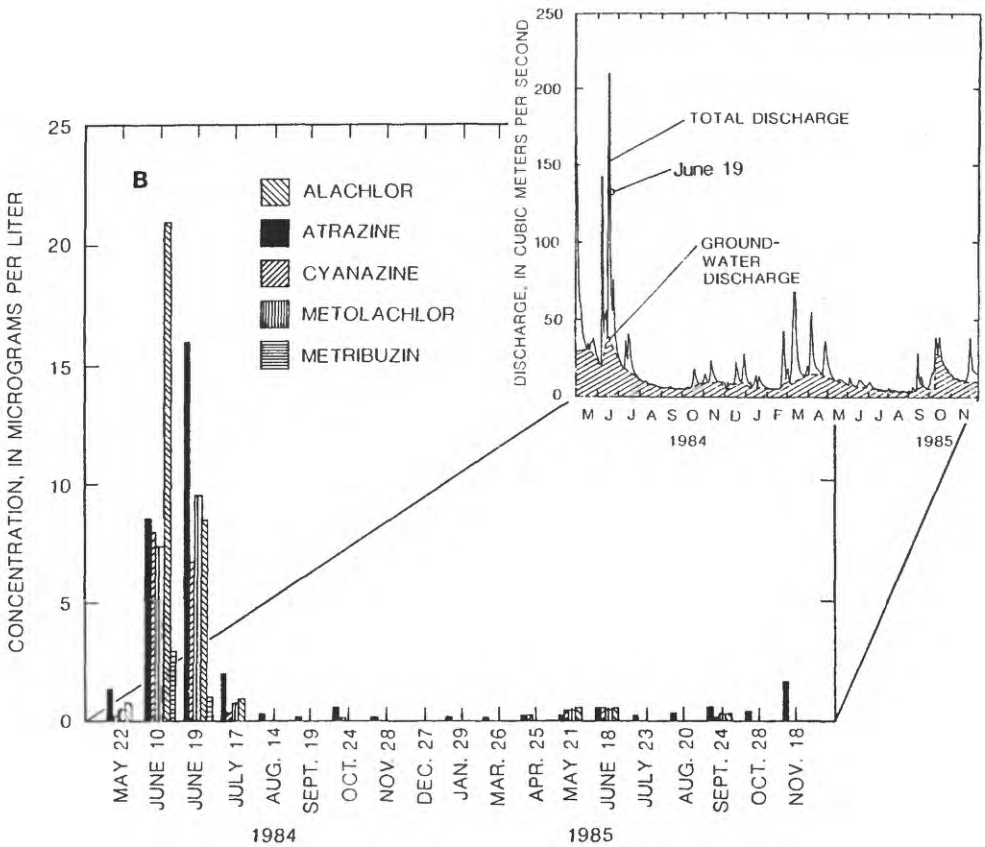
1. Isolate extracts of surface and ground water affected by nonpoint-source pollution using solid-phase extraction and determine adjuvants (pesticide inert ingredients) and urban-related compounds (for example, alkylbenzenes andboron from sewage) with state-of-the-art chemical methods.

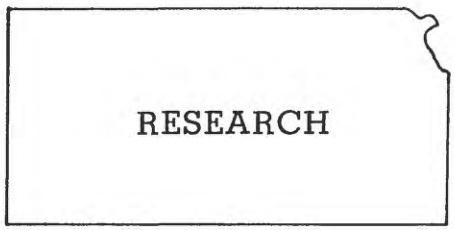
2. Contrast these analyses with chemical analyses of both natural constituents and contaminants for an undisturbed prairie site (Konza Prairie) not affected by human activities but which is important to studies, such as the National Water Quality Assessment (NAWQA) and to the National Science Foundation's long-term ecological research. At the Konza Prairie, both the importance and magnitude of hydrologic, biological, and chemical processes in transport through the unsaturated zone will be assessed.

3. Chemical modeling of nonpoint-source contamination will be accomplished by combining knowledge of the chemistry of nonpoint-source pollutants with the large data base on the distribution of herbicides and related chemicals (nitrogen) available from the U.S. Geological Survey.

Significant milestones -- (1) A gas chromatograph-mass spectometry procedure and an immunoassay procedure for atrazine and other triazine herbicides have been developed. (2) Samples from midcontinent surface waters are being analyzed to survey the importance of herbicides in water quality.

A journal article, entitled "Herbicide transport in the Cedar River, Minnesota and Iowa: Importance of hydrology and geochemistry in nonpoint-source contamination," is in review.





PROJECT TITLE: Chemical and microbial degradation rates of atrazine in ground-water systems
PROJECT NUMBER: KS-157
COOPERATING AGENCY: Kansas State University
PROJECT CHIEF: C.A. Perry

Problem -- Little is known about atrazine degradation rates or degradation pathways (chemical, microbiological, or both) in ground water. This information is essential to understanding the transport, persistence, and long-term effects of atrazine in ground-water systems. Also, an understanding of the physical, chemical, and microbial factors that affect the degradation of atrazine in the unsaturated zone and their relation to each other are important in protecting midcontinent environments.

Objectives -- Define the persistence and long-term effects of atrazine in ground-water systems and overlying soils typical of midcontinent environments. Specific objectives are to: (1) determine the degradation rates in ground-water systems, (2) determine the principal degradation pathways (chemical or microbiological), (3) determine to the extent possible the principal degradation products of atrazine in ground water, and (4) conduct a parallel study of atrazine in unsaturated soil environments.

Approach -- Define a representative shallow aquifer and overlying soil properties, including ranges of temperature, moisture content (soil), pH, organic-matter content, soil texture, oxide concentrations, minerology, and fertility. Determine hypothetical ranges of properties for the midcontinent United States. Complete literature review of degradation rates and pathways and compare these with laboratory experiments involving saturated and unsaturated aquifer material and soils. Emphasis will be placed on the effect of microbes on degradation.

Significant milestones -- A method for atrazine analysis from soils has been developed for gas-chromatographic analysis. The procedure uses solid-phase and liquid-phase extraction, purification, and gas chromatography. Two-hundred samples were analyzed from a cornfield dissipation study for atrazine and alachlor to determine the rate of movement to ground water. Interpretation of the results of these analyses is continuing.

PROJECT TITLE: Data analysis by expert system
PROJECT NUMBER: KS-158
COOPERATING AGENCY: Federal
PROJECT CHIEF: E.M. Thurman

Problem -- Large data bases of both chemical determinations and hydrologic measurements exist in each U.S. Geological Survey office. These data bases are used in studies of water quality, but their use requires time-intensive efforts. The graphical plotting of both chemical and hydrologic data takes considerable time and effort. Yet graphical analysis of data is a powerful tool in understanding scientific processes at work.

The problem is to decrease the time needed for graphical and some statistical analyses of the water-quality and hydrologic data available from project studies as well as from data-base information presently available. Furthermore, expert advise on water quality takes time to implement for large sets of data.

Objectives -- The objective of this research is to develop an expert system on a desktop workstation that is an intelligent data analyzer (IDA). The IDA will rapidly analyze chemical and hydrologic data from its data base using the color graphics of the workstation to enhance relations among variables (for example, water quality, hydrology, and mass transport). Some limited expert-system advice will be given on water quality by the IDA.

Approach -- The approach consists of three parts:

1. Develop the prototype IDA on a Sun color workstation using the chemical and hydrologic data from the study of the Cedar River in Iowa.

2. The prototype will be coded and implemented to do histograms, bar charts, and scatter diagrams of the water-quality data in a series of stacked windows. This will allow the user to view an entire data set graphically in approximately 1 hour (normally a 1-week job). Hydrographs and mass-transport calculations will also be done on the IDA.

3. Test prototype and complete project report.

Significant milestones -- A tape and computer program for the IDA have been completed. The program runs on a Sun 3/60 workstation. The project is complete. A journal article is being written detailing the results of this IDA research.

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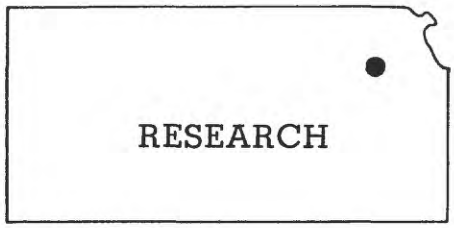


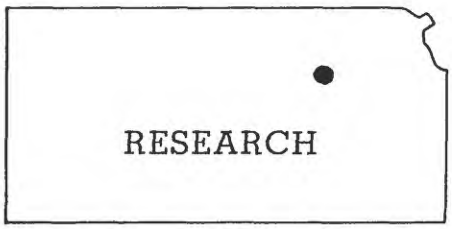
PROJECT TITLE: Effects of soil and cropping management on atrazine movement in soil water
PROJECT NUMBER: KS-159
COOPERATING AGENCY: Kansas State University
PROJECT CHIEF: C.A. Perry

Problem -- Atrazine has been detected in both ground and surface water in Kansas. The source of this contamination is predominantly the agricultural regions devoted to production of corn, sorghum, or wheat. Information is needed at the initiation point concerning the initial transport of the herbicide into the surface-drainage pattern or into the ground-water system. The effects of soil-particle size, field slope, and tillage techniques need to be studied.

Objectives -- Measure the flux of atrazine and the degradation product, hydroxy-atrazine, through the unsaturated zone to the water table and determine the relation of this flux to tillage practice, land slope, soil texture, and time. Apply the U.S. Department of Agriculture's computer model GLEAMS to the experimental plots for verification. Information from the plots will be used to broaden the scope of the model for application to watersheds on the scale of acres to square miles.

Approach -- Field experiments will be conducted at the Kansas River Valley Experiment Station near Topeka. Plots of corn about 50 by 100 feet in size will be used for the experiments. Field plots will include eight combinations of the following factors: (1) land slope, 0 and 0.2 percent; (2) soil texture, clay and silt loam; and (3) tillage, clean and residue conservation. Soil water will be sampled using a suction lysimeter. For each plot, soil water will be sampled at depths of 2, 3, 4, 6, 12, and 15 feet, and at the water table. Soil-water samples will be analyzed for atrazine before application of the herbicide to determine background concentrations. Two sets of samples will be taken the first month and one set each for the next 3 months after application. A potassium chloride tracer will be used to follow the movement of the atrazine. An irrigation system designed specifically for controlled plot experiments will apply water to the plots. Runoff water will be sampled for sediment and atrazine.

Significant milestones -- Atrazine concentrations in water from the first surface-runoff episode in June 1988 were 1 to 3 parts per million. Data-collection activities are continuing.



PROJECT TITLE: Flux of dissolved organic carbon in ground water of the Kings Creek watershed (Konza Prairie)
PROJECT NUMBER: KS-161
COOPERATING AGENCY: Kansas State University
PROJECT CHIEF: E.M. Thurman

Problem -- The flux of dissolved organic carbon in a prairie ecosystem is a function of the primary production of prairie grasses, such as Big Bluestem (*Andropogon gerardi*), of the conversion of this biomass to soil organic matter, and of its transport through the unsaturated zone, ground water, and streams. The flux of dissolved nutrients, such as dissolved organic carbon, has received considerable attention and study in forested streams, but much less is known of the nature, movement, and fate of dissolved organic carbon in prairie streams. This study proposes to follow the movement of dissolved organic carbon through soil profiles, soil water, the unsaturated zone, ground water, and streams of a prairie region in order to understand the organic geochemistry of carbon flux in prairie hydrologic systems.

