WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN SOUTH DAKOTA--FISCAL YEAR 1984

Compiled by E. F. LeRoux and E. M. Decker

U.S. GEOLOGICAL SURVEY

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Huron, South Dakota

1985

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IN SOUTH DAKOTA--FISCAL YEAR 1984

Compiled by
E. F. LeRoux and E. M. Decker

THE U.S. GEOLOGICAL SURVEY

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

Since 1879, the research and fact-finding role of the USGS has grown and been modified to meet the changing needs of the Nation it serves. As part of that evolution, the USGS has become the Federal Government's largest earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists. Today programs serve a diversity of needs and users. Programs include:

Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.

Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.

Conducting research on the geologic structure of the Nation.

Studying the geologic features, structure, processes, and history of the other planets of our solar system.

Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.

Developing and producing digital cartographic data bases and products.

Collecting data on a routine basis to determine the quantity, quality, and use of surface and ground water.

Conducting water-resource appraisals in order to describe the consequences of alternative plans for developing land and water resources.

Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

Using remotely sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural resources planning and management.

Providing earth-science information through an extensive publications program and a network of public access points.

Along with its continuing commitment to meet the growing and changing earth-science needs of the Nation, the USGS remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation--providing 'Earth Science in the public Service.' "

THE WATER RESOURCES DIVISION

The mission of the U.S. Geological Survey's Water Resources Division is to provide the hydrologic information and understanding needed for the optimum use and management of the Nation's water resources for the overall benefit of the people of the United States. For more than 87 years, the U.S. Geological Survey has studied the occurrence, quantity, quality, distribution, and movement of the surface and underground water that composes the Nation's water resources. As the principal Federal water-data agency, the Geological Survey collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage our water resources. This nationwide program, which is carried out through the Water Resources Division's 43 District offices and 4 Regional offices, includes the collection, analysis, and dissemination of hydrologic data and water-use information, areal resource appraisals and other interpretive studies, and research projects. Much of this work is a cooperative effort in which planning and financial support are shared by State and local governments and other Federal agencies.

The Geological Survey, through its Office of Water Data Coordination (OWDC), also coordinates the water-data-acquisition activities of other Federal agencies. Information on these Federal activities is consolidated into a "Catalog of Information on Water Data." Many State and local agencies and private organizations that have water-data-acquisition activities also contribute information to this catalog. This information is made available to all users of water data by means of a national network of assistance centers managed by the Geological Survey's National Water Data Exchange (NAWDEX). In South Dakota, NAWDEX services can be obtained from the District Chief, U.S. Geological Survey, Water Resources Division, Federal Building, Huron, SD 57350. A leaflet explaining NAWDEX services is available from the Assistance Center or from the NAWDEX Program Office, U.S. Geological Survey, 421 National Center, Reston, VA 22092.

HISTORICAL SUMMARY - SOUTH DAKOTA DISTRICT

During 1979, the U.S. Geological Survey observed its 100th anniversary. Despite its early beginning, it was not until October 16, 1944, that the Bismarck District, comprising the states of North Dakota and South Dakota, was created to assess the water resources of the two states with R. E. Marsh as District Engineer. To operate the South Dakota stream-gaging stations, a subdistrict office, with W. M. Littlefield in charge, was established in Pierre, South Dakota. The Pierre office was virtually independent of Bismarck, except for major questions of policy. Marsh and Littlefield were the only experienced men in the District yet it was a period of expansion and in less than three years the number of stream-gaging stations increased from 68 to 144. A second subdistrict office for South Dakota was later opened in Rapid City to

establish and maintain 20 stations on streams and 12 stations on ditches in the Black Hills area.

In May 1947 a ground-water office was opened in Huron. This office supervised ground-water activities while surface-water activities in South Dakota were supervised from the Bismarck office. Then, as part of the reorganization of the Water Resources Division in 1966, South Dakota was separated from the Bismarck District and both surface- and ground-water activities were supervised from Huron. John E. Powell was the new District Chief.

In South Dakota, the first measurements of streams by the U.S. Geological Survey were made in 1903, however, the first systematic collection of records began in 1928. The early records collected during the periods 1903-06 and 1912-20 were at scattered sites and mostly on an intermittent basis. During the period of 1928-30, the U.S. Army Corps of Engineers provided financial support for the establishment and operation of three gaging stations on the main stem of the Missouri River. One or two stations have been in operation on the Missouri River continuously since 1930.

The next major increase in collection of surface water records occurred during the mid-1940's as a result of the Pick-Sloan Plan for Missouri Basin development. Most of the stations established during this period were financed by Interior Department Missouri Basin funds and were primarily associated with U.S. Bureau of Reclamation studies.

Attempts had been made by State officials at various times to obtain State funds for cooperation in stream gaging but without success as the Legislature, reflecting the attitude of the citizens, was not water-minded. However, in 1944, a new Governor became convinced that with the proposed development of the Missouri Basin, then coming actively into the picture, the State should participate in study of its water resources. Having no specific appropriation for that purpose, he decided that a number of State agencies should contribute from their general funds, and as the work would be done in cooperation with the U.S. Geological Survey, it seemed logical to him that the State Geological Survey should be designated as the cooperating State agency. Accordingly, that agency, the Highway Department, and the Department of Game, Fish, and Parks, each contributed equal amounts of funding totaling $2,400 for the years 1944 and 1945. By 1958 the cooperative surface-water program had grown to $57,000 in cooperation with the State Water Resources Commission. The network of gaging stations has continued to expand and presently records of daily flow are collected at about 120 sites.

In addition, in 1955, a cooperative program was begun with the South Dakota Department of Highways to determine the magnitude and frequency of floods in South Dakota. It was recognized that hydrologic data for floods from small drainage areas were lacking and provision was made for establishment of approximately 60 crest-stage gages in 16 areas in the State, mostly on basins of less than 10 square miles.

The State Geologist started a small observation-well program in 1936 and in the fall of 1939, he began cooperation with the USGS for the purpose of enlarging that program; $400 was allotted annually through the fiscal year 1945, when cooperation ceased. At that time, Missouri Basin funds for ground-water investigations became available.

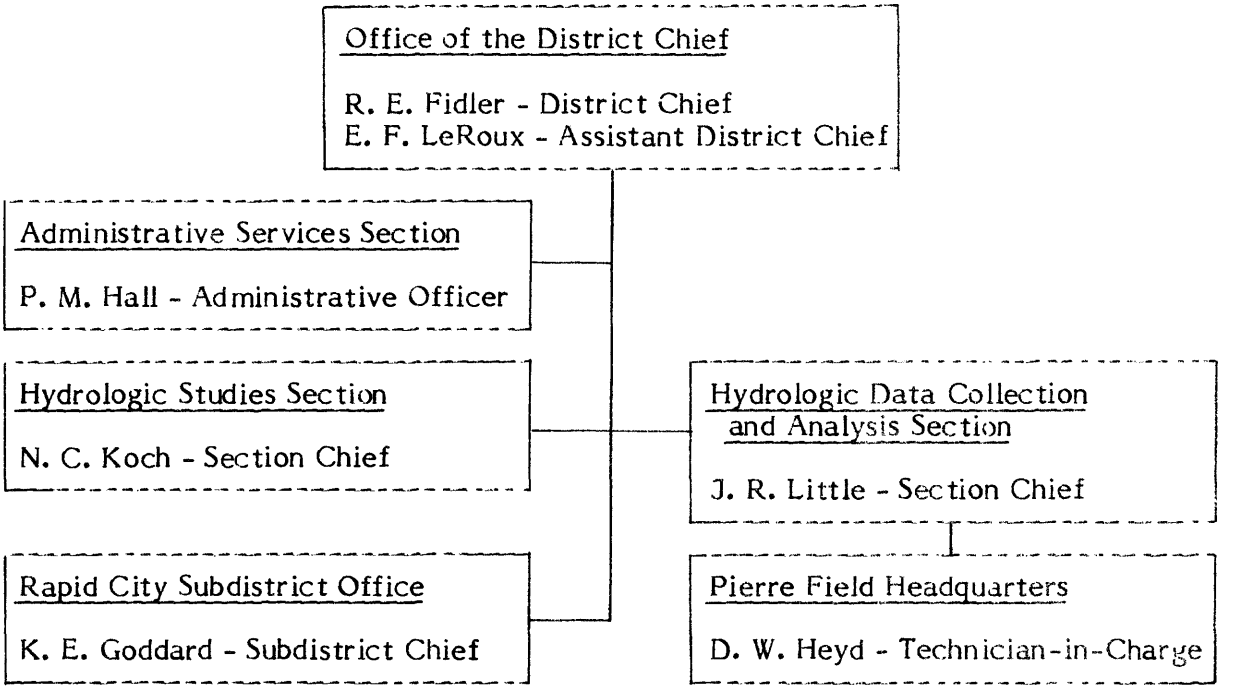
A formal program of ground-water investigations was begun in South Dakota in 1946, with investigations in a proposed unit of the Oahe Irrigation Project. The Oahe Unit studies were begun under the supervision of the district engineer at Bismarck, North Dakota. A field office was established in Huron on May 13, 1947, and an office has been maintained in Huron ever since. The early ground-water studies were made in cooperation with the U.S. Bureau of Reclamation (USBR) and were financed by funds appropriated for studies in the Missouri River Basin. In addition to the long-range investigations in the Oahe area, several smaller projects were initiated in cooperation with the USBR between 1946 and 1956. The State-Federal Cooperative Program in South Dakota began in 1955 when the South Dakota State Water Resources Commission entered into a cooperative agreement with the U.S. Geological Survey to investigate the large and wasteful uncontrolled artesian wells throughout the State. In 1958, the South Dakota State Geological Survey entered into a cooperative agreement for a study of ground-water resources with particular emphasis to be placed upon the determination of ground-water resources primarily in the eastern counties of the State.

During the early years of USGS activity in South Dakota, interest in water quality centered on ground water, and studies of the chemical quality of water were made as integral parts of ground-water investigations. Laboratory work was done either in the Geological Survey Laboratory in Washington, D. C., or was contracted to other laboratories. Because of the need for large amounts of water-quality information in connection with plans for development of the Missouri River basin, the Quality of Water Branch of the U.S. Geological Survey established laboratories in Lincoln, Nebraska, in 1945, which served the South Dakota District for many years.

In the 40 years since the opening of the subdistrict office in Pierre, about 88 water resources studies have been made in South Dakota. These range from reconnaissance type studies of counties and Indian Reservations to research on small-basin runoff, the quality of water in lakes, the use of remote sensing for defining aquifers, and studies using digital models to describe the ground-water regimen such as those currently underway in the James River Basin, the Big Sioux Basin, and the Black Hills. During the past 18 years, 120 formal reports describing the studies and results of investigations have been prepared to inform the public and the scientific community. Fifty of these reports were prepared in the past five years, an indication of the growth and health of the program in South Dakota.

DISTRICT ORGANIZATION

The South Dakota District of the Water Resources Division consists of two operating sections and one support unit. Water-resources projects conducted by the District are assigned to one of the two operating sections with responsibility for a project assigned to a project chief. Personnel are based at the District Office in Huron, the Subdistrict Office in Rapid City, and one Field Headquarters in Pierre. The District is assisted and advised by research centers, laboratories, technical consultants, and training centers maintained throughout the United States by the Water Resources Division.



Inquiries regarding work of the U.S. Geological Survey, Water Resources Division, in South Dakota may be directed to the following offices:

Huron District Office

U.S. Geological Survey
Water Resources Division
Room 317, Federal Building
200 4th St. SW
Huron, SD 57350

(605) 352-8651

Rapid City Subdistrict

U.S. Geological Survey
Water Resources Division
Federal Building/Courthouse
Room 237 - 515 9th St.
Rapid City, SD 57701

(605) 342-6812

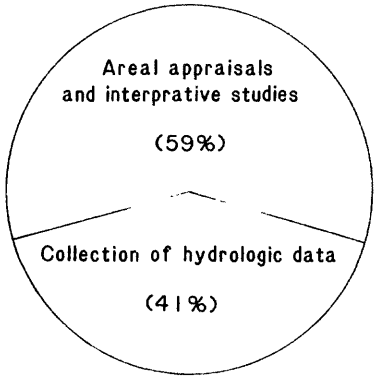
Pierre Field Headquarters

U.S. Geological Survey
Water Resources Division
Room 344, Federal Building
P.O. Box 220
Pierre, SD 57501

(605) 224-7856

TYPES OF INVESTIGATIONS

The diagram below shows the percentage of water resources investigations in South Dakota for fiscal year 1984 in the broad categories of collection of hydrologic data, and areal appraisals and interpretive studies, as a percent of total budget.



The investigations are directed toward obtaining the information needed by managers and planners for the solution or allevation of water problems in the State.

The investigations are supported (table 1) by services and (or) funds provided by State and local agencies, matched on a 50-50 basis by Federal/State cooperative program funds; by funds transferred from other Federal agencies (OFA program); and by funds appropriated directly to the Geological Survey for research, data collection, and special projects (Federal program). In fiscal year 1984 the financial support for these programs in South Dakota was about $2,160,000 which was distributed as follows:

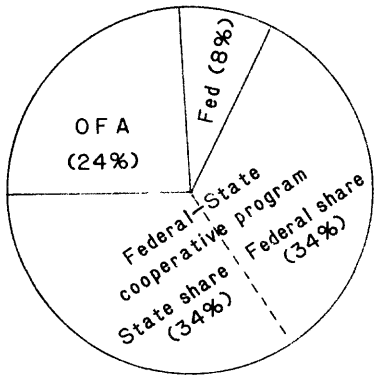


Table 1.--Agencies supporting water-resources investigations in South Dakota during fiscal year 1984

State Agencies

South Dakota Department of Transportation

South Dakota Department of Water and Natural Resources
- Division of Water Rights
- Division of Water Quality
- Geological Survey

Local Agencies

Black Hills Conservancy Sub-District

East Dakota Conservancy Sub-District

Lower James Conservancy Sub-District

Counties of:	Brookings	Kingsbury	Moody
	Codington	Lake	Sanborn
	Grant	Lincoln	Turner
	Hutchinson	Minnehaha	Union

City of Aberdeen

City of Rapid City

City of Sioux Falls

City of Watertown

Federal Agencies

Department of the Army
- Corps of Engineers, Omaha District

Department of the Interior
- Bureau of Indian Affairs
- Bureau of Reclamation, Upper Missouri Region
- EROS Data Center

Tennessee Valley Authority

WATER RESOURCES SUMMARY

South Dakota has an average annual precipitation of about 18 inches, ranging from about 13 inches in the northwest to about 25 inches in the southeast (fig. 1). In most years, 75 to 85 percent of the precipitation falls between April and September. Droughts, especially those of the 1930's, 1950's, and 1970's, have been disastrous to agriculture, the State's dominant industry. With the exception of the Missouri River, where 31 million acre-feet of water is stored in four large reservoirs, streamflow during low flows generally is not dependable for continued irrigation or for municipal or industrial withdrawals (fig. 2). Although the four large Missouri River reservoirs, built under the Pick-Sloan Missouri River Program, provide flood protection and navigation benefits for the basin States downstream from Sioux City, Iowa, periodic flooding, resulting from spring snowmelt and intense summer thunderstorms, can occur in prairie streams such as the Big Sioux and James Rivers in the eastern part of the State. The majority of damage is to lands used for agricultural purposes. Flash floods resulting from intense thunderstorms also can occur in the western part of the State. The U.S. Geological Survey outlines flood-prone areas on topographic maps as part of a nationwide Federal program for managing flood losses. Parts of these topographic maps showing flood-prone urban areas have also been published in urban-area pamphlets. In South Dakota 311 topographic maps and 45 urban-area pamphlets have been completed (fig. 3). Information on these maps and pamphlets is available on request from the District Chief, Water Resources Division, Huron, South Dakota.

Ground-water reservoirs constitute a large and reliable source of water for domestic, industrial, stock, and municipal use. Historically, water from confined (artesian) bedrock aquifers has been very important in the settlement of the State, and in the development of its chief industry, agriculture. Although artesian aquifers from which water flows, or can be pumped from moderate depth, underlie nearly all the State, shallow ground water is absent or scarce in much of the State, especially in the unglaciated western part. Hence, the availability of artesian water and the development of inexpensive methods of drilling deep wells were of special importance in bringing about early settlement, which otherwise might have been restricted to river valleys where water is available from shallow alluvium. Much of the artesian water is of inferior chemical quality, but it has been used nevertheless.

The other major ground-water system in the State is the glacial drift that blankets South Dakota east of the Missouri River. Several hundred million acre-feet of water, much of it suitable for irrigation, is stored in glacial outwash and alluvium. These deposits are irregular in shape and size, and are scattered throughout the area. Figure 4 shows areas in the State where glacial deposits containing large amounts of ground water are known to occur. The major glacial drift aquifers have been mapped as a result of cooperative Federal-State-County water-resources studies.

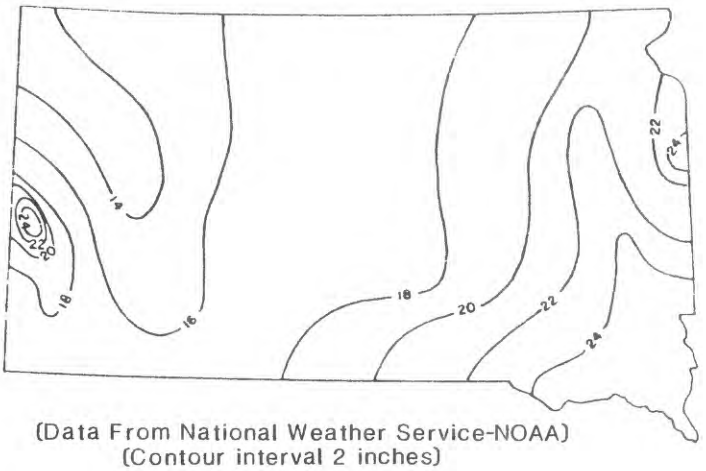


Figure 1.--Annual average precipitation, in inches.

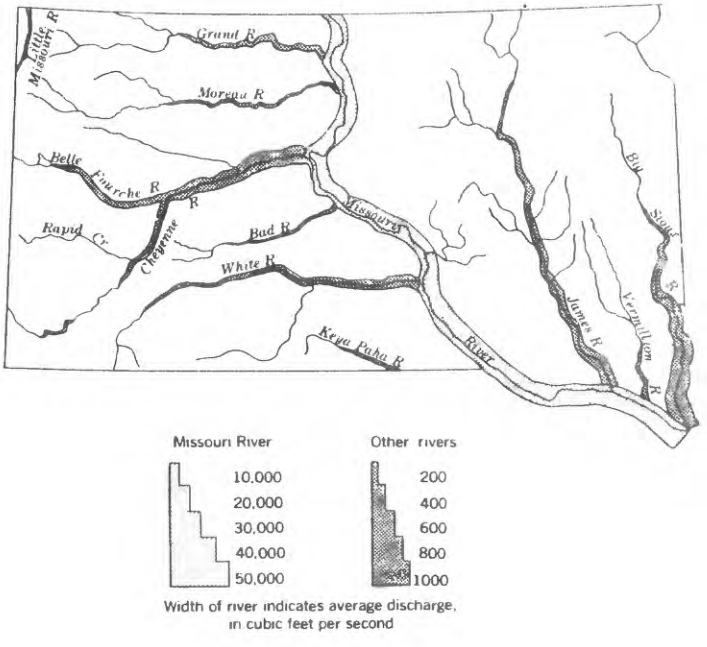


Figure 2.--Average discharge of the principal streams.