Objectives -- The objectives of this project are to:

1. Determine the ground-water flow through the riparian zone of the Kings Creek watershed in order to estimate the flow of dissolved organic carbon transported by ground water from the watershed. Kings Creek is instrumented for surface water, and only the ground-water component is lacking.

2. Measure the amount (concentration and flux) of dissolved organic carbon moving through soils of the Konza Prairie.

3. Measure the volume of ground water transported annually in the saturated flow in the riparian zone of the stream and the amount (mass) of dissolved organic carbon also transported.

Approach -- To measure the amount of dissolved-organic-carbon flux through soil, a part of the Kings Creek watershed will be instrumented with lysimeters and ground-water observation wells, as well as stream gaging of South Branch Kings Creek. The amount of ground-water flux will be estimated based on measurements of recharge and water budgets. The purpose of this part of the study is to characterize the hydrologic regime with estimates of water flow, both direction and quantity. Secondly, in order to calculate the amount of dissolved-organic-carbon flux in soil water, stream water, and ground water, dissolved organic carbon will be measured in each of these

three environments and combined with estimates of flow for flux calculations. Standard methods of dissolved-organic-carbon determinations will be used. Finally, a simple conceptual model of dissolved-organic-carbon flux will be constructed from the study of the hydrologic-geochemical system.

Significant milestones -- Michael L. Pomes joined the Kansas District in August 1988 to work on the Konza project. By December, the study area was fully instrumented with 58 lysimeters in the A, B, and C horizons in the soil profiles at selected sites in a part of the South Branch Kings Creek. Additionally, 20 observation wells were installed in the alluvium immediately adjacent to the stream and in the Morrill Member of the Beattie Limestone, and the Eiss and Middleburg Members of the younger Bader Limestone (Wolfcampian, Lower Permian) at upland locations.

In what could be described as a joint operation between the Departments of Defense and the Interior, the U.S. Army, 55th Engineering Company (MGB), Fort Riley, erected a temporary bridge over a gully at the Konza Prairie that had blocked the U.S. Geological Survey drill rig from reaching well sites in the southern part of the study area. With the bridge in place, the drill rig crossed over the gully, and the observation wells were installed.

Sampling and analysis of lysimeters and observation wells are scheduled for fiscal year 1989.

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HYDROLOGIC-DATA STATIONS IN KANSAS, 1988 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 to meet objectives of measuring principal unregulated streams.

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 objectives of defining regulated flow.

Type of Gage, Complete-Record Gaging Station

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

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

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, specific conductance, pH, dissolved oxygen

Cooperator or Supporting Program

CBR	Collection of basic records (Federal)
COMP	Arkansas River Compact Administration
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
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 a modified version of a system of land subdivisions by the U.S. Bureau of Land Management (fig. 11). An example of a typical well number is 21S 34W 16AADA 02 in Finney 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 (E) or west (W) of the sixth principal meridian. The last two digits indicate the section in which the well is located. The first letter following the section number 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. Wells located within the smallest subdivision indicated are numbered serially.

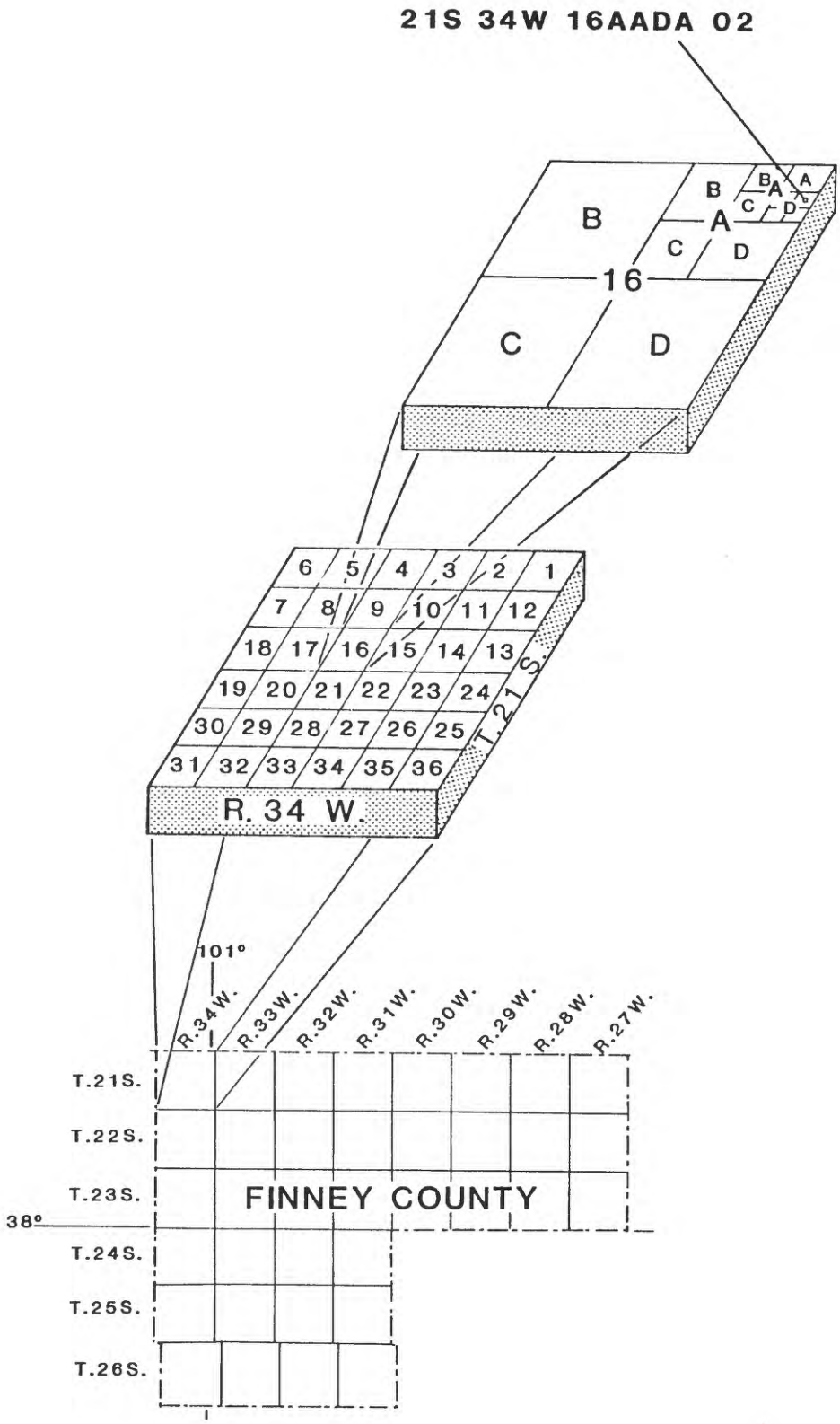

Figure 11. Well-numbering system.

Table 1. *Complete-record streamflow-gaging stations, 1988 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
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	BDRT	CBR/ KC-CE
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	BCDR	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/ KC-CE
85705	Milford Lake nr Junction City		20	11S	5E	RT	KC-CE
8571	Republican R. bl Milford Dam	C,R	--	--	--	BCDRT	KC-CE
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
86405	Smoky Hill R. nr Bunker Hill	C,R	33	14S	13W	BDRT	KC-CE
8645	Smoky Hill R. at Ellsworth	C,R	20	15S	8W	BDRT	KC-CE
8650	Kanopolis Lake nr Kanopolis		3	17S	6W	BRT	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
8695	Saline R. at Tescott	C,F,R	16	12S	5W	BDRT	KWO/ KC-CE

Table 1. *Complete-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
06-							
8702	Smoky Hill R. at New Cambria	C,R	1	14S	2W	BDRT	CBR/ KC-CE
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	BDRT	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	CBR
8740	S. Fk. Solomon R. at Osborne	C,F,R	20	7S	12W	BDRT	KWO/ KC-CE
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
88251	Big Blue R. at Marysville	C,P	32	25S	7E	BDRT	KC-CE
8842	Mill Cr. at Washington	F,H	1	3S	3E	BDR	KWO
8844	Little Blue R. nr Barnes	C,P	22	3S	5E	BDRT	KC-CE
8855	Black Vermillion R. nr Frankfort	C,P	20	4S	9E	BDRT	KC-CE
8869	Tuttle Creek Lake nr Manhattan		24	9S	7E	BRT	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
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

Table 1. *Complete-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
06-							
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
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	BRT	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
9108	Marais des Cygnes R. nr Reading	C,P	15	17S	13E	BDRT	KC-CE
910997	Melvern Lake nr Melvern		1	18S	15E	RT	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	RT	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	BDRT	KWO
914995	Hillsdale Lake nr Hillsdale		17	16S	23E	BRT	KC-CE
9150	Big Bull Cr. nr Hillsdale	C,R	20	16S	23E	BCDRT	KC-CE
9158	Marais des Cygnes R. at at La Cygne	C,R	32	19S	24E	BDRT	KWO
9166	Marais des Cygnes R. nr Kansas-Missouri State Line	C,F,R	16	21S	25E	BDRT	KWO/ KC-CE
9170	Little Osage R. at Fulton	C,F,L	25	23S	24E	BDR	KWO
91738	Marmaton R. nr Marmaton	C,F,L	4	26S	24E	BCDRT	KC-CE

Table 1. *Complete-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
	Arkansas River basin						
07-							
1370	Frontier Ditch nr Coolidge	C,I	21	23S	43W	BDRTW	CBR/ COMP
1375	Arkansas R. nr Coolidge	C,I,R	26	23S	43W	BDRT	CBR/ COMP
1380	Arkansas R. at Syracuse	C,F,R	18	24S	40W	BDRDpT	KWO
1390	Arkansas R. at Garden City	C,F,R	19	24S	32W	BDRT	KWO
1395	Arkansas R. at Dodge City	C,R	35	26S	25W	BDRT	T-CE/ CBR
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/ T-CE
14333	Arkansas R. nr Hutchinson	C,F,R	21	24S	4W	BDRT	KWO/ T-CE
143375	Arkansas R. nr Maize	C	23	26S	1W	BDR	USBR/ WICH-ITA
143665	Little Ark. R. at Alta Mills	H,P	30	22S	2W	BDR	KWO
1442	Little Ark. R. at Valley Center (floodway)		34	25S	1W	BR	KWO
1442	Little Ark. R. at Valley Center (main stem)	C,L	36	25S	1W	BDR	KWO
1443	Arkansas R. at Wichita (floodway)		11	27S	1W	BR	KWO
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

Table 1. *Complete-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
07-							
14479	Cheney Reservoir nr Cheney		6	27S	4W	BRT	WICH-ITA/ T-CE
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	BDRT	KWO/ T-CE
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	T-CE
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	R	T-CE
14683	Walnut R. at Hwy. 54 east of El Dorado	C,R	1	26S	5E	BDRT	T-CE
14707	Whitewater R. at Towanda	C,F,P	8	26S	4E	BDRT	KWO/ T-CE
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
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	RT	T-CE
1660	Verdigris R. nr Coyville	C,R	8	27S	14E	DRT	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	BRT	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	BRT	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	BRT	T-CE
1707	Big Hill Cr. nr Cherryvale	C,H	7	32S	18E	BDRT	T-CE

Table 1. *Complete-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
07-							
1720	Caney R. nr Elgin	C,L	16	35S	10E	BDR	KWO
1794	Council Grove Lake nr Council Grove		10	16S	8E	BRT	T-CE
1795	Neosho R. at Council Grove	C,R	14	16S	8E	BDRT	T-CE
17973	Neosho R. nr Americus	C,R	24	18S	10E	BDRT	T-CE
179794	Marion Lake nr Marion		27	19S	3E	BRT	T-CE
179795	Cottonwood R. bl Marion Lake	C,R	27	19S	3E	BCDRT	T-CE
1802	Cottonwood R. at Marion	C,R	31	19S	4E	BDRT	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/ T-CE
1840	Lightning Cr. nr McCune	H,L,P	7	32S	22E	BDR	KWO

Table 2. *Partial-record streamflow-gaging stations, 1988 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
8447	S. Fk. Sappa Cr. nr Brewster	9	9S	37W	KWO
8448	S. Fk. Sappa Cr. trib. nr Goodland	36	8S	39W	KDOT
8451	Long Branch Draw nr Norcatur	6	2S	25W	KDOT
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
8585	N. Fk. Smoky Hill R. nr McAllaster	17	12S	36W	KWO
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
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
87712	Mud Cr. at Abilene	17	13S	2E	KC-CE
8775	Turkey Cr. nr Abilene	26	14S	2E	KWO

Table 2. *Partial-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
06-					
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
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
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
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
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
	Arkansas River basin				
07-					
1386	White Woman Cr. trib. nr Selkirk	34	17S	39W	KDOT
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

Table 2. *Partial-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
07-					
1431	Cheyenne Cr. trib. nr Claflin	28	18S	11W	KDOT
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
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

Table 2. *Partial-record streamflow-gaging stations, 1988 water year*--Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
	Rating Forecast				
	Missouri River basin				
06-					
88549	Black Vermillion R. at Frankfort (Hwy 99)	16	4S	9E	KC-CE
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
14462	N. Fk. Ninnescah R. ab Silver Cr. nr Arlington	25	25S	8W	KWO
14464	Silver Cr. nr Langdon	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
1486	Medicine Lodge R. at Sun City	2	31S	15W	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
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-					
146895	Walnut R. at Augusta	27	27S	4E	T-CE
17971	Neosho R. nr Dunlap	24	17S	9E	T-CE
1832	Neosho R. nr Chanute	4	27S	18E	T-CE

Table 3. *Precipitation-record gaging station, 1988 water year*

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
	Missouri River basin				
06-87965	Kings Cr. nr Manhattan	18	11S	8E	CBR