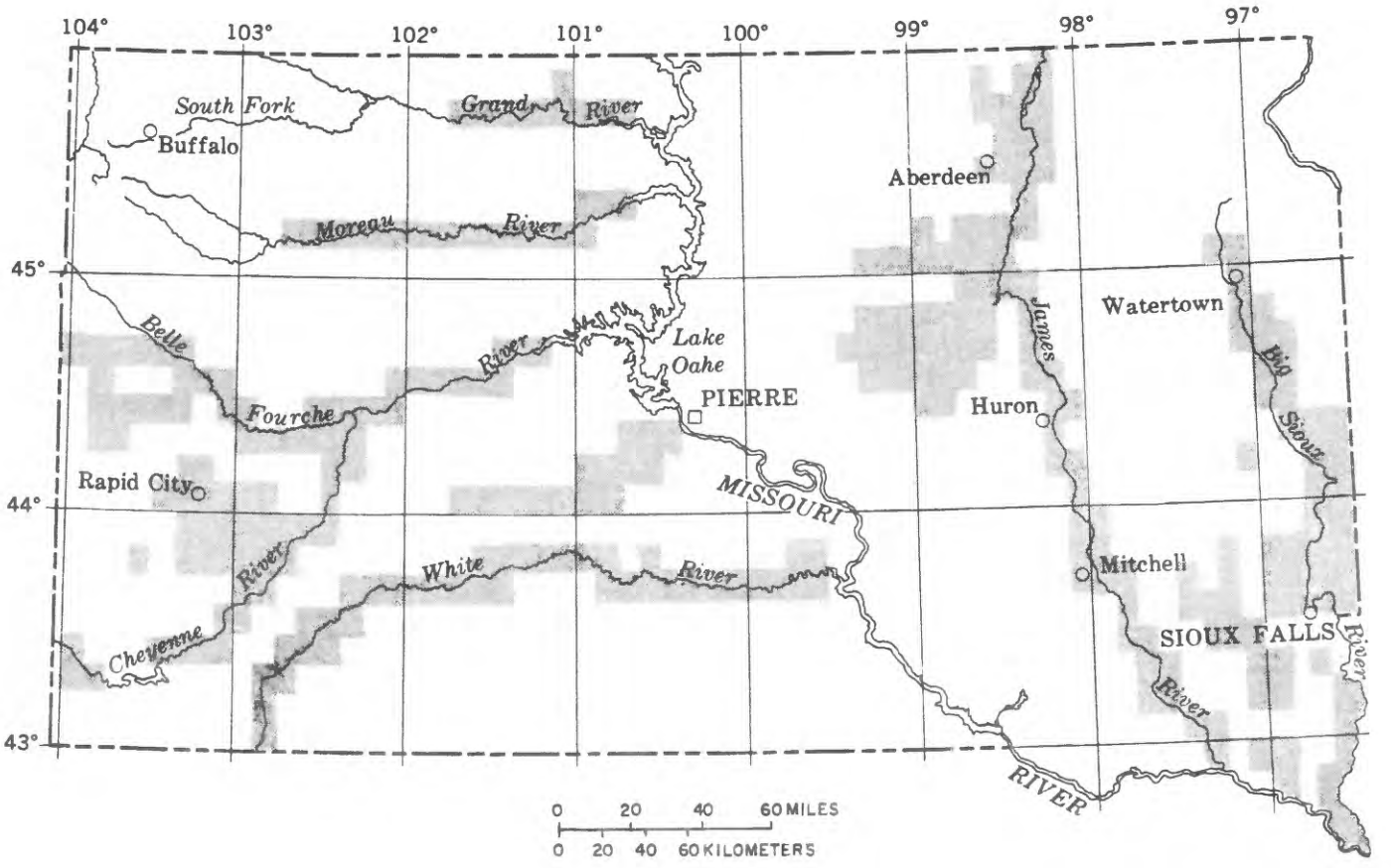


Figure 3.--Flood-prone area maps completed in South Dakota.

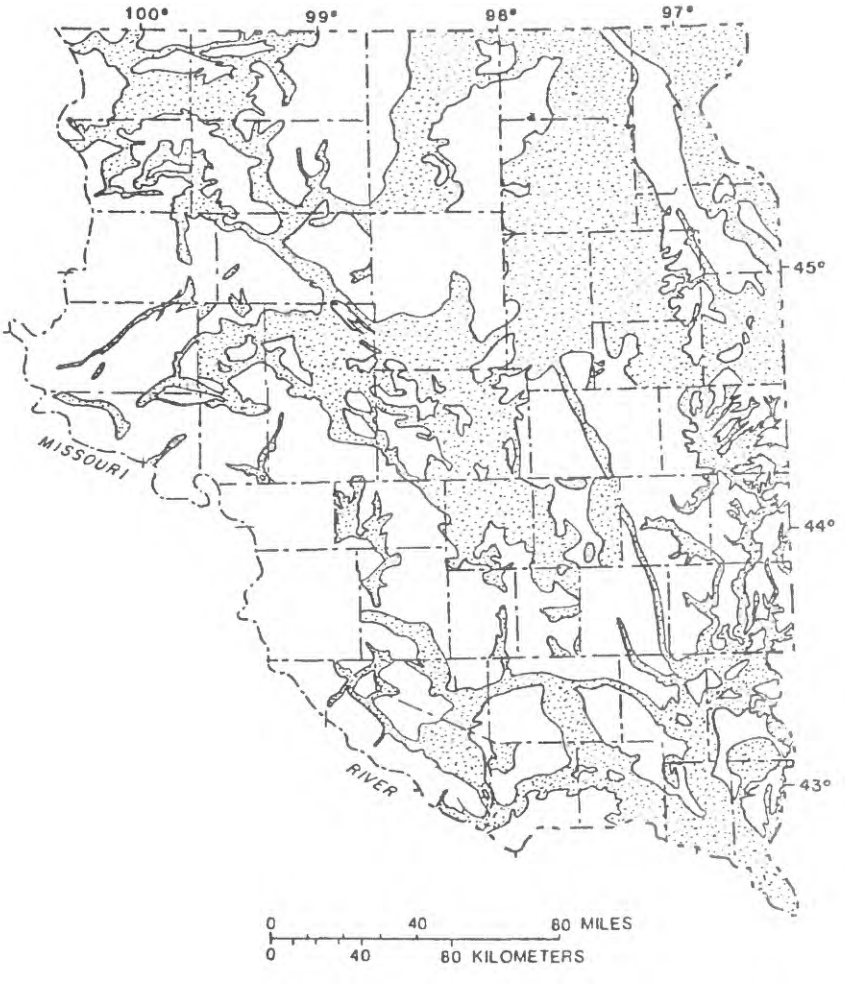


Figure 4.--Major glacial aquifers in eastern South Dakota.

HYDROLOGIC-DATA PROGRAM

Surface Water

Surface-water discharge (streamflow) and stage (water level) data (fig. 5, table 2) are collected for general hydrologic purposes such as assessment of water resources, areal analyses, determination of long-term trends, research and special studies, or for management and operational purposes. Each year surface-water gaging stations are added and others are terminated; thus, the U.S. Geological Survey has both a current and historical file of hydrologic data. All data collected are stored in the Survey's National Water Data Storage and Retrieval System (WATSTORE) and are available on request to water planners and others involved in making decisions affecting the State's water resources. These data can be retrieved in machine-readable form or in the form of computer-printed tables or graphs, statistical analyses, and digital plots. Local assistance in the acquisition of services or products from WATSTORE can be obtained from the District Chief, U.S. Geological Survey, Water Resources Division in Huron.