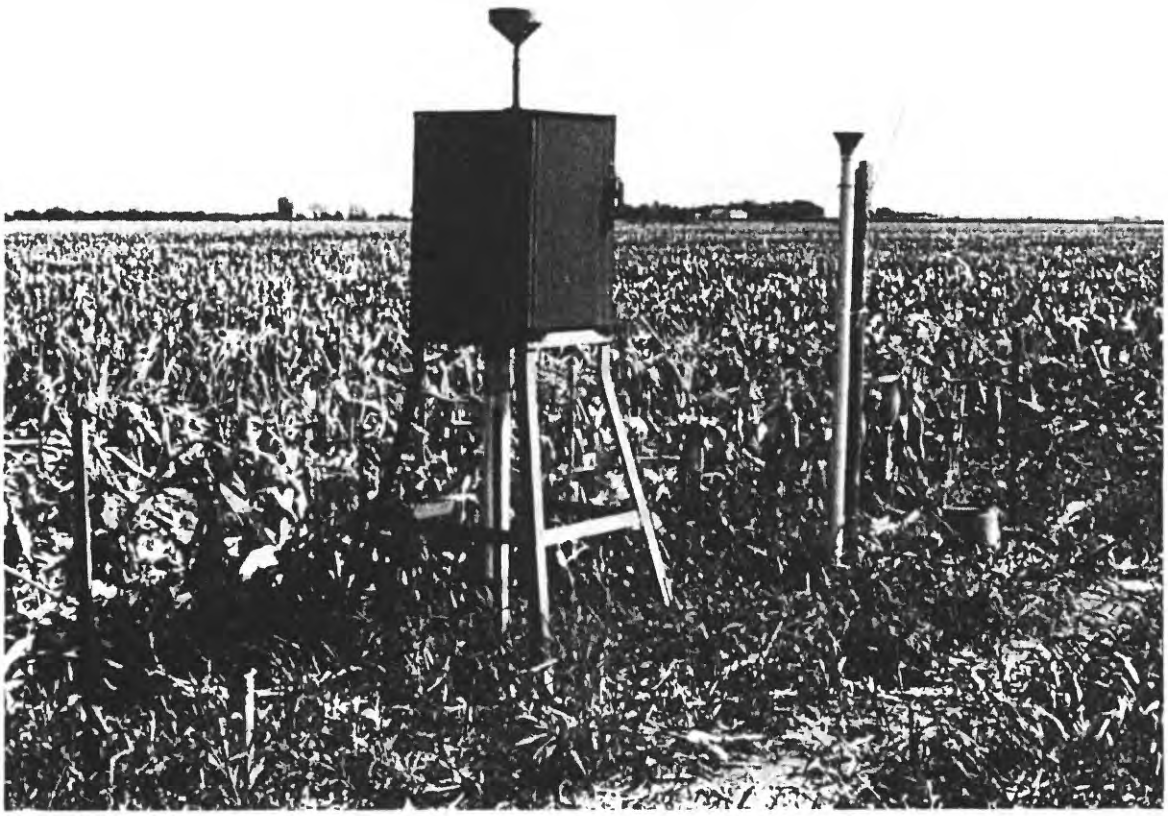

Table 4. *Ground-water-level observation wells, 1988 water year*

County	Well number	County	Well number
Allen	24S 18E 28CDD 01	Cheyenne (continued)	03S 37W 19BBC 01
			03S 37W 21DDD 01
Barber	32S 12W 04DBC 01		03S 37W 36ADB 01
			03S 38W 04BCC 01
Barton	18S 14W 27CDD 01		03S 38W 21BCB 01
	18S 15W 28CCC 03		03S 38W 25BBB 01
	19S 11W 19BDD 01		
	19S 11W 26BDA 01		03S 39W 04CCC 01
	19S 12W 06ADA 01		03S 39W 20DAC 01
			03S 39W 24DDD 01
	19S 13W 08BAD 01		03S 39W 32BDB 01
	19S 13W 33DDB 01		03S 40W 09BAA 02
	19S 14W 06BBB 01		
	19S 14W 23BBD 01		03S 40W 35AAC 01
	19S 14W 29DDB 01		03S 41W 33ABB 01
			03S 42W 04AAA 01
	19S 14W 36BBC 01		03S 42W 26CCD 01
	20S 11W 06CCC 01		04S 37W 17AAC 01
	20S 11W 26AAC 01		
	20S 12W 03DAC 01		04S 37W 25DCA 01
	20S 12W 06AAC 01		04S 38W 04BAC 01
			04S 38W 20CCC 01
	20S 12W 23CCA 01		04S 38W 21ADC 01
	20S 13W 17DDC 01		04S 40W 22BCB 01
	20S 13W 24DCB 01		
	20S 14W 22DCB 01		04S 41W 16DAA 01
	20S 15W 24DBD 01		04S 41W 23AAA 01
	20S 15W 33ADD 01		04S 41W 25BCB 01
			04S 41W 31ACA 01
Bourbon	25S 24E 36AAC 01		04S 42W 02BCC 01
Cherokee	34S 25E 13BAC 01		04S 42W 16CDD 01
			05S 37W 15DBB 01
Cheyenne	01S 38W 02CDC 01		05S 38W 13BAD 01
	01S 38W 08DCC 01		05S 38W 22ACB 01
	01S 38W 30BDC 01		05S 39W 06DAA 01
	01S 39W 25CBC 01		
	02S 37W 33DCC 01		05S 39W 11CBC 01
			05S 39W 18CCC 01
	02S 39W 27BBB 01		05S 39W 25CDA 01
	02S 40W 28DBA 01		05S 40W 14BCD 01
	02S 40W 32BCB 01		05S 41W 20DAA 01
	02S 41W 27BBD 01		
	02S 41W 33DBC 01		05S 42W 14CBC 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Clark	30S 23W 06AAA 01	Decatur	05S 27W 21CCA 01
	33S 22W 30CBC 01	(continued)	05S 28W 07BBC 01
			05S 28W 10BBB 01
Clay	06S 01E 02BCD 01		05S 28W 14ADD 01
	06S 02E 29DAC 01		05S 28W 17DAC 01
	08S 02E 02CCA 01		
			05S 29W 11BAA 01
Cloud	05S 02W 01BAC 01		05S 29W 22CBB 01
			05S 30W 15CCB 01
Comanche	31S 18W 19ACB 01		05S 30W 35BCB 01
Crawford	29S 23E 24DBA 01	Dickinson	13S 01E 26DDC 01
		Douglas	12S 20E 07CBC 01
Decatur	01S 26W 18DDB 01		12S 20E 17CCB 01
	01S 29W 03DDB 01		15S 19E 15AAD 01
	01S 29W 19BDD 01		
	01S 30W 34DDD 01	Edwards	23S 19W 22CCC 01
	02S 26W 11BBA 01		24S 16W 12CBC 01
			24S 17W 20ADC 01
	02S 28W 13ABA 01		24S 17W 24DDD 01
	02S 30W 26DCC 01		24S 18W 13DAC 01
	03S 26W 30CBB 02		
	03S 27W 32ABA 01		24S 18W 17ABD 01
	03S 28W 06DCB 01		24S 18W 28DAC 01
			24S 18W 36DDC 01
	03S 28W 32BCA 01		24S 19W 34ADD 01
	03S 29W 12BBA 01		25S 16W 02BBB 01
	03S 29W 17DCB 01		
	03S 29W 31DCC 01		25S 16W 27AAC 01
	03S 30W 03CBA 01		25S 16W 31DCC 01
			25S 17W 01DAB 01
	03S 30W 26BBB 01		25S 17W 17AAC 01
	04S 26W 08DDD 01		25S 17W 31BBD 01
	04S 26W 19DCA 01		
	04S 27W 17DAC 01		25S 18W 09AAA 01
	04S 27W 33BBB 01		25S 18W 33CDC 01
			25S 19W 08BDD 01
	04S 28W 30DDD 01		25S 19W 26DDB 01
	04S 30W 07BBB 01		25S 19W 31CAB 01
	05S 26W 05ADD 01		
	05S 26W 26DDA 01		25S 20W 03BCD 01
	05S 26W 33DCC 01		25S 20W 34CCC 01
			26S 16W 10CCC 01
			26S 16W 31CCA 01
			26S 16W 34ABC 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Edwards (continued)	26S 17W 04AAC 01	Finney (continued)	22S 34W 10AAA 01
	26S 17W 14BAA 01		22S 34W 18CDD 01
	26S 17W 33DDB 01		22S 34W 26CCC 01
	26S 18W 15DCB 01		23S 27W 12CCC 01
	26S 18W 31CCC 01		23S 27W 22DAB 01
	26S 19W 12ABB 02		23S 28W 22DCD 01
	26S 19W 16BCB 01		23S 28W 34DDC 01
	26S 19W 31BAC 01		23S 29W 30BBB 01
	26S 19W 34BBD 01		23S 29W 34CDD 01
	26S 20W 20BBC 01		23S 30W 04CAC 01
Ellis	13S 18W 29CCC 01		23S 30W 19CCB 01
	14S 18W 12AAD 01		23S 31W 03DCD 01
	15S 18W 25CCD 01		23S 31W 17ABA 01
	15S 19W 25CAB 01		23S 31W 35CCC 01
			23S 32W 11ADC 01
Ellsworth	17S 09W 20BCD 01		
	17S 09W 21BCC 01		23S 32W 31CBD 01
	17S 09W 28CBB 02		23S 33W 17BBB 01
	17S 09W 31AAB 01		23S 33W 26ABB 01
	17S 09W 31ADC 01		23S 33W 28CDC 01
			23S 34W 17CCC 01
Finney	21S 29W 36CCB 01		
	21S 30W 05BBB 01		23S 34W 21DDC 01
	21S 31W 08ABB 01		24S 31W 27CCB 01
	21S 31W 26CCC 01		24S 32W 03DAC 01
	21S 32W 08ABD 01		24S 33W 09CCD 01
			24S 33W 09CCD 02
	21S 32W 20CBD 01		
	21S 32W 26DAA 01		24S 33W 09CCD 03
	21S 33W 07DDAA01		24S 33W 18BDB 02
	21S 33W 29BBC 01		24S 33W 19DBB 02
	21S 34W 14DBB 01		24S 33W 22BCC 01
			24S 33W 22DCA 01
	21S 34W 16AADA02		
	22S 27W 14ADC 01		24S 33W 28DAA 01
	22S 31W 08CCC 01		24S 33W 34CAC 01
	22S 31W 16ADD 01		24S 34W 01BCBB01
	22S 31W 29DCC 01		25S 31W 35DBA 01
			25S 32W 22DBC 01
	22S 32W 08ACB 01		
	22S 32W 21CDC 01		25S 32W 31DDC 01
	22S 33W 22BAA 01		25S 32W 35ADB 01
	22S 33W 36AAA 02		25S 33W 03BCC 01
	22S 34W 08BCB 01		25S 33W 05ABD 01
			25S 33W 09ABD 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Finney (continued)	25S 33W 15DAC 01	Ford (continued)	26S 26W 18CCB 01
	25S 33W 16DCC 01		26S 26W 32DCC 01
	25S 33W 17DBD 01		26S 26W 36DCC 01
	25S 33W 33CDA 01		27S 21W 10DBB 01
	25S 33W 35DBD 01		27S 22W 09DAB 01
	25S 34W 06AAA 01		27S 23W 24BCB 01
	25S 34W 10ABB 01		27S 23W 28AAA 01
	25S 34W 34DBD 01		27S 23W 36CCC 01
	26S 31W 01DDA 01		27S 24W 03BBD 01
	26S 31W 06BBBB01		27S 24W 03CDD 01
	26S 31W 31CDC 01		27S 24W 04BBC 01
	26S 31W 36CAB 01		27S 24W 09AAD 01
	26S 33W 17DBD 01		27S 24W 16BDB 01
	26S 32W 22ABB 01		27S 24W 26DAA 01
	26S 33W 26ABB 01		27S 25W 09ACA 01
	26S 34W 05ADC 01		27S 25W 25BBB 01
	26S 34W 21BBD 01		28S 21W 10DDD 01
	26S 34W 30BD 01		28S 21W 23DBC 01
			28S 21W 25ABB 01
Ford	25S 22W 20AAA 01		28S 22W 05ADD 01
	25S 22W 27CCD 01		
	25S 23W 11CCC 01		28S 22W 12CAC 01
	25S 23W 12BBB 01		28S 22W 32BAB 01
	25S 23W 14ADD 01		28S 23W 18BAB 01
			28S 23W 24ABB 01
	25S 25W 32CDD 01		28S 24W 08DCC 01
	25S 25W 32DAD 01		
	25S 26W 25CDD 01		28S 24W 22CDA 01
	25S 26W 30ABC 01		28S 24W 35CAB 01
	26S 21W 17DBC 01		28S 25W 06ABB 01
			28S 25W 19BBB 01
	26S 21W 23ADA 01		28S 26W 06AAB 01
	26S 21W 25CCC 01		
	26S 22W 21DCD 01		28S 26W 10BAA 01
	26S 23W 02ABB 01		28S 26W 13CAA 01
	26S 23W 10DAD 01		29S 21W 05BBB 01
			29S 21W 20CAD 01
	26S 24W 29DDD 01		29S 22W 17DAD 01
	26S 24W 31DDA 01		
	26S 24W 32CBA 01		29S 22W 36ACA 01
	26S 24W 33CDA 01		29S 23W 12BAC 01
	26S 25W 16DCC 01		29S 24W 01ABA 01
			29S 24W 13BCA 01
			29S 24W 18BAA 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Ford	29S 25W 03ADA 01
(continued)	29S 25W 10BBBC01
	29S 26W 01CDD 01
	29S 26W 20BDD 01
	29S 26W 29ABB 01
	29S 26W 36BBB 01
Geary	11S 06E 27CBB 01
Gove	11S 26W 04CDC 01
	11S 27W 04CCD 01
	11S 27W 13ABB 01
	11S 27W 36BCC 01
	11S 28W 08AAA 01
	11S 28W 17DDC 01
	11S 28W 26ABA 01
	11S 29W 04DAD 01
	11S 29W 33BBA 01
	11S 30W 27ABB 01
	11S 30W 28CBA 01
	11S 30W 36CBB 01
	11S 31W 12AAB 01
	11S 31W 27ADC 01
	11S 31W 35BDC 01
	12S 26W 12BCC 01
	12S 27W 10CCB 01
	12S 27W 12ABB 01
	12S 28W 07DDD 01
	12S 28W 12DDD 01
	13S 26W 20CBC 01
Graham	06S 21W 19CDC 01
	06S 22W 19CCC 01
	06S 22W 28ACA 01
	06S 23W 13BBB 01
	06S 23W 17CCA 01
	06S 24W 14AAA 01
	06S 24W 28BAB 01
	06S 24W 35DDD 01
	06S 25W 12CCC 01
	06S 25W 28CBC 01
Graham	07S 22W 10BBC 01
(continued)	07S 22W 19BBB 01
	07S 23W 17BBC 01
	07S 24W 08CBA 01
	07S 25W 24BBB 01
	07S 25W 33DDD 01
	08S 21W 17ABB 01
	08S 22W 18CDC 01
	08S 24W 23ACC 01
	08S 25W 24BAB 01
	09S 22W 19BBB 01
	09S 24W 12BCC 01
	09S 24W 22BAA 01
	09S 25W 14DDD 01
Grant	27S 35W 17ADD 01
	27S 35W 25CAB 01
	27S 36W 18DCB 01
	27S 36W 21DCC 01
	27S 36W 25CC 01
	27S 37W 04ABB 01
	27S 37W 11ABA 01
	27S 37W 16AAD 01
	27S 37W 21BDD 01
	27S 38W 12ADC 01
	27S 38W 15BBB 01
	27S 38W 22CBB 01
	27S 38W 23CBB 01
	27S 28W 32BCC 01
	28S 35W 03DBB 01
	28S 35W 05BCC 01
	28S 35W 15CBB 01
	28S 35W 36ABC 01
	28S 36W 02CDD 02
	28S 36W 18ABC 01
	28S 36W 21CDD 01
	28S 37W 02BBB 04
	28S 37W 10BCD 02
	28S 38W 07BBB 01
	28S 38W 12DDD 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Grant (continued)	28S 38W 17AAA 01	Gray (continued)	26S 30W 01ABC 01
	28S 38W 33BDB 01		26S 30W 24DDD 01
	29S 35W 07CBD 01		27S 27W 01BAA 01
	29S 35W 24BAA 01		27S 27W 07ADC 01
	29S 35W 28ACC 01		27S 27W 10CDB 01
	29S 36W 19BCB 01		27S 27W 25CCD 01
	29S 36W 33ADB 01		27S 28W 05AAA 01
	29S 37W 03CDB 01		27S 28W 30CCA 01
	29S 37W 08CBA 01		27S 29W 27CAA 01
	29S 37W 29BBA 01		27S 30W 08BBB 01
	29S 38W 20CDC 01		27S 30W 23BBA 01
	29S 38W 35CCD 01		27S 30W 34CCC 01
	30S 35W 19BCD 0		28S 27W 03BBB 01
	30S 36W 01BBB 01		28S 28W 07CDD 01
	30S 36W 04ABB 01		28S 28W 20ADD 02
	30S 36W 32BBC 01		28S 29W 16ACC 01
	30S 37W 02BAA 02		28S 30W 10DDD 01
	30S 37W 03DBA 01		28S 30W 17BBA 01
	30S 37W 20CBC 01		28S 30W 24BAB 01
			29S 27W 30BCC 01
	30S 38W 13CCC 01		
	30S 38W 15DBC 01		29S 28W 28CDC 01
	30S 38W 30ACA 01		29S 29W 10ABB 01
			29S 29W 27BCB 01
Gray	24S 27W 08CCC 01		29S 30W 22BBC 01
	24S 27W 14ABB 01		29S 30W 35ACD 01
	24S 27W 29BCC 01		
	24S 28W 28BBA 01	Greeley	16S 39W 02BDC 01
	24S 28W 31DD 01		16S 39W 22DCB 01
			16S 40W 15ACC 01
	24S 28W 36ACA 01		16S 40W 17CBC 01
	24S 29W 16DCA 01		16S 40W 18DBA 01
	24S 29W 18CCB 01		
	24S 30W 15CCC 01		16S 40W 26ADA 01
	24S 30W 33ADD 01		16S 41W 20BAD 01
			16S 41W 33AAB 01
	25S 27W 33ABB 01		16S 42W 22BCB 01
	25S 29W 07BCB 01		17S 39W 02BAA 01
	25S 29W 14ABB 01		
	25S 29W 27CCB 01		17S 39W 22ABB 01
	25S 30W 20BCB 01		17S 39W 34CCB 01
			17S 40W 15CCB 01
	26S 27W 13BBC 01		17S 40W 17BBA 01
	26S 27W 27CDD 01		17S 40W 31BBA 01
	26S 28W 06DDB 01		
	26S 29W 15BCA 01		
	26S 29W 35CCC 01		