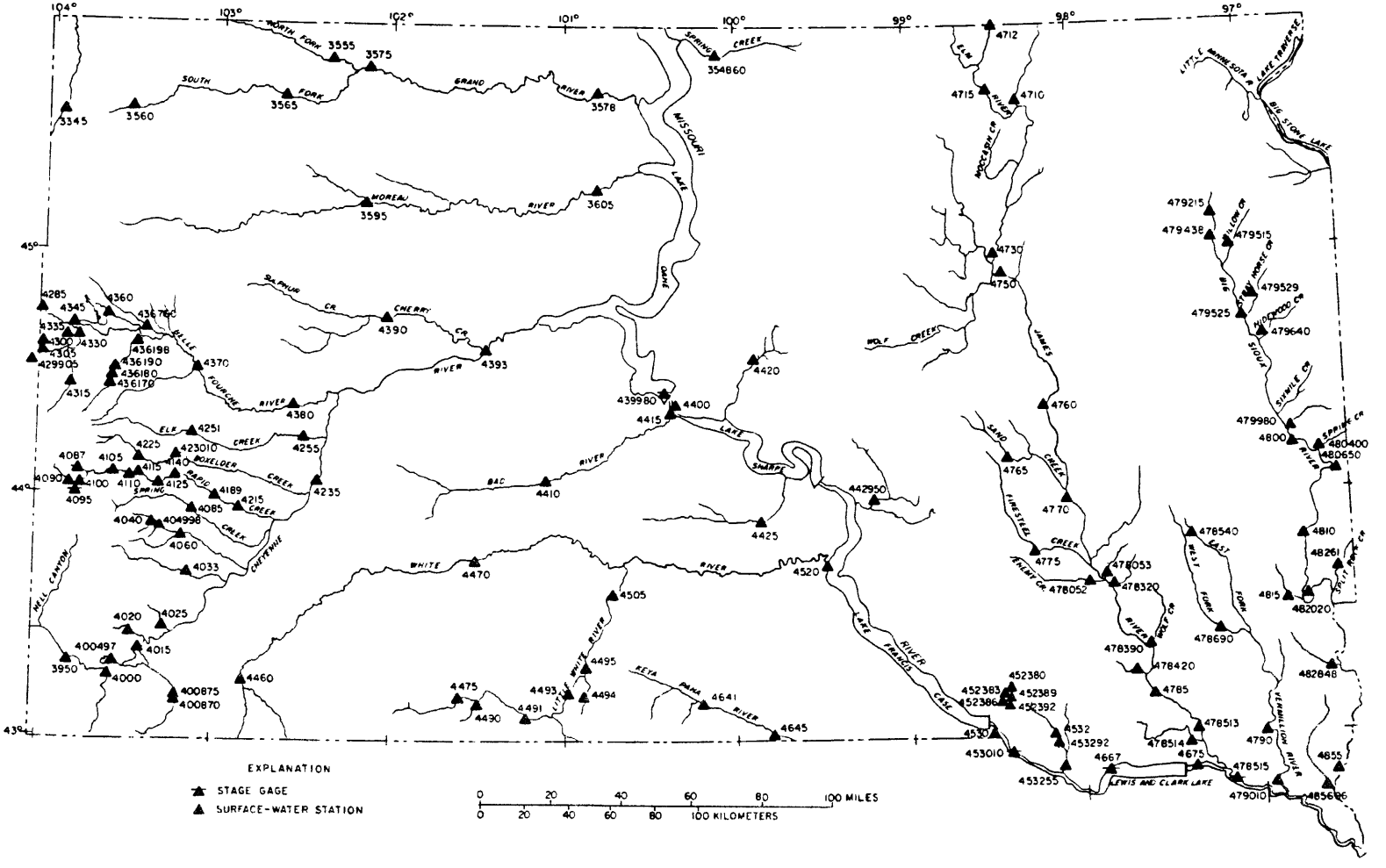


Figure 5.--Location of lake and stream-gaging stations, September 30, 1984.

Table 2.--Surface-water stations in operation in South Dakota, September 30, 1984

[Classification: B, benchmark or long-term change station; C, current-purpose station; H, hydrologic station to meet objective of defining regional streamflow characteristics; P, principal stream station to meet objective of measuring principal unregulated streams; R, regulated stream station required to meet objective of defining regulated flow; S, stage. Equipment: D, digital water-stage recorder; M, servo-manometer unit; R, graphic water-stage recorder; T, telemark. Cooperation: A, U.S. Army Corps of Engineers; BHC, Black Hills Conservancy Sub-District; BIA, Bureau of Indian Affairs; BR, Bureau of Reclamation; EDC, East Dakota Conservancy Sub-District; F, Federal; NR, Department of Water and Natural Resources; WAT, City of Watertown; RC, City of Rapid City; WYO, State of Wyoming.]

Station number	Station name	Classification	Gage equipment	Period of record		Cooperation
				Begin	End	
06334500	Little Missouri River at Camp Crook	C,P	D,M	1903 1956	1906	NR
06354860	Spring Creek near Herreid	B,H	D,M	1962		NR
06355500	North Fork Grand River near White Butte	C,R	D,M	1945		NR
06356000	South Fork Grand River at Buffalo	B,H	D,M,R	1955		NR
06356500	South Fork Grand River near Cash	C	M,R	1945		A
06357500	Grand River at Shadehill	C,R	D	1943		BR
06357800	Grand River at Little Eagle	C,R	D,M,T	1958		A
06359500	Moreau River near Faith	C,P	D,M	1943		A
06360500	Moreau River near Whitehorse	C,P	D,M,R,T	1954		A
06395000	Cheyenne River at Edgemont	C,P	D,R	1903 1928 1946	1906 1933	NR
06400000	Hat Creek near Edgemont	C	R	1905	1906	NR
06400870	Horsehead Creek near Oelrichs	C	D,M	1981		NR
06401500	Cheyenne River below Angostura Dam	C,R	D	1945		BR
06402000	Fall River at Hot Springs	C,R	R	1937		A

Table 2.--Surface-water stations in operation in South Dakota, September 30, 1984--Continued

Station number	Station name	Classification	Gage equipment	Period of record		Cooperation
				Begin	End	
06402500	Beaver Creek near Buffalo Gap	B,C	D	1937		NR
06403300	French Creek above Fairburn	C	D,M	1981		NR
06404000	Battle Creek near Keystone	C,H	D,M	1945	1947	NR
				1961		
06404989	Grace Coolidge Creek near Game Lodge, near Custer	C,H	M,R	1976		BHC
06406000	Battle Creek at Hermosa	C,H	D,M	1949		NR
06408500	Spring Creek near Hermosa	C,H	D,M	1949		NR
06408700	Rhoads Fork near Rochford	C	D,M	1981		NR
06409000	Castle Creek above Deerfield Reservoir, near Hill City	B,C	M,R	1948		F
06409500	Deerfield Reservoir near Hill City	S	M,R	1947		F
06410000	Castle Creek below Deerfield Dam	C,R	D,M	1946		BR
06410500	Rapid Creek above Pactola Reservoir, at Silver City	C,R	D,R	1953		NR
06411000	Pactola Reservoir near Silver City	S	M,R	1956		F
06411500	Rapid Creek below Pactola Dam	C,R	R	1928	1932	BR
				1946		
06412500	Rapid Creek above Canyon Lake, near Rapid City	C,R	M,R	1946		NR
06414000	Rapid Creek at Rapid City	C,R	D,M,T	1903	1906	A
				1942		
06418900	Rapid Creek below Sewage Treatment Plant, near Rapid City	C	D,M	1981		FNR
06421500	Rapid Creek near Farmingdale	C,R	D,M	1946		BR,RC
06422500	Boxelder Creek near Nemo	C,H	D,M	1945	1947	NR
				1966		
06423010	Boxelder Creek near Rapid City	C,H	D	1978		NR

Table 2.--Surface-water stations in operation in South Dakota, September 30, 1984--Continued

Station number	Station name	Classification	Gage equipment	Period of record		Cooperation
				Begin	End	
06423500	Cheyenne River near Wasta	C,R	D,M	1914 1928 1934	1915 1932	A
06425100	Elk Creek near Rapid City	C	D,M	1979		NR
06425500	Elk Creek near Elm Springs	C,P	D,M	1949		NR
06428500	Belle Fourche River at Wyoming-South Dakota State line	C,R	D	1946		F
06430000	Murray Ditch at Wyoming-South Dakota State line	C,R	R	1954		WYO,NR
06430500	Redwater Creek at Wyoming-South Dakota State line	C	D	1929 1936 1954	1931 1937	WYO,NR
06431500	Spearfish Creek at Spearfish	C	D,M	1946		NR
06433000	Redwater River above Belle Fourche	C	D,M	1945		NR
06433500	Hay Creek at Belle Fourche	B,H	D	1953		A,F
06434500	Inlet Canal near Belle Fourche	C,R	D	1945		BR
06436000	Belle Fourche River near Fruitdale	C,R	D,M	1945		NR
06436150	Whitewood Creek above Lead	C	—	1983		NR
06436170	Whitewood Creek at Deadwood	C	D,M	1981		NR
06436180	Whitewood Creek above Whitewood	C	D,M,T	1983		NR
06436190	Whitewood Creek near Whitewood	C	D,M	1981		NR
06436198	Whitewood Creek above Vale	C	D,M,T	1983		NR
06436760	Horse Creek above Vale	C,H	D,M	1962		F
06437000	Belle Fourche River near Sturgis	C,R	D,M,T	1945		NR
06438000	Belle Fourche River near Elm Springs	C,R	M,R	1928 1934	1932	A
06439000	Cherry Creek near Plainview	C,P	D	1945		A
06439300	Cheyenne River at Cherry Creek	C,R	M,R,T	1960		A

Table 2.--Surface-water stations in operation in South Dakota, September 30, 1984--Continued

Station number	Station name	Classification	Gage equipment	Period of record		Cooperation
				Begin	End	
06440000	Missouri River at Pierre	S	T	1971		A
06441000	Bad River near Midland	C,P	D,M	1945		A
06441500	Bad River near Fort Pierre	C,P	M,R,T	1928		A
06441590	Missouri River at LaFramboise Island, at Fort Pierre	S	M,R			A
06441595	Missouri River at Farm Island, near Pierre	S	M,R			A
06442000	Medicine Knoll Creek near Blunt	C,H	D,M	1950		A,F
06442500	Medicine Creek at Kennebec	C,H	D,M	1954		A
06442950	Crow Creek near Gann Valley	C,H	R	1971		F
06443005	Lake Francis Case at Chamberlain	S	R			A
06446000	White River near Oglala	B,C	D,M	1943		NR
06447000	White River near Kadoka	C,P	R	1942		A
06447500	Little White River near Martin	B,C	R	1938 1962	1940	NR
06449000	Lake Creek below refuge, near Tuthill	C,H	D,R	1938 1962	1940	NR
06449100	Little White River near Vetal	C,H	D,M	1959		F
06449300	Little White River above Rosebud	C	D,M	1981		BIA
06449400	Rosebud Creek at Rosebud	C,P	M,R	1974		F
06449500	Little White River near Rosebud	C,P	D,R	1943		NR
06450500	Little White River below White River	C,P	D,M,R	1949		NR
06452000	White River near Oacoma	B,C	M,R,T	1928		A
06452278	Lake Francis Case near Platte	S	M,R	1981		A
06452380	Andes Creek near Armour	H	--	1983		BR
06452383	Lake Andes tributary No. 3 near Armour	H	--	1983		BR
06452386	Lake Andes tributary No. 2 near Lake Andes	H	--	1983		BR

Table 2.--Surface-water stations in operation in South Dakota, September 30, 1984--Continued