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Greeley (continued)	17S 42W 27CBB 01		
	18S 39W 07BBD 01	Hamilton (continued)	26S 42W 10BB 02
	18S 39W 19CDA 01		26S 42W 17CBB 01
	18S 39W 23CCB 01		26S 42W 22CDB 01
	18S 39W 24AAC 01		26S 43W 10DBB 01
			26S 43W 25DCC 01
Hamilton	21S 39W 07CBA 01		
	22S 39W 03BBB 01	Harper	32S 06W 01DDD 01
	22S 39W 08DDD 01		
	23S 39W 15ADD 01	Harvey	22S 02W 05CBD 01
	23S 40W 29DDB 01		22S 03W 02DCD 01
			22S 03W 29BAD 01
	23S 42W 19CBB 01		22S 03W 35AAA 01
	23S 42W 26DCA 01		23S 01W 19AAC 01
	23S 42W 27DDB 01		
	23S 42W 34CBB 01		23S 01W 28AAD 01
	23S 43W 21ABA 01		23S 02W 22CCD 01
			23S 02W 34DCC 01
	23S 43W 23BCB 01		23S 03W 06DDD 01
	23S 43W 25CBD 02		23S 03W 14AAC 01
	23S 43W 26BCC 01		
	24S 39W 19CBC 01		23S 03W 32DCC 02
	24S 39W 22CCB 01		24S 01W 05AAB 01
			24S 01W 19BCC 01
	24S 39W 35BAC 01		24S 01W 22BCC 01
	24S 39W 35CBA 01		24S 02W 16BAA 01
	24S 40W 07CBB 01		
	24S 40W 17BBB 01		24S 02W 28DDD 01
	24S 40W 23AAB 01		24S 03W 14BBB 01
	24S 40W 31BBB 01	Haskell	27S 31W 24CDC 01
	24S 41W 01DAD 01		27S 31W 31BCC 01
	24S 42W 04AAD 01		27S 32W 03CBB 01
	24S 42W 28DDD 01		27S 32W 06CBB 01
	24S 43W 14CBB 01		27S 32W 19CCD 01
	25S 39W 02CAD 01		27S 33W 29DAA 01
	25S 39W 23BDD 01		27S 34W 16DDD 01
	25S 40W 01CA 01		27S 34W 28DAA 02
	25S 40W 26BBB 01		28S 31W 35CCB 01
	25S 43W 03ABB 01		28S 32W 18BBB 01
	25S 43W 21AAB 01		28S 32W 24BCC 01
	25S 43W 25CCD 01		28S 33W 20DDD 01
	26S 41W 12DCC 01		28S 34W 13BBB 01
	26S 41W 20BCD 01		28S 34W 15DAB 01
	26S 41W 36CCC 01		29S 31W 09CB 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Haskell (continued)	29S 31W 34BCA 01
	29S 32W 04AAA 01
	29S 32W 19CCC 01
	29S 32W 26CBB 02
	29S 33W 01AAB 01
	29S 33W 28BCB 01
	29S 33W 34DDD 01
	29S 34W 11CCC 01
	30S 31W 24BBC 01
	30S 31W 26ABB 01
	30S 32W 11BBB 01
	30S 32W 31BAB 01
	30S 33W 06DBD 01
	30S 33W 30CBD 01
	30S 34W 05BBB 01
	30S 34W 30ADD 02
Hodgeman	21S 22W 12BCB 01
	22S 22W 13CCC 01
	22S 23W 31ADD 01
	22S 24W 14BBC 01
	22S 24W 15BDA 01
	22S 24W 16ADB 02
	22S 24W 24DDD 01
	22S 24W 25DDC 01
	22S 24W 26DDA 01
	22S 24W 35DAC 01
	23S 22W 07DAA 01
	23S 23W 04AAD 01
	23S 23W 04DCA 01
	23S 23W 12ABD 01
	23S 24W 11DAA 01
	23S 25W 22DBB 01
	23S 26W 07CCC 01
	23S 26W 20CCC 01
	23S 26W 26AAD 01
	23S 26W 31CDD 01
	24S 21W 20CBB 01
	24S 23W 03CCC 01
	24S 23W 06AAB 01
	24S 24W 02CCC 01
	24S 24W 20CCC 01
Hodgeman (continued)	24S 25W 22BAB 01
	24S 26W 35CBC 01
Jackson	06S 15E 27BAB 01
Jefferson	11S 16E 25CBA 01
	11S 17E 27BBC 01
	11S 18E 08DAC 01
	11S 19E 29CCA 01
Johnson	12S 22E 25BCCB01
	12S 22E 29BBD 01
Kearny	22S 35W 23CDD 01
	22S 36W 28DCC 01
	22S 37W 34BBC 01
	23S 35W 05ACC 01
	23S 35W 12CCC 01
	23S 35W 16BBC 01
	23S 35W 25BBB 02
	23S 36W 04CBB 01
	23S 36W 32BBB 01
	23S 36W 35BBB 01
	23S 37W 04ABC 01
	23S 37W 19CCC 01
	23S 37W 28CCB 01
	24S 35W 09CCC 01
	24S 35W 13CCC 02
	24S 35W 24BCB 01
	24S 36W 23CBB 02
	25S 35W 02BAA 01
	25S 35W 04BDD 01
	25S 35W 17AAA 01
	25S 35W 26BAB 01
	25S 36W 14B 01
	25S 36W 28BBD 01
	25S 36W 35CCA 01
	25S 37W 15ABA 02
	25S 37W 25BAD 02
	25S 38W 02BDA 01
	25S 38W 08CAA 01
	25S 38W 20ACC 01
	25S 38W 26ACC 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Kearny (continued)	26S 35W 29BBD 01
	26S 36W 22CCA 01
	26S 37W 06ACB 01
Kingman	27S 05W 24CDC 01
	27S 05W 33ABB 02
	27S 06W 12CCD 01
	27S 06W 16CCB 01
	27S 07W 03ADC 01
	27S 07W 23BCC 01
	27S 08W 17DAB 01
	27S 08W 25DAD 01
	27S 08W 30AAA 02
	27S 08W 35CBC 01
	27S 09W 15ABA 01
	27S 09W 29AAA 01
	27S 10W 03DDD 01
	27S 10W 17DDD 01
	27S 10W 24DAD 01
	28S 07W 29CDD 01
	28S 07W 35CCD 01
	28S 08W 21BBB 01
	28S 08W 26ABC 01
	28S 09W 01BCC 01
	28S 09W 21AAA 01
	28S 09W 29CCC 01
	28S 09W 34AAB 01
	28S 10W 16BCB 01
	29S 10W 19DDB 01
Kiowa	27S 16W 10BAC 01
	27S 16W 19BBD 01
	27S 16W 28CDD 01
	27S 17W 21ADC 01
	27S 18W 13AAA 01
	27S 18W 18DDC 01
	27S 18W 22ADC 01
	27S 19W 28CBD 01
	27S 20W 26ABD 01
	27S 20W 32ABD 01
Kiowa (continued)	28S 16W 12BCA 01
	28S 16W 17AAC 01
	28S 16W 31DCA 01
	28S 17W 01CAB 01
	28S 17W 05DDB 01
	28S 17W 15DDB 01
	28S 18W 09BAC 01
	28S 18W 19CCB 01
	28S 18W 26DCA 01
	28S 19W 10AAC 01
	28S 19W 30CBC 01
	28S 19W 33CBD 01
	28S 20W 12BBD 01
	28S 20W 30ACA 01
	29S 17W 04ABC 01
	29S 18W 02ACC 01
	29S 18W 07BBD 01
	29S 19W 22BAA 01
	29S 20W 11CDD 01
Labette	31S 21E 15CCC 02
Lane	16S 29W 26CCD 01
	16S 30W 24DCC 01
	16S 30W 29CDD 01
	16S 30W 34DAB 01
	17S 27W 20CCC 01
	17S 27W 26CCC 01
	17S 28W 07BBB 01
	17S 28W 15BBC 01
	17S 28W 26ABB 01
	17S 28W 34CBB 01
	17S 29W 03BDC 01
	17S 29W 36BAA 01
	17S 30W 13CBB 01
	17S 30W 20BBB 01
	18S 27W 13CCC 01
	18S 28W 18ACC 01
	18S 29W 04DAD 01
	18S 30W 02AAA 01
	18S 30W 04BAB 01
	18S 30W 23AAA 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Leavenworth	12S 22E 21BCD 01	Meade	30S 26W 04CBB 01
	12S 22E 22CAA 01		30S 26W 13ABB 01
			30S 26W 32DDD 01
Logan	11S 32W 04ACD 01		30S 27W 20ABA 01
	11S 32W 19AAB 01		30S 27W 23ABB 01
	11S 32W 31CCD 01		
	11S 32W 36ABA 01		30S 27W 27BBB 01
	11S 33W 10BDD 01		30S 27W 32DDD 01
			30S 28W 17ABB 01
	11S 33W 14DCC 01		30S 28W 33AAA 01
	11S 34W 13AAB 01		30S 29W 23CAD 01
	11S 34W 16CDB 01		
	11S 35W 01DCC 01		30S 29W 28BBB 01
	11S 36W 06ADD 02		30S 30W 06CCC 01
			30S 30W 28ABB 01
	11S 37W 01DCD 01		31S 26W 30BBB 01
	15S 37W 29AAA 01		31S 27W 20AAA 02
			31S 28W 02CCC 01
McPherson	17S 04W 25DDD 01		31S 28W 10BCB 01
	17S 05W 07CBB 01		31S 28W 26ABB 01
	17S 05W 22BAA 01		31S 29W 02DBB 01
	18S 03W 30CCC 01		31S 29W 25AAA 02
	18S 04W 21CCC 01		
			31S 29W 30AAA 01
	19S 01W 32DAC 01		31S 30W 16BBC 01
	19S 03W 16BCB 01		32S 28W 04ADD 01
	19S 03W 31BBA 01		32S 29W 05CC 01
	19S 04W 15AAC 01		32S 29W 27AAB 02
	20S 01W 22BBB 01		
			32S 30W 09CCC 01
	20S 01W 29DDD 01		32S 30W 28BBC 01
	20S 03W 22DAA 01		33S 28W 29BCB 01
	20S 03W 30BBA 01		33S 29W 36AAB 01
	20S 04W 15BDD 01		33S 30W 21ACC 01
	20S 04W 27DAC 01		
			33S 30W 35CBB 01
	21S 02W 12BBB 01		34S 28W 05BDA 01
	21S 02W 36ACA 01		34S 30W 22CBC 01
	21S 03W 06CBD 01		35S 30W 10CDA 01
	21S 03W 22BBB 01		
	21S 03W 33BBC 01		
	21S 04W 26CDC 01		

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Morton	31S 39W 18CCC 01
	31S 39W 33BCC 01
	31S 40W 01DA 01
	31S 40W 29ABB 01
	31S 41W 07CDD 01
	31S 41W 31CBB 01
	31S 42W 29AAB 01
	31S 43W 03CB 01
	31S 43W 14DDC 01
	31S 43W 20CBB 01
	32S 40W 07BDC 01
	32S 40W 21ADB 01
	32S 41W 15CDC 01
	32S 41W 35DCC 01
	32S 42W 14CCC 01
	32S 42W 21BCC 01
	32S 42W 26CDD 01
	32S 43W 08CBD 01
	32S 43W 17DCC 01
	32S 43W 28BBC 01
	33S 39W 04DBB 01
	33S 39W 16ABB 01
	33S 40W 27CCC 01
	33S 41W 03AAD 01
	33S 41W 33DDD 01
	33S 42W 01AA 01
	33S 42W 05DCC 01
	33S 42W 21BCB 01
	33S 43W 08BDA 01
	33S 43W 09DBA 01
	34S 39W 06CCA 01
	34S 40W 16ABB 01
	34S 41W 26DCD 01
	34S 41W 28CBA 01
	34S 42W 05BDC 01
	34S 42W 22CDB 01
	34S 43W 07BDD 01
	35S 39W 06CDD 01
	35S 40W 03BBB 02
	35S 41W 16CCD 01
Morton (continued)	35S 42W 02DBB 01
	35S 43W 04AAC 01
	35S 43W 13BDB 01
Nemaha	05S 11E 10ADB 01
Ness	16S 24W 15ABB 01
	18S 21W 25AAB 01
	18S 21W 31CAA 01
	18S 24W 36ADB 01
	18S 25W 33BBC 01
	18S 26W 06BAB 02
	19S 23W 01CCB 01
	19S 23W 08CBB 01
	20S 22W 20CCC 01
	20S 22W 35BCC 01
	20S 23W 32CDA 01
	20S 26W 07BDC 01
Norton	01S 21W 17AAA 01
	01S 23W 15AAA 01
	01S 24W 13BCB 01
	01S 25W 25BBB 01
	02S 21W 35CCC 01
	02S 23W 22AAA 01
	02S 25W 14AAA 01
	04S 23W 03DDD 01
	04S 23W 26CCC 01
	04S 25W 13CCC 01
	05S 21W 10AAA 01
	05S 22W 18CCD 01
	05S 24W 21AAA 01
Osborne	06S 12W 23CDC 01
	07S 12W 28ABA 01
	07S 15W 10CCC 01
Pawnee	21S 15W 11CBB 01
	21S 15W 31BAD 01
	21S 16W 14ADC 01
	21S 18W 32DAA 01
	21S 19W 27CCC 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Pawnee (continued)	21S 19W 30BCC 01	Pratt	26S 11W 01DDB 01
	21S 20W 29BBB 01		26S 11W 27AAC 01
	22S 15W 03AAA 01		26S 11W 29BCB 01
	22S 15W 03AAA 02		26S 12W 02DBD 01
	22S 15W 13DCA 01		26S 12W 17CCA 01
	22S 15W 20CDC 01		26S 12W 34CDC 01
	22S 15W 33DDD 01		26S 12W 34CDC 02
	22S 16W 03CBC 02		26S 13W 16DAA 01
	22S 16W 06BBA 01		26S 13W 19BBD 01
	22S 16W 23AAA 01		26S 13W 34BCB 01
	22S 16W 32CDD 01		26S 14W 17DCB 01
	22S 17W 05BBC 02		26S 15W 18DAB 01
	22S 17W 18AAD 01		27S 11W 12CBC 01
	22S 17W 24CBC 01		27S 11W 31DAA 01
	22S 19W 07AAA 0		27S 12W 12DAA 01
	22S 19W 10BBA 01		27S 12W 33CBA 01
	23S 15W 12DDB 01		27S 13W 13DDC 01
	23S 15W 18DDB 01		27S 14W 03DAC 01
	23S 16W 16BAB 01		27S 14W 12DDD 01
	23S 16W 35CCD 02		27S 14W 21CAB 01
	23S 17W 07ACC 01		27S 15W 02ABC 01
	23S 17W 10CDB 01		27S 15W 08BBD 01
	23S 17W 25ADC 01		27S 15W 32CCA 01
	23S 17W 33CCA 01		27S 15W 36ADD 01
	23S 18W 28DAD 01		28S 11W 12ACC 01
	23S 18W 36DAC 01		28S 11W 20CAC 01
Phillips	04S 18W 23CDC 01		28S 12W 21BAD 01
	04S 19W 35DDD 01		28S 13W 02DDC 01
			28S 13W 17AAA 01
Pottawa-tomie	09S 11E 19CDB 01		28S 13W 26DCB 01
	09S 11E 27CAA 01		
	09S 11E 31DCC 01		28S 14W 14CCC 01
	09S 11E 32ADC 01		28S 15W 23CCD 01
	09S 11E 34CAB 01		29S 11W 06AAA 01
			29S 11W 09ADD 01
	09S 11E 35DDD 01		29S 11W 29AAD 01
	10S 08E 14CBA 01		
	10S 10E 10DBC 01		29S 12W 20CCD 01
	10S 11E 01CBC 01		29S 13W 12ABB 01
	10S 11E 03BCA 01		29S 13W 31CAA 01
			29S 14W 12ABB 01
	10S 11E 04ACB 01		29S 14W 17DBD 01
	10S 12E 07BBC 01		
			29S 15W 02CCA 01
			29S 15W 18ADA 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Rawlins	01S 33W 29CCC 01	Reno	22S 04W 12CDA 01
	02S 31W 03CAD 01		22S 04W 32BBC 01
	02S 32W 20DCD 01		22S 05W 17BCC 01
	02S 33W 26DCC 01		22S 05W 33DBD 01
	02S 35W 13ABB 01		22S 06W 18BCB 01
	02S 35W 34CAA 01		22S 06W 28CCB 01
	02S 36W 13DDD 01		22S 07W 17DCB 01
	02S 36W 15CDD 01		22S 08W 09DBB 01
	02S 36W 36BAA 01		22S 08W 23DAD 01
	03S 31W 07CBD 01		22S 08W 33CCD 01
	03S 31W 23BBB 01		22S 09W 03BBD 01
	03S 33W 03DCC 01		22S 09W 17BAB 01
	03S 33W 08CDC 01		22S 09W 25BBA 01
	03S 34W 03ABB 01		22S 10W 02DCC 01
	03S 34W 26BAC 01		22S 10W 08BBB 01
	03S 35W 24CBB 01		22S 10W 30DAA 01
	03S 36W 14CBB 01		23S 04W 03BAB 02
	03S 36W 17CCC 01		23S 04W 16BBB 01
	04S 31W 16ABD 01		23S 04W 30BAA 01
	04S 31W 25DDD 01		23S 06W 15BAC 01
	04S 33W 10ABC 01		23S 06W 31DCB 01
	04S 33W 18DDA 01		23S 07W 01ABA 01
	04S 33W 28DCA 01		23S 07W 05ABA 01
	04S 34W 33CBC 01		23S 07W 13DDD 01
	04S 35W 06DCD 01		23S 08W 18AAD 01
	04S 35W 13DAD 01		23S 09W 05CBD 01
	04S 35W 29DDD 01		23S 09W 21DDB 01
	04S 36W 06BBB 01		23S 09W 35CCC 01
	04S 36W 23CBB 01		23S 10W 02BAB 01
	04S 36W 23DCA 01		23S 10W 25CAC 01
	05S 31W 10DDA 01		24S 04W 05CDB 01
	05S 31W 20CCA 01		24S 04W 14DAC 01
	05S 32W 14CDD 01		24S 04W 25BBD 01
	05S 33W 29BDA 01		24S 04W 31DAB 01
	05S 34W 01BBB 01		24S 05W 10CCA 01
	05S 34W 28ADC 01		24S 06W 03AAB 01
	05S 35W 10CDD 01		24S 06W 23CBA 01
	05S 35W 30CBC 01		24S 07W 08ADA 01
	05S 36W 21BCD 01		24S 07W 28AAA 01
			24S 08W 04AB 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Reno (continued)	24S 08W 18BAC 01
	24S 08W 34DAC 01
	24S 09W 19DDB 01
	24S 10W 06DBB 01
	24S 10W 17DDC 01
	24S 10W 31CBC 01
	25S 04W 02ABB 01
	25S 07W 07BBD 01
	25S 07W 36CCC 01
	25S 08W 19ADB 01
	25S 09W 01DCD 01
	25S 09W 17BBC 01
	25S 09W 30DDA 01
	25S 10W 14BBB 01
	25S 10W 19ABD 01
	26S 06W 13BAB 01
	26S 06W 34BBC 01
	26S 07W 12DCC 01
	26S 07W 21DDC 01
	26S 08W 09ABA 01
	26S 08W 30DCB 01
	26S 09W 10DDB 01
	26S 09W 18AAA 01
	26S 09W 31DCC 01
	26S 09W 34DBD 01
	26S 10W 18CDC 01
	26S 10W 32BBD 01
Republic	01S 03W 01CCA 01
	01S 03W 09CBD 01
	01S 04W 15AAA 01
Rice	18S 09W 04BCC 01
	18S 10W 24BBB 01
	20S 08W 22AAA 01
	20S 09W 12DDA 01
	20S 10W 27BBB 01
	20S 10W 36ACD 01
	21S 07W 04AAC 01
	21S 07W 26CBD 01
	21S 08W 09CBD 01
	21S 08W 25ABB 01
Rice (continued	21S 08W 32DBB 01
	21S 09W 02DDA 01
	21S 09W 15AAC 02
	21S 10W 16CDC 01
	21S 10W 21ADB 01
Riley	10S 09E 17BDD 01
Rooks	07S 17W 24BBB 01
	07S 19W 23CDB 01
Rush	18S 16W 23DCC 01
	18S 16W 23DCC 02
	18S 17W 22AAD 01
	18S 17W 23BCC 01
	18S 18W 27AAC 01
	18S 19W 20ADD 01
	18S 20W 14CCC 01
	18S 20W 19AAD 01
Saline	13S 01W 23BCB 02
	13S 02W 33DDC 01
Scott	16S 31W 17DDD 01
	16S 31W 31BCB 01
	16S 33W 19CBB 01
	16S 33W 33BAA 01
	16S 34W 09CCB 01
	16S 34W 29CBB 01
	17S 31W 04DCC 01
	17S 31W 19CDA 01
	17S 31W 35CCB 01
	17S 32W 16BBB 01
	17S 32W 27BBB 01
	17S 32W 31BCB 01
	17S 33W 07BBB 01
	17S 33W 14ACB 01
	17S 34W 06BCB 01
	17S 34W 16ACB 01
	17S 34W 25DBB 01
	18S 31W 24BCB 01
	18S 31W 27ABA 01
	18S 32W 14BBB 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Scott (continued)	18S 32W 17ABA 02
	18S 33W 03CCB 01
	18S 33W 05CCC 01
	18S 33W 11ABB 01
	18S 33W 15DDD 01
	18S 33W 26DAD 02
	18S 33W 34ADB 01
	18S 34W 05CBB 01
	18S 34W 25BBD 01
	18S 34W 34BBC 01
	19S 32W 06CCB 01
	19S 32W 32ACB 01
	19S 33W 06DBB 01
	19S 33W 12DDC 01
	19S 33W 15DBD 01
	19S 33W 29CBB 02
	19S 34W 19DCCC01
	20S 32W 16DAD 01
	20S 32W 30BCD 01
	20S 33W 02DBB 01
	20S 33W 09BBB 01
	20S 33W 17BAB 01
	20S 33W 21ABD 01
	20S 33W 35DBA 01
	20S 34W 15BAA 01
	20S 34W 36CCD 01
Sedgwick	25S 01W 07ABD 01
	25S 01W 26DBD 01
	25S 01W 28DBA 01
	25S 02W 16DDA 01
	25S 02W 23DBD 01
	25S 03W 03DDD 01
	25S 03W 15CCC 01
	26S 01W 12BAD 01
	26S 01W 19ABA 01
	26S 01W 31CCC 02
	26S 01W 31CCD 01
	26S 02W 02DDD 02
	26S 02W 07AAA 02
	26S 02W 08AAB 01
	26S 02W 10DAA 01
Sedgwick (continued)	26S 02W 13ACA 01
	26S 02W 14DDD 01
	26S 02W 15DBB 01
	26S 02W 23CCC 01
	26S 02W 29AAA 01
	26S 03W 02AAC 01
	28S 01W 11BCB 01
	28S 01W 15ACA 02
	28S 01E 16DDD 01
	29S 01E 16DDD 01
Seward	31S 31W 08BCC 01
	31S 31W 13BBC 01
	31S 31W 32DCC 01
	31S 32W 03DAD 01
	31S 32W 31BBB 01
	31S 33W 06CBD 01
	31S 33W 20DBB 01
	31S 34W 18BBB 01
	32S 31W 02BBB 01
	32S 31W 08BBB 01
	32S 31W 26CAA 01
	32S 32W 14BBB 01
	32S 32W 19BAB 01
	32S 33W 04BAA 01
	32S 33W 32DBD 01
	32S 34W 10DAA 01
	32S 34W 17DCC 01
	32S 34W 32BBB 01
	33S 31W 28DDB 01
	33S 32W 28CDD 02
	33S 33W 12AAD 01
	33S 33W 20BCC 01
	33S 33W 25DCC 01
	33S 34W 17DCC 01
	34S 31W 30BBB 01
	34S 32W 29BAA 01
	34S 32W 35ADA 01
	34S 33W 04BCD 01
	34S 33W 07CCB 01
	34S 34W 16DAA 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number
Seward (continued)	34S 34W 26BCA 01
	35S 31W 10AAC 01
	35S 31W 18BBA 01
	35S 32W 06CBB 01
	35S 33W 16BCA 01
	35S 34W 03CBC 01
	35S 34W 10BBB 01
Shawnee	11S 12E 01ABA 01
	11S 13E 04ADA 01
	11S 14E 13BBB 01
	11S 14E 15ABB 01
	11S 14E 18CBB 01
	11S 14E 22CCC 01
	11S 15E 13DBC 01
	11S 15E 16DCA 01
	11S 15E 23DBD 02
	11S 16E 29ACA 01
Sheridan	06S 26W 26CBB 01
	06S 27W 05CBB 01
	06S 27W 08DCA 01
	06S 27W 19DAB 01
	06S 27W 27BCC 01
	06S 29W 10DBC 01
	06S 29W 24ABB 01
	06S 29W 33CDA 01
	06S 30W 13BAA 01
	06S 30W 14CCD 01
	07S 26W 06AAB 01
	07S 26W 12BAC 01
	07S 26W 19BBC 01
	07S 26W 28CAB 01
	07S 27W 22DAC 01
	07S 28W 08BDC 01
	07S 28W 21ABB 01
	07S 28W 36ABA 01
	07S 29W 05BBB 01
	07S 29W 27CCC 01
Sheridan (continued)	07S 29W 30ABA 01
	07S 30W 08CBB 01
	08S 26W 14DAA 01
	08S 27W 11DCD 01
	08S 27W 35CBB 01
	08S 28W 09ABC 01
	08S 28W 11DAA 01
	08S 29W 01DCB 01
	08S 30W 11CBC 01
	08S 30W 13DAA 01
	08S 30W 30ABC 01
	09S 26W 22BBB 01
	09S 27W 12CCC 01
	09S 27W 19DDD 01
	09S 27W 27DAA 01
	09S 28W 04BCC 01
	09S 29W 03AAA 01
	09S 29W 17BAB 01
	09S 29W 26BAA 01
	09S 30W 03AAB 02
	09S 30W 35BBB 01
	10S 26W 08BAA 01
	10S 26W 12AAD 01
	10S 27W 20CBC 01
	10S 27W 22DBA 01
	10S 28W 05DDB 01
	10S 28W 29DAA 01
	10S 29W 02DDD 01
	10S 29W 20CAA 01
	10S 30W 08DDD 01
	10S 30W 12ADA 01
Sherman	06S 37W 07BBA 01
	06S 37W 16CDD 01
	06S 37W 19ABB 01
	06S 38W 09ABD 01
	06S 39W 09DDD 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Sherman (continued)	06S 40W 10AAC 01	Sherman (continued)	09S 38W 13BCC 01
	06S 40W 13CBC 01		09S 39W 01DBA 01
	06S 40W 30DCC 01		09S 39W 02BAB 01
	06S 41W 01ABB 01		09S 39W 10CCB 01
	06S 41W 19DBD 01		09S 39W 19CCC 01
	06S 41W 27DBD 01		09S 40W 13CDC 01
	06S 42W 02AAA 01		09S 40W 29BBB 01
	06S 42W 08CBB 01		09S 41W 05DCC 01
	06S 42W 22DCC 01		09S 41W 14BBC 01
	06S 42W 30ADA 01		09S 41W 28AAA 01
	07S 37W 04BBC 01		09S 41W 34BAB 01
	07S 37W 05CCB 01		09S 42W 08AAA 01
	07S 38W 28DAA 01		09S 42W 14AAA 01
	07S 39W 01DCD 01		09S 42W 29CBB 01
	07S 39W 09BBB 01		09S 42W 35ABB 01
	07S 39W 24BAA 01		10S 37W 23ABB 01
	07S 40W 06ADB 01		10S 40W 10ADC 01
	07S 40W 29BBA 01		10S 41W 15CAD 01
	07S 40W 35BBB 01		10S 42W 20ABB 01
	07S 40W 36BAB 01		10S 42W 21BBB 01
	07S 41W 07BCB 01		10S 42W 24BAB 01
	07S 41W 28DBB 01		
	07S 42W 07DAA 01	Stafford	21S 11W 07BBB 01
	07S 42W 17CCC 01		21S 12W 10CDD 01
	07S 42W 27AAB 01		21S 13W 27DDD 02
			21S 14W 22AAC 01
	08S 37W 03ADB 01		21S 14W 32BAC 01
	08S 37W 21CCC 01		
	08S 37W 32ABB 01		22S 11W 07BBB 01
	08S 38W 17CDD 01		22S 12W 05BBD 01
	08S 38W 24AAB 01		22S 12W 30BBD 01
			22S 12W 36BBB 02
	08S 39W 15CCC 01		22S 13W 05CBC 01
	08S 40W 12DBA 01		
	08S 40W 17CDB 01		22S 13W 12CAC 01
	08S 40W 20CCC 01		22S 13W 29DAD 01
	08S 40W 25AAC 01		22S 14W 14CCA 01
			22S 14W 35DDB 01
	08S 41W 17CBA 01		23S 11W 02BBB 01
	08S 41W 25BBC 01		
	08S 42W 15DDB 01		
	08S 42W 31DCD 01		
	09S 37W 07DDB 01		