Station number	Station name	Classification	Gage equipment	Period of record		Cooperation
				Begin	End	
06452389	Lakes Andes tributary No. 1 near Lake Andes	H	--	1983		BR
06453000	Missouri River at Fort Randall Dam	C,R	R	1947		F
06453010	Missouri River at Greenwood	S	M,D,R	1981		A
06453200	Choteau Creek near Wagner	H	--	1983		BR
06453255	Choteau Creek near Avon	H,P	D,M	1982		BIA
06453292	Choteau Creek near Dante	H	--	1983		BR
06464100	Keya Paha River near Keyapaha	C	M,D	1981		NR
06464500	Keya Paha River at Wewela	B,C	D,R	1937 1947	1940	NR
06466700	Missouri River at Springfield	S	M,D,R	1981		A
06467500	Missouri River at Yankton	C,R	D,M,R,T	1930		F,A
06471000	James River at Columbia	C,R	M,R,T	1945		NR
06471200	Maple River at North Dakota-South Dakota State line	B,C	M,R	1956		NR
06471500	Elm River at Westport	B,C	D,M	1945		NR
06473000	James River at Ashton	C,R	D,M	1945		F
06475000	James River near Redfield	C,R	D,M	1950		F
06476000	James River at Huron	C,R	D	1928 1943	1932	NR
06476500	Sand Creek near Alpena	C,H	D,M	1950		NR
06477000	James River near Forestburg	C,R	D,R,T	1950		NR
06477500	Firesteel Creek near Mount Vernon	C,H	R	1955		NR
06478052	Enemy Creek near Mitchell	C	D,M,R	1975		F
06478053	Pierre Creek near Alexandria	C	D,M	1981		LJC
06478320	Plum Creek near Milltown	C	D,M,R	1981		LJC
06478390	Wolf Creek near Clayton	C	D,M	1975		F
06478420	Lonetree Creek at Olivet	C	D,M,R	1981		LJC
06478500	James River near Scotland	C,R	D,M,R,T	1928		A

Table 2.--Surface-water stations in operation in South Dakota, September 30, 1984--Continued

Station number	Station name	Classification	Gage equipment	Period of record		Cooperation
				Begin	End	
06478513	James River near Yankton	C	D,M	1981		LJC
06478514	Beaver Creek near Yankton	C	D,M,R	1981		LJC
06478515	Missouri River near Gayville	S	D,M	1969		A
06478540	Little Vermillion River near Salem	B,C	R	1966		F
06478690	West Fork Vermillion River near Parker	C,P	D,M	1961		NR
06479010	Vermillion River near Vermillion	C,P	D,M	1984		A
06479215	Big Sioux River near Florence	C,H	D,M	1984		EDC
06479438	Big Sioux River near Watertown	B,C	D,M	1972		EDC,WAT
06479515	Willow Creek near Watertown	H	D,M	1971		EDC
06479525	Big Sioux River near Castlewood	H	D,M	1976		EDC
06479529	Stray Horse Creek near Castlewood	H	D,M	1968		F
06479640	Hidewood Creek near Estelline	H	D,M	1968		F
06479980	Medary Creek near Brookings	H	D,M	1980		EDC
06480000	Big Sioux River near Brookings	C,P	D	1953		NR
06480400	Spring Creek near Flandreau	H,P	D,M	1982		NR
06480650	Flandreau Creek above Flandreau	C	D,M	1981		EDC
06481000	Big Sioux River near Dell Rapids	C,H	D,M,T	1948		A
06481500	Skunk Creek at Sioux Falls	B,C	D,M,T	1948		A
06482020	Big Sioux River at North Cliff Avenue, at Sioux Falls	C,H	D,M,T	1972		A
06482610	Split Rock Creek at Corson	C,H	M,D	1970		BR
06482848	Beaver Creek at Canton	H,P	D,M	1982		NR
06485500	Big Sioux River at Akron, Iowa	C,P	D,T	1928		F,A
06485696	Brule Creek near Elk Point	H,P	D,M	1982		NR

Water-quality data are obtained at many of the surface-water stations (fig. 6, table 3) and occasionally at other surface-water sites where discharge and stage are not measured routinely. In addition to monitoring the quality of surface water in South Dakota, some of these stations also are part of a U.S. Geological Survey nationwide network known as the National Stream Quality Accounting Network (NASQAN), which is used to detect trends in water quality.

Table 3.--Water-quality and sediment stations in operation in South Dakota, September 30, 1984

[Cooperation: A, U.S. Army Corps of Engineers; BIA, Bureau of Indian Affairs; BM, Federal bench-mark station; BR, Bureau of Reclamation; NASQAN, National stream-quality accounting network.]

Station number	Station name	Cooperation	
		Water quality	Sediment
06357800	Grand River at Little Eagle	NASQAN	NASQAN
06360500	Moreau River near Whitehorse	NASQAN	NASQAN
06409000	Castle Creek above Deerfield Reservoir, near Hill City	BM	BM
06434500	Inlet Canal near Belle Fourche	F	
06437000	Belle Fourche River near Sturgis	F	
06438000	Belle Fourche River near Elm Springs	NASQAN	NASQAN
06439300	Cheyenne River at Cherry Creek	NASQAN	NASQAN
06440000	Missouri River at Pierre	NASQAN	NASQAN
06441500	Bad River near Fort Pierre		A
06449300	Little White River above Rosebud	BIA	
06452000	White River near Oacoma	NASQAN	NASQAN,A
06452380	Andes Creek near Armour	BR	
06452383	Lake Andes tributary No. 3 near Armour	BR	
06452386	Lake Andes tributary No. 2 near Lake Andes	BR	
06452389	Lake Andes tributary No. 1 near Lake Andes	BR	
06452392	Lake Andes near Lake Andes	BR	
06453000	Missouri River at Fort Randall Dam	NASQAN	NASQAN
06453200	Choteau Creek near Wagner	BR	
06453252	Choteau Creek near Dante	BR	
06471000	James River at Columbia	NASQAN,BR	NASQAN
06473000	James River at Ashton	F	
06476000	James River at Huron	F	
06478500	James River near Scotland	NASQAN,BR	NASQAN
06481000	Big Sioux River near Dell Rapids	F	F
06485500	Big Sioux River at Akron, Iowa	NASQAN	NASQAN

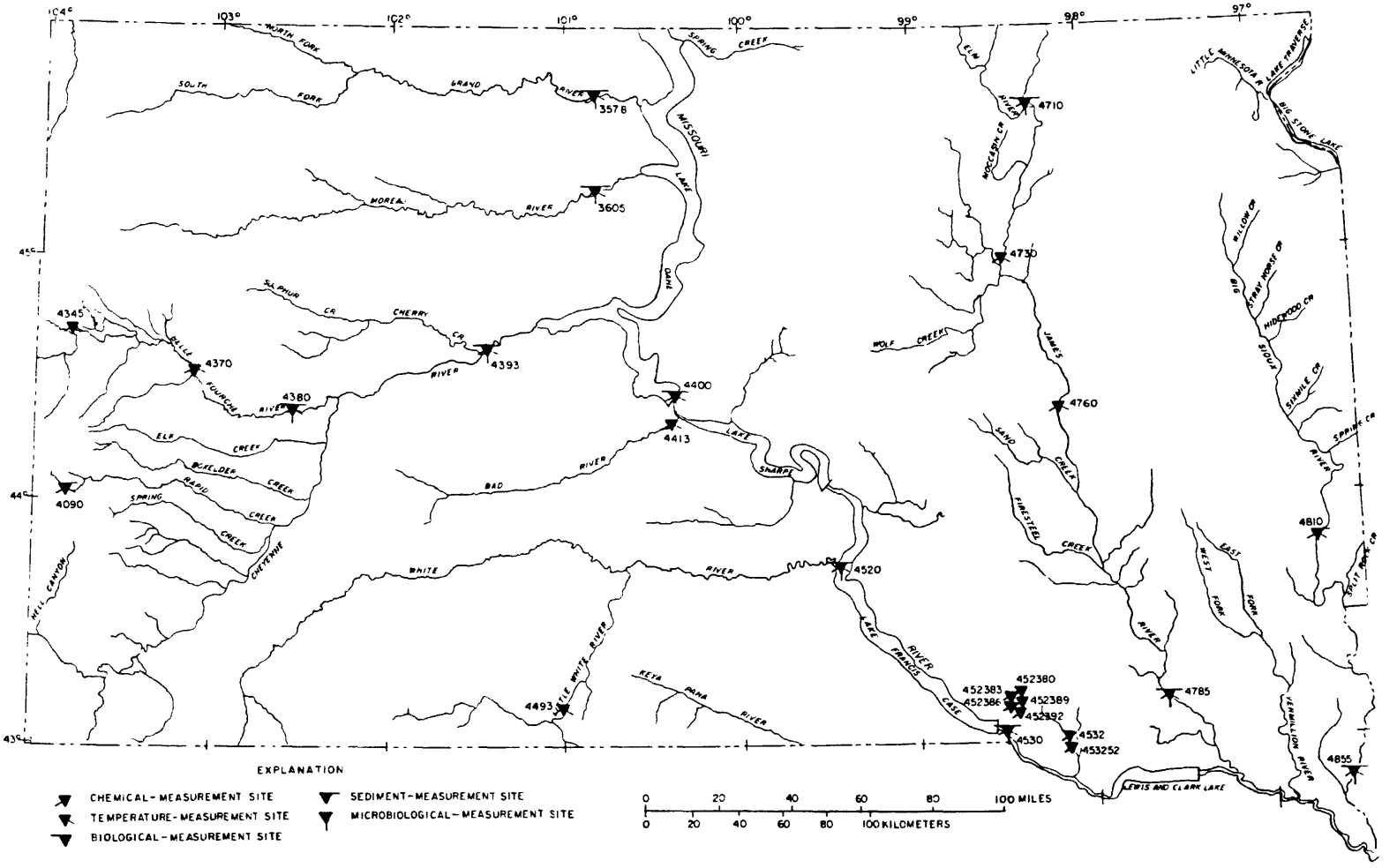


Figure 6.--Location of surface-water quality stations, September 30, 1984.

Ground Water

Water levels in wells, discharge of springs and wells, and water-quality data are key characteristics in monitoring ground-water trends; however, these hydrologic characteristics must be integrated with other observations and ground-water system studies in order to have the fullest meaning and usefulness. In South Dakota, the U.S. Geological Survey makes annual water-level measurements in a number of observation wells (table 4, fig. 7) in the bedrock artesian aquifers. Other wells, which are known as project wells, are used for specific (generally short-term) studies and, although they are not part of the observation-well program, data obtained from them also are available. In addition, the South Dakota Department of Water and Natural Resources maintains and measures more than 1,400 observation wells that are not listed in table 4.

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)

[Well number: The wells are numbered according to a system based on the Federal land-surveys of South Dakota. The well number consists of the township number followed by "N", the range number followed by "W", and the section number, followed by a maximum of four upper-case letters that indicate, respectively, the 160-, 40-, 10-, and 2½-acre tract in which the well is located. These letters are assigned in a counter-clockwise direction beginning with "A" in the northeast quarter. A serial number following the last letter is used to distinguish between wells in the same tract. Thus, well 103N65W21ADCC is the well in the SW¼, SW¼, SE¼, NE¼, sec. 21, T. 103 N., R. 65 W.]

County	Well number	Formation	Date of first measurement
Aurora	101N66W34BBBC	Dakota Formation	7-19-60
	103N65W21ADCC	do.	7-18-79
	103N65W21CAA	do.	8-20-76
	105N63W33CDBB	do.	7-21-77
	105N64W13DDA	do.	6- 9-61
Beadle	109N61W 6BAAC	do.	10-30-63
	109N64W33ACCD	do.	11- 2-60
	110N62W 9BBAD2	do.	10-16-67
	110N62W 9BBAD3	Greenhorn Limestone	7-16-68
	111N62W13DDDB	Dakota Formation	12-26-76
	113N65W16DDCD	do.	11- 4-63
Bon Homme	92N61W 5DDB	do.	4-12-60
	94N58W 1CCC	do.	10- 5-60
	94N59W 6DABA	do.	7- 7-67
Brookings	111N52W25DDCC	do.	10- 9-63
Brown	122N60W 8CBBA2	do.	6-21-60
	128N61W 5DCCC	do.	5-26-60

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)--Continued

County	Well number	Formation	Date of first measurement
Brule	103N67W25CAD	Dakota Formation	7-13-60
	104N70W26DCBC	Lakota Formation	3-23-59
	105N68W11CDB	Dakota Formation	7-14-60
Buffalo	107N73W 1BBBA	do.	10-13-71
	108N72W12BBCA	do.	9-26-61
	108N73W35DDA2	do.	11- 6-73
	108N73W35DDA3	Inyan Kara Group	7-19-79
Butte	8N 2E21CDBC	Lakota Formation	6- 4-80
	8N 2E23DCCA	Inyan Kara Group	6-10-80
	8N 3E12DBB	do.	10-22-70
	8N 3E33CCB	Minnelusa Formation	6- 4-80
	11N 1E17DCAC	Inyan Kara Group	7- 3-79
	12N 3E28ACBB	Minnelusa Formation	2-19-83
	12N 3E32ACBC	Madison Group	8- 1-77
Campbell	127N78W20DCDD	Fall River Formation	8-14-62
Charles Mix	99N68W31DDDB	Dakota Formation	5-24-59
Clark	113N56W 5DDDD	do.	- -83
	115N59W15CAAB	do.	3-10-83
	116N59W23DDAA	do.	8-13-76
Clay	92N52W14DBBD	do.	12- 7-70
	93N52W28AAD	do.	6-21-61
	95N51W 7ADA	do.	6-21-61
Codington	116N52W 2CBBC	do.	2- 9-58
Corson	18N25E23DAD	Fox Hills Formation	7-15-80
	19N22E 1DB	do.	7-15-80
	20N29E25BBBC	Pierre Shale	7-14-80
	22N18E 4DBAC	Fort Union Formation	7-15-80
	22N19E32CBDA	Ludlow Member of the Lance Formation	7-15-80
	23N17E23ADCB	Fort Union Formation	7-15-80
Custer	2S 7E34ABBC	Minnelusa Formation	7-27-83
	2S 7E36CBCB	Lakota Formation	6-29-83
	3S 7E23DDAC	do.	6- 5-80
	3S 7E35DBB	do.	6- 5-80
	3S 8E17BACB	Graneros Shale	5-22-80
	3S 8E19BBBB	Morrison Formation	6-28-83
	3S 8E22ACDB	Inyan Kara Group	8-17-76
	3S 8E22ACDB2	do.	8- 1-77

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)--Continued

County	Well number	Formation	Date of first measurement
Custer (Cont.)	4S 7E 1DAAB	Dakota Formation	6-11-80
	4S 7E28DBBC	Fall River Formation	5-22-80
	5S 6E12DAAD	Sundance Formation	5-22-80
	6S 6E15ABDD	Madison Group	6-11-80
Davison	102N61W30CAC2	Dakota Formation	6- 2-83
	104N61W30DAA	do.	7-29-60
Dewey	12N22E 7ACC	Fox Hills Formation	7-16-80
	12N24E17CBBD	--	7-15-81
	12N25E12BB	Fox Hills Formation	7- 6-80
	14N29E36DBDD	--	5-19-81
	15N26E12CDB	Dakota Formation	6- 9-82
	15N30E26CCDA	Inyan Kara Group	9-25-75
Edmunds	121N68W 3AAAB	Dakota Formation	4-12-66
	121N68W11BCB	do.	8- 9-62
Fall River	7S 1E14BAAC	Sundance Formation	6-12-80
	7S 2E 3ACDD	do.	6-12-80
	7S 2E 3DAAB	do.	7-25-83
	7S 5E12CDBB	Minnelusa Formation	6-13-80
	7S 6E 1AAAD	Fall River Formation	5-22-80
	8S 2E 8AADD	do.	6-12-80
	8S 2E20DACC	Lakota Formation	6-12-80
	8S 2E36ADBB	Dakota Formation	6-12-80
	8S 2E36ADBC	Fall River Formation	4-11-81
	8S 3E32BDAB	Dakota Formation	6-12-80
Faulk	117N72W15CCCA	Inyan Kara Group	10-12-82
	118N67W16DBCC	Dakota Formation	6-22-60
	119N66W11ABAA	do.	6-23-60
	120N67W15AAAA	do.	11-28-61
Grant	120N48W 2ABBB	Cretaceous sandstone, undifferentiated	7-31-62
	121N47W36BBCB	do.	7-23-76
Gregory	96N68W29BDCB	Dakota Formation	7-10-63
Haakon	1N20E14DADB	Madison Group	7-23-80
	1N23E24DBAC	Newcastle Sandstone	- -83
	1N23E33CACC	Fall River Formation	- -83
	2N23E 4DA	do.	7- 6-80
	3N23E10BCAA	Newcastle Sandstone	7-15-80
	4N23E35AA	do.	- -83
	6N18E31ABDC	do.	7- 4-80

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)--Continued

County	Well number	Formation	Date of first measurement
Haakon (Cont.)	6N22E13BD	Lakota Formation	7-23-80
	8N23E31DB	Fall River Formation	7-16-80
	8N23E26ACDA	Madison Group	7-23-80
Hamlin	113N55W23BBAB	Dakota Formation	10-10-63
Hand	110N67W 7CBBB2	do.	5- 5-77
	116N67W31DDDB	do.	10-10-62
Hanson	104N58W13DCC	Codell Sandstone Member of the Carlile Shale	6-15-61
Harding	15N 1E13AADD	Fox Hills Formation	5-12-80
	19N 5E30DDA	Hell Creek Formation	7-16-80
Hughes	110N79W 4CAAA	Madison Group	5-13-81
	111N74W15BDAD	do.	7-20-76
Hutchinson	99N58W 6CCD	do.	9-20-60
	99N60W 1BBBC	do.	3-27-59
	99N61W 4AAD	do.	9-16-60
Hyde	109N72W32BAA	do.	5- 4-60
	109N73W12BDCB	Sundance Formation and Minnelusa Formation	6-24-70
	110N72W 1CDAA	Minnelusa Formation	6-24-70
	114N72W19CDD	Dakota Formation	6-24-60
	116N72W18DAAB	Inyan Kara Group	9-14-62
Jackson	1S22E10CCCC	do.	5-17-66
	1S22E19AADA	Fall River Formation	9-12-63
	1S22E28DAAA	Inyan Kara Group	7-22-80
	2S22E28BAD	Dakota Formation	8- -65
	2S22E32ABAD	do.	12-13-55
	2S24E11BDAC	Inyan Kara Group	7-22-80
	2S24E23DADD	Dakota Formation	8-17-76
	2S24E27CADA	do.	8-18-76
Jerauld	106N67W26CCDB	do.	11- 3-78
	108N63W20DCB	do.	4-27-61
Jones	1S28E36BBDB	Minnelusa Formation	7- 9-80
	2N26E31CBD	Dakota Formation	8-28-63
	2N27E17DDD	do.	8-28-63
	2S28E 8ADD	do.	5-17-78
	2S28E 8CBAC	do.	8-18-76
	3S28E 3AAA	Inyan Kara Group	9-13-63