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Stafford (continued)	23S 11W 22BCC 01	Stanton (continued)	27S 41W 31CCB 02
	23S 12W 07DBD 01		27S 41W 35CCC 01
	23S 12W 22BCC 01		27S 42W 11DBD 01
	23S 12W 36BBC 01		27S 42W 17CCC 01
	23S 13W 08CCB 01		27S 42W 31CCC 01
	23S 13W 30CBB 01		27S 43W 02BBD 01
	23S 13W 35CCA 01		28S 39W 14BBC 01
	23S 14W 15ADD 01		28S 39W 16CCC 01
	23S 14W 30BBB 01		28S 39W 33ACC 01
	24S 11W 14CAB 01		28S 39W 36ABB 01
	24S 11W 17DDB 01		28S 40W 04CCC 01
	24S 12W 17CAB 01		28S 40W 12DDD 02
	24S 12W 34ABC 01		28S 40W 23ACC 01
	24S 13W 16ACA 01		28S 40W 32CCB 01
	24S 13W 20CDD 01		28S 41W 02CCC 01
	24S 13W 36DDD 01		28S 41W 19CBB 01
	24S 14W 17AAC 01		28S 41W 31BDD 01
	24S 14W 31BBD 01		28S 42W 08CCC 01
	24S 15W 10BAB 01		28S 42W 20BCC 01
	24S 15W 32DBC 01		28S 42W 32BBB 01
	25S 11W 02ACB 01		29S 39W 17BCB 01
	25S 11W 23DDD 01		29S 39W 21DBD 01
	25S 12W 11AAA 01		29S 39W 24DDA 01
	25S 12W 24DDB 01		29S 40W 28ABB 01
	25S 13W 16AAC 01		29S 41W 13ACC 01
	25S 13W 31DDA 01		29S 41W 31CBD 01
	25S 13W 36DCC 01		29S 42W 08CDC 01
	25S 14W 04AAD 01		29S 42W 24CCC 01
	25S 14W 21DDB 01		29S 43W 33CDB 01
	25S 14W 30CDB 01		30S 39W 18BBB 01
	25S 15W 11BCB 01		30S 39W 23BBB 01
	25S 15W 29BBD 01		30S 40W 12BBB 01
			30S 40W 24CDC 01
Stanton	27S 39W 02BBB 01		30S 40W 33CCB 01
	27S 39W 27BBA 01		30S 41W 13CCC 02
	27S 40W 07ABB 01		
	27S 40W 16CCC 01		30S 41W 23DDB 01
	27S 40W 25CBC 01		30S 42W 12ACC 01
			30S 42W 16BDB 01
			30S 43W 34BBB 01
			30S 43W 36BB 01

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Stevens	31S 35W 15BAA 01	Stevens (continued)	35S 36W 01AAA 01
	31S 35W 19CCC 01		35S 36W 15AAD 01
	31S 35W 26DCC 01		35S 37W 16BCC 01
	31S 36W 02CDD 01		35S 39W 10CAD 01
	31S 36W 27BCB 01		
		Sumner	30S 04W 34BAA 01
	31S 37W 09BCC 01		31S 04W 01BBB 01
	31S 37W 22BCC 01		31S 04W 01DAC 01
	31S 37W 30DDB 01		31S 04W 02BBB 01
	31S 39W 23BBB 01		
	32S 35W 08DDD 01	Thomas	06S 31W 03ADB 01
			06S 31W 33CCD 01
	32S 36W 21AAC 01		06S 32W 12CBC 01
	32S 36W 27DDD 01		06S 32W 29CDC 01
	32S 37W 10DCC 01		06S 33W 07BBB 01
	32S 37W 26BAC 01		
	32S 38W 11ADA 01		06S 33W 23DDD 01
			06S 34W 01DDD 01
	32S 38W 23BDD 01		06S 34W 11CDD 01
	32S 39W 02BBB 01		06S 34W 17CBC 01
	32S 39W 14DDD 01		06S 34W 22DCA 01
	33S 35W 23CBB 01		
	33S 36W 03ACA 01		06S 34W 31CDB 01
			06S 35W 02CDD 01
	33S 36W 26DDD 01		06S 35W 26ACB 01
	33S 37W 17CCC 01		06S 36W 06BCD 01
	33S 37W 23CDB 01		06S 36W 11ACC 01
	33S 38W 06AAB 01		
	33S 38W 10ACC 01		06S 36W 30DCB 01
			06S 36W 34DDB 01
	33S 38W 20DAD 01		07S 31W 01DCA 01
	34S 35W 03DCC 01		07S 32W 07ACA 01
	34S 35W 07CBB 01		07S 32W 13AAA 01
	34S 35W 26ACC 01		
	34S 36W 10CAC 01		07S 32W 33BCB 01
			07S 33W 07BDA 01
	34S 36W 21DBD 01		07S 33W 35ADD 01
	34S 37W 08DAC 01		07S 34W 25AAA 01
	34S 37W 27ABC 01		07S 34W 26DBD 01
	34S 37W 29BBD 01		
	34S 37W 35AAD 01		07S 35W 09CCC 01
			07S 36W 17CCC 01
	34S 38W 02CAC 01		07S 36W 35CBB 01
	34S 38W 34CAA 01		08S 31W 03CDD 01
	34S 39W 02CCA 01		08S 31W 20CDD 01
	34S 39W 15CAD 01		
	35S 35W 15BCC 01		