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)--Continued

County	Well number	Formation	Date of first measurement
Kingsbury	109N57W28AABA	Dakota Formation	6-21-62
	110N58W32CCBC	do.	7-12-76
	111N58W13AAAA	do.	3-10-83
Lake	107N53W20BBC	do.	7-17-61
	108N53W32BDD2	do.	4-28-67
Lawrence	6N 2E 4BDD	Minnekahta Limestone	6- 4-80
	6N 2E23BBBA	Minnelusa Formation	6- 2-80
	6N 2E10BCBB	Spearfish Formation	6-10-80
	6N 4E21DBC	Minnelusa Formation	6-10-80
	6N 4E28BBA	Sundance Formation	5-28-80
	7N 1E14CCDD	Minnelusa Formation	6- 4-80
	7N 1E20AAD	do.	6- 2-80
	7N 1E21BBC	do.	6- 2-80
	7N 1E26ACD	do.	6- 2-80
	7N 1E30BDA	Minnekahta Limestone	8-10-60
	7N 1E30BDA2	--	8-25-80
	7N 2E26BCDA	Minnelusa Formation	6- 3-80
	7N 2E32DD	Spearfish Formation	6- 4-80
	7N 3E 7AABA	Minnelusa Formation	8-27-62
	7N 4E 2BDBD	Fall River Formation	5-28-80
Lincoln	97N49W33AAAA	Dakota Formation	7- 6-61
	98N50W32AAAA2	do.	8-22-79
Lyman	101N72W35DADA	do.	7-10-63
	103N78W12BBAD	do.	10-21-75
	105N73W21CCBA2	do.	7-18-79
	105N73W27ADAC	do.	7- 9-62
	105N78W 9CABD	do.	8- 6-76
	105N78W14ADDA	do.	8-17-76
	106N72W28BDBD	Graneros Shale	7- 8-80
	108N77W21CCAB	Dakota Formation	7-18-63
McPherson	125N66W23ABAA	do.	8- 8-62
	127N66W 5BBBD	do.	8- 8-62
	128N66W 8BAD	Red River Formation	5-22-80
Marshall	127N58W19AABB	Dakota Formation	4-22-65
	127N58W23DAD	do.	7- 1-70
	128N59W24CBBB	do.	6- 4-63
Meade	3N 6E15ABBB	Minnelusa Formation	7- 7-84
	3N 6E23DCB	Spearfish Formation	6-29-80
	4N 6E19AABA	Minnelusa Formation	7-10-84
	4N 9E 2DBDB	Sundance Formation	7-13-82

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)--Continued

County	Well number	Formation	Date of first measurement
Meade (Cont.)	6N 5E19ADCD	Fall River Formation	5-28-80
	6N 5E21DABA	Inyan Kara Group	5-28-80
	6N 5E22DDBC	do.	5-28-80
	7N14E25BDD	Newcastle Sandstone	6-23-80
	10N16E 3DB	Fox Hills Formation	6-11-80
Mellette	41N26W30DDC	do.	7- 7-80
	41N27W25DBDC	do.	6-27-78
	41N32W28CCD	Arikaree Formation	7- 8-80
	42N30W12CB	Dakota Formation	6-11-80
	43N27W 3BDA	do.	5-15-79
	43N27W14ACD	do.	7-25-63
	43N30W 8BBC	do.	7-30-63
	43N30W29A	Inyan Kara Group	7- 8-80
	44N31W20BBBB	Dakota Formation	7- 7-83
Miner	105N58W31BACC	Dakota Formation	7-30-79
Moody	106N48W13BAAC	do.	7-13-61
	107N48W30DCCC	do.	7-13-61
Pennington	1N 7E14CBBD	Spearfish Formation	5-30-80
	1N 7E29CAD	Deadwood Formation	6-30-84
	1N 8E10DAAA	Inyan Kara Formation	8-30-82
	1N16E31CDA	Fall River Formation	8-19-70
	2N 7E17BAAD	Minnelusa Formation	7- 3-84
	2N 8E28BCB	Spearfish Formation	5-22-80
	1S 7E11ADB	Madison Group	11- 1-84
	1S 8E19BBBB	do.	3-13-84
	1S16E 6AAB	Fall River Formation	2- 2-61
	3S14E22DADA	Lakota Formation	6- 2-80
Perkins	13N14E 9DDA	Fox Hills Formation	6-17-80
	20N11E35BBA	Hell Creek Formation	6-18-80
	21N14E23C	Ludlow Member of the Lance Formation	6-18-80
	23N16E20ACAC	Fox Hills Formation	6-17-80
	23N17E31BBB	Ludlow Member of the Lance Formation	6-18-80
Potter	118N76W25AB	Dakota Formation	11-24-74
	120N76W33CDDB	Minnelusa Formation	7-24-76
Roberts	126N51W 9CCCA	Dakota Formation	6-20-62
	127N49W29BBBC	do.	6-20-62
Sanborn	106N62W30BCBA	do.	10-28-60

Table 4.--Observation wells in bedrock aquifers in South Dakota, September 30, 1984 (statewide network)--Continued

County	Well number	Formation	Date of first measurement
Spink	115N65W 4ADDC	Dakota Formation	3-15-66
	116N62W 5DDCC	do.	3-15-66
Stanley	3N25E32BCDD	Inyan Kara Group	6-23-80
	5N27E22CDBB	Madison Group	5-20-81
	6N28E27ABBA	Newcastle Sandstone	6-24-80
	7N26E20B	Fall River Formation	6-25-80
	109N77W 9CDDA	Dakota Formation	8-21-63
Tripp	99N79W33CC	Upper Cretaceous, undifferentiated	6- 9-80
	100N76W17ABB	Dakota Formation	6- 9-80
	101N74W 8DDCC	Graneros Shale	6- 9-80
	102N74W28CDAA	Dakota Formation	6-19-63
Turner	96N53W36DDDA	do.	7- 7-61
	97N54W 5AB	Niobrara Formation	3-31-66
	99N55W 1CAC	Dakota Formation	6-23-61
Union	93N50W 4DAA	do.	6-30-61
	94N48W 6AAAC	do.	7- 7-61
	95N49W16ACD	do.	7- 7-61
Walworth	123N78W 3BABA	Minnelusa Formation and Madison Group	7-14-76
	123N78W12BDCC	Dakota Formation	8-15-62
Yankton	93N54W 6CCD	do.	4-28-65
	93N55W 4BBC	do.	10- 6-60
Ziebach	13N18E29BBB	Fox Hills Formation	7-22-80
	13N19E36CC	do.	- -80
	13N21E31BDDA	do.	7-15-81

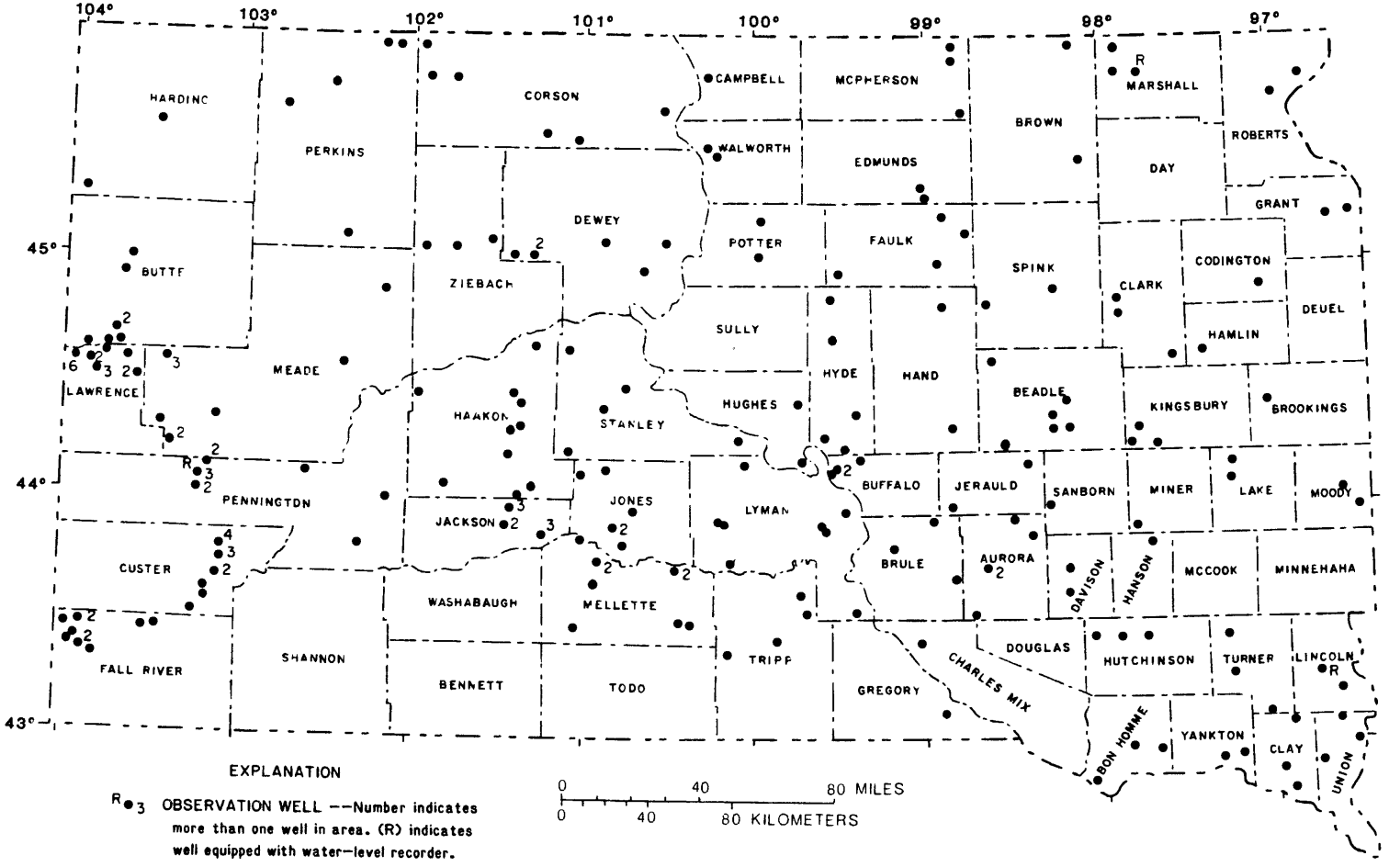
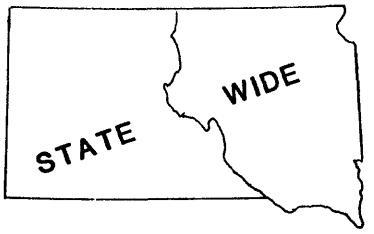


Figure 7.--Location of observations wells in bedrock aquifers, September 30, 1984.