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Thomas (continued)	08S 32W 07BAA 01	Wallace	11S 38W 35CCC 02
	08S 32W 12DBC 01		11S 42W 08DDC 01
	08S 32W 27DAB 01		11S 42W 10AAD 01
	08S 33W 34BBC 01		13S 39W 33BBB 01
	08S 34W 01BAC 01		13S 42W 10BAC 01
	08S 35W 04CCC 01		13S 43W 36ABB 01
	08S 34W 06CBC 01		14S 38W 21DCC 01
	08S 34W 23CBD 01		14S 40W 23ADD 01
	08S 34W 29CCC 01		14S 40W 29ABA 01
	08S 36W 15CBB 01		14S 41W 22BBC 01
	08S 36W 18ABA 02		14S 42W 10BAA 01
	08S 36W 31BCD 01		14S 42W 14DBD 01
	09S 31W 10BBB 01		14S 42W 30BCA 01
	09S 31W 17CCC 01		15S 38W 05CCB 01
	09S 31W 36AAB 01		15S 38W 14CCD 01
	09S 32W 03AAA 01		15S 38W 28DBB 01
	09S 32W 27BCD 01		15S 38W 36CBB 01
	09S 33W 35AAD 01		15S 39W 02BAC 01
	09S 34W 11CCC 01		15S 39W 06CBC 01
	09S 34W 12ADA 01		15S 39W 08ACC 01
	09S 34W 17ABA 01		15S 39W 26ACC 01
	09S 35W 32DAA 01		15S 40W 03BAB 01
	10S 31W 26AAA 01		15S 40W 09DCB 01
	10S 31W 29AAB 01		15S 40W 26CAB 01
	10S 32W 11BAA 01		15S 41W 05ACB 01
	10S 32W 29DCB 01		15S 41W 10BAB 01
	10S 33W 03DBC 01		15S 41W 27CBC 01
	10S 33W 06BBC 01		15S 41W 36DDB 02
	10S 33W 19CBD 01		15S 42W 02BBB 01
	10S 34W 12BCD 01		15S 42W 32BDA 01
	10S 34W 29BBC 01		15S 42W 36CDC 01
	10S 35W 09ABB 01		
	10S 36W 16CCC 01	Washington	01S 05E 05ADA 01
	10S 36W 36ACC 01		04S 02E 14CCC 01
			05S 01E 20ADA 01
Trego	12S 23W 20CCC 01		05S 01E 31DDD 01
Wabaunsee	10S 10E 15DCC 01		
	10S 12E 29ADD 01		

Table 4. *Ground-water-level observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Wichita	16S 35W 06AAB 01	Wichita (continued)	18S 36W 15DAD 01
	16S 35W 13CCC 01		18S 37W 01BBB 01
	16S 35W 20CCC 01		18S 37W 21BBB 01
	16S 36W 03DCC 01		18S 37W 36ABB 01
	16S 36W 07BCB 01		18S 38W 02BCC 01
	16S 36W 21CCC 01		18S 38W 08BBD 01
	16S 36W 30CBC 01		18S 38W 12BCC 01
	16S 36W 34CCC 02		18S 38W 20ACC 02
	16S 36W 36CBC 01		18S 38W 23BAB 01
	16S 37W 17BBB 01		18S 38W 31DBC 01
	16S 37W 30BAB 01		18S 38W 36DDD 01
	16S 38W 10ABB 01		19S 35W 01AAA 01
	16S 38W 26BBB 01		19S 35W 08BBB 01
	17S 35W 02BBB 01		19S 36W 15BAA 01
	17S 35W 15CDC 01		19S 37W 22AAB 01
	17S 35W 18ACB 01		19S 38W 26CCB 01
	17S 35W 27CCC 01		19S 38W 31CBC 01
	17S 35W 30CBB 01		20S 35W 15BBB 01
	17S 36W 10CBB 01		20S 36W 14DAD 01
	17S 36W 23BCC 01		20S 37W 29DCC 01
	17S 36W 33BCB 01		20S 38W 17CBD 01
	17S 37W 08BAA 01		20S 38W 33BBA 01
	17S 37W 13CDD 01		
	17S 37W 28CCC 01	Wyandotte	11S 24E 14BDA 01
	17S 38W 21BBB 01		
	17S 38W 24ACC 01		
	17S 38W 28CCC 01		
	18S 35W 08BBC 02		
	18S 35W 14DCD 01		
	18S 35W 31DDD 01		

Table 5. *Surface-water-quality stations, 1988 water year*

Ident. no.	Station name	Sampling purpose	Coop. or support
	Missouri River basin		
06-			
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, SED, FIELD	CBR
8635	Big Cr. nr Hays	SED	KWO
8670	Saline R. nr Russell	SED	KWO
8710	N. Fk. Solomon R. at Glade	SED	KWO
8725	N. Fk. Solomon R. at Portis	CHEM, FIELD	CBR
8730	S. Fk. Solomon R. ab Webster Res.	SED	KWO
8740	S. Fk. Solomon R. at Osborne	CHEM, BIOL, TOC, METAL, COLI, SED, FIELD	CBR
8776	Smoky Hill R. at Enterprise	CHEM, BIOL, TOC, METAL, SED, BED, COLI, FIELD	CBR/KWO
87965	Kings Cr. nr Manhattan	CHEM, METAL, TOC, FIELD, SED	CBR
8844	Little Blue R. nr Barnes	SED	KWO
9119	Dragoon Cr. nr Burlingame	SED	KWO
9140	Pottawatomie Cr. nr Garnett	SED	KWO
	Arkansas River basin		
07-			
1375	Arkansas R. nr Coolidge	CHEM, BIOL, TOC, METAL, COLI, FIELD, SED	CBR
1423	Rattlesnake Cr. nr Macksville	SED	KWO
1433	Cow Cr. nr Lyons	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
1457	Slate Creek at Wellington	SED	KWO
1465	Arkansas R. at Arkansas City	SED, BED	KWO
14707	Whitewater R. at Towanda	SED	T-CE

Table 5. *Surface-water-quality stations, 1988 water year*--Continued

Ident. no.	Station name	Sampling purpose	Coop. or support
07-			
1575	Crooked Cr. nr Nye	SED	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. bl Marion Lake	SED	T-CE
18225	Cottonwood R. nr Plymouth	SED	T-CE
1835	Neosho R. nr Parsons	CHEM, BIOL, TOC, METAL, SED, COLI, FIELD	CBR/ KWO
1840	Lightning Cr. nr McCune	SED	KWO

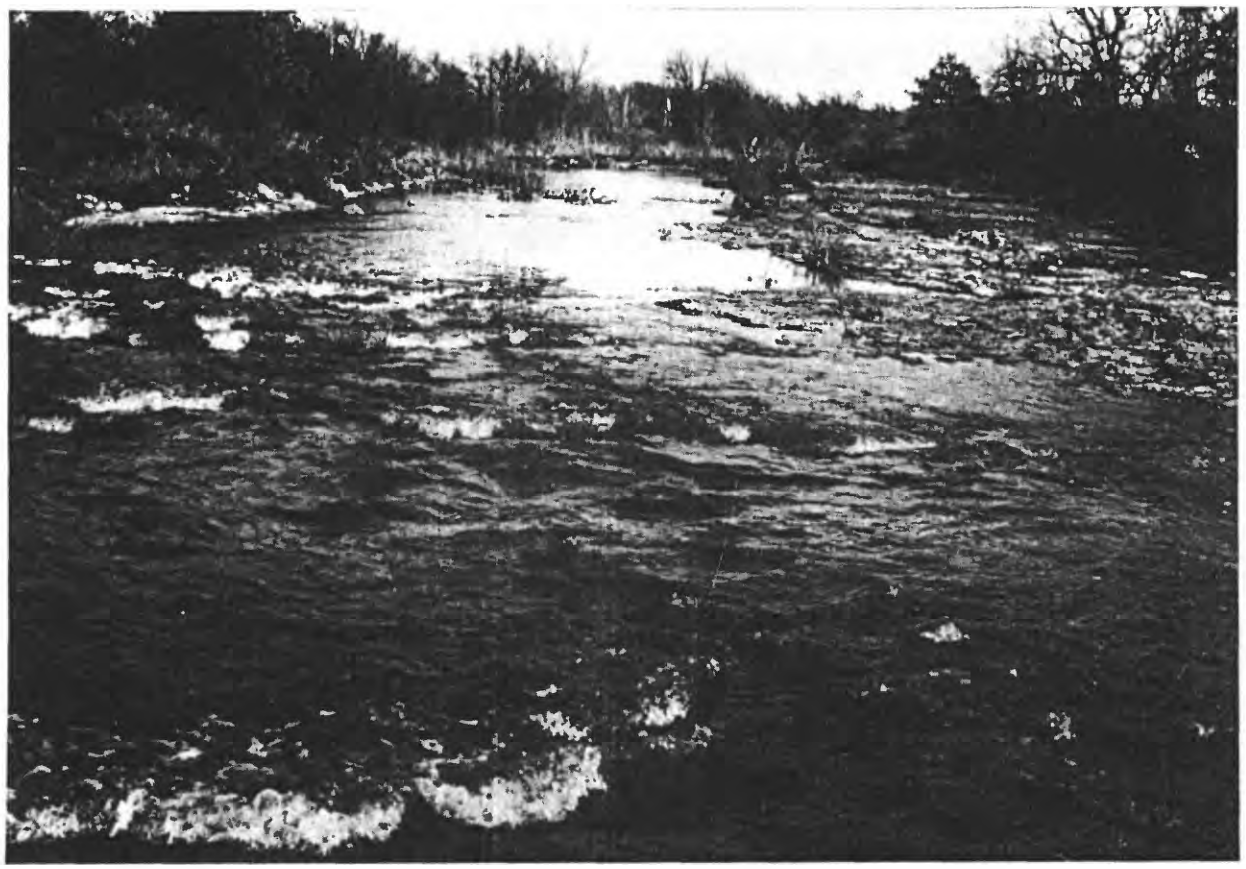

Table 6. *Ground-water-quality observation wells, 1988 water year*

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

Table 6. *Ground-water-quality observation wells, 1988 water year*--Continued

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

Table 6. *Ground-water-quality observation wells, 1988 water year*--Continued

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

Table 6. *Ground-water-quality observation wells, 1988 water year*--Continued

County	Well number	County	Well number
Stanton	28S 41W 36DB	Trego	12S 22W 08BAB
	30S 39W 23BBB		14S 22W 36ADD
Stevens	31S 35W 26DCC	Washington	02S 03E 32AAB
	33S 37W 16AC		04S 05E 09CAA
			05S 02E 12CBA
Sumner	31S 01E 04BDC		
	31S 03W 05ACA	Wichita	18S 37W 13CAC
	32S 02W 31DBD		
	33S 02E 06BBA	Wyandotte	10S 25E 27DBD
	34S 02W 21DAB		11S 23E 28CBC
			11S 25E 20ABA
Thomas	07S 33W 31DBB		
	07S 36W 15DBB		

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