CURRENT PROJECTS

The project descriptions in this section show the location, project number, title, period of the project, cooperating agencies, project leader, purpose of the project, progress, plans, and completed reports.

SURFACE-WATER STATIONS
(SD001)



Project leader: John R. Little

Project period: Continuous

Cooperators: South Dakota Department of Water and Natural Resources, East Dakota Conservancy Sub-District, Black Hills Conservancy Sub-District, City of Watertown, City of Rapid City, U.S. Bureau of Reclamation, U.S. Bureau of Indian Affairs, U.S. Army Corps of Engineers.

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

Objective: A. To collect surface-water data sufficient to satisfy needs for current-purpose uses, such as 1) assessment of water resources, 2) operation of reservoirs or industries, 3) forecasting, 4) disposal of wastes and pollution controls, 5) discharge data to accompany water-quality measurements, 6) compact and legal requirements, and 7) research or special studies. B. To 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, estuaries, etc., for use in planning and design.

Approach: Standard methods of data collection will be used as described in the series, "Techniques of water resources investigations of the United States Geological Survey." Partial-record gaging will be used instead of complete-record gaging where it serves the required purpose.

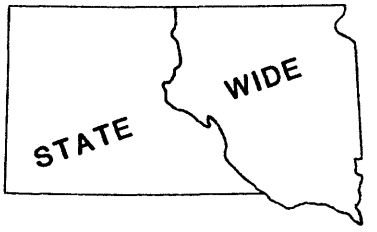
Progress and significant results during fiscal year 1984: Data were collected and published in U.S. Geological Survey Water-Data Report SD-83-1. No significant changes were made in the network. One-hundred twenty active sites.

Plans for 1985: Review the network, consult the cooperators as to their needs and expect to continue on about the same scale as last year. Data will be published in U.S. Geological Survey Water-Data Report SD-84-1, and requests for data will be answered.

Completed reports:

U.S. Geological Survey, 1984, Water resources data for South Dakota, water year 1983: U.S. Geol. Survey water-data report SD-83-1, 269 p.

GROUND-WATER RECORDS
(SD002)



Project leader: John R. Little

Project period: Continuous

Cooperators: South Dakota Department of Water and Natural Resources, City of Sioux Falls.

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

Objective: A. To collect water-level data sufficient to provide a minimum long-term data base so that the general response of the hydrologic system to natural climatic variations and induced stresses is known and potential problems can be defined early enough to allow proper planning and management. B. To provide a data base against which the short-term records acquired in areal studies can be analyzed.

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

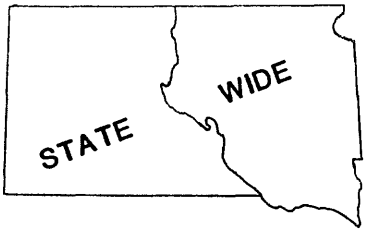
Progress and significant results during fiscal year 1984: Hydrologic data was collected for bedrock aquifers. All water levels for bedrock aquifers are either in the computer or ready for entry. All data collections and storage are up to date. There are 228 active sites.

Plans for 1985: Continue collecting water-level data on existing observation wells and establish new observation wells in areas of poor coverage.

Completed reports:

U.S. Geological Survey, 1984, Water resources data for South Dakota, water year 1983: U.S. Geol. Survey water-data report SD-83-1, 269 p.

WATER-QUALITY STATIONS (SD003)



Project leader: John R. Little

Project period: Continuous

Cooperators: U.S. Bureau of Reclamation, U.S. Bureau of Indian Affairs, EROS Data Center.

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

Objective: To provide a national bank of water-quality data for broad Federal and state planning and action programs and to provide data for Federal management of interstate and international waters.

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

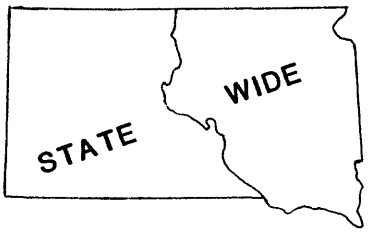
Progress and significant results during fiscal year 1984: Water-quality data were published in the basic data release. There were no significant changes in the network. Thirty-one active sites.

Plans for 1985: Network will continue to be operated.

Completed reports:

U.S. Geological Survey, 1984, Water resources data for South Dakota, water year 1983: U.S. Geol. Survey water-data report SD-83-1, 269 p.

SEDIMENT STATIONS
(SD004)



Project leader: Eugene B. Hoffman

Project period: Continuous

Cooperator: U.S. Army Corps of Engineers.

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

Objective: To provide a national bank of sediment data for use in broad Federal and state planning and action programs and to provide data for Federal management of interstate and international waters.

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

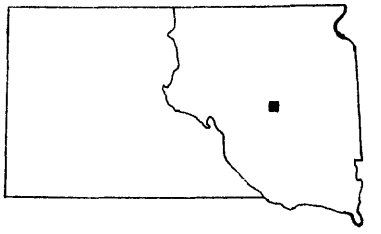
Progress and significant results during fiscal year 1984: Data collected as scheduled and published in U.S. Geological Survey Water-Data Report SD-83-1. Twenty-four active sites.

Plans for 1985: Continue network operation.

Completed reports:

U.S. Geological Survey, 1984, Water resources data for South Dakota, water year 1983: U.S. Geol. Survey water-data report SD-83-1, 269 p.

NATIONAL TRENDS NETWORK FOR MONITORING ATMOSPHERIC DEPOSITION (SD005)



Project leader: Gerald R. Wisnieski

Project period: Continuous

Cooperator: Federal (USGS).

Problem: To establish and operate a nationwide long-term monitoring network to detect and measure levels of atmospheric deposition.

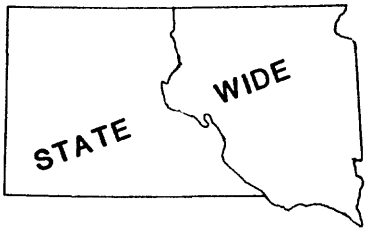
Objective: To determine variations in atmospheric deposition that occurs on a week to week basis. To collect wet and dry deposition products for analysis of elements and compounds that can contribute to the chemical composition of surface waters.

Approach: Set up a monitoring station as part of the National Trends Network. Maintain station, make on-site measurements, process samples, and submit samples to an analytical laboratory. Verify data retrievals and report on results.

Progress and significant results during fiscal year 1984: Data were collected as scheduled.

Plans for 1985: Dry deposition sampling will be discontinued. Continue rest of operation and store data in the ADR files. Data will be published in U.S. Geological Survey Water-Data Report SD-84-1.

SOUTH DAKOTA WATER-USE DATA PROGRAM (SD007)



Project leader: Rick D. Benson

Project period: Continuous

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: The water requirements in South Dakota for irrigation and energy development have increased considerably in recent years. As a result of the drought in 1976-1977 that affected the economics of the state, a state water plan was prepared. An important part of the state water plan is a continuing comprehensive statewide water-use assessment. Without adequate data on existing uses of water, predictions for future uses will be inaccurate.

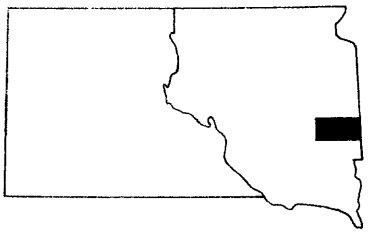
Objective: To develop a statewide water-use data program that will include field collection procedures and computer storage, retrieval, manipulation, and dissemination of water-use data. During the first year of the project, water-use data collection techniques will be developed and evaluated and the requirements for a water-use data handling system will be identified.

Approach: The USGS and the South Dakota Department of Water and Natural Resources will work together in developing a statewide water-use data program. The USGS will provide direction, management, and standards development to meet the national needs. The South Dakota Department of Water and Natural Resources will provide manpower and computer facilities for field collection and processing of water-use data to meet the local needs.

Progress and significant results during fiscal year 1984: The Utah District had previously developed a computer program to convert South Dakota Irrigation Questionnaire Data for entry onto the National Water Use Data System. However, problems were encountered with the program and the decision was made to develop a new computer program for the PRIME computer which would convert the data for entry onto the State Water Use Data System. The program was nearing completion as of Sept. 30, 1984.

Plans for 1985: Irrigation questionnaire data for the 1979, 1980, 1981, and 1982 irrigation seasons will be entered onto the State Water Use Data System and subsequently onto the National Water Use Data System. A report summarizing irrigation water use in South Dakota will be prepared. Development of data collection systems for public, rural domestic, industrial, and thermoelectric water usage will continue.

WATER RESOURCES OF LAKE AND MOODY COUNTIES, SOUTH DAKOTA (SD053)



Project leader: Donald S. Hansen

Project period: 1979-1984

Cooperator: South Dakota Department of Water and Natural Resources.

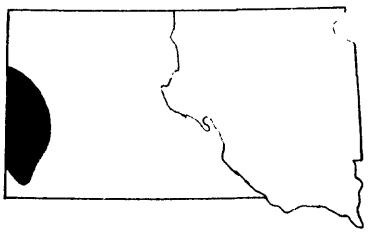
Problem: A reconnaissance study, which included part of Moody County, was completed in 1968 but contained little detailed analysis of the Big Sioux aquifer or other glacial aquifers. A knowledge of the hydrology of these aquifers is needed for land-use planning and development of irrigation and rural water systems in the area. The counties are quite heavily populated in the rural areas where rural water systems may be developed.

Objective: To provide the reliable and up-to-date hydrologic data and the analyses needed for water-resources evaluation and for the efficient use of these resources by agriculture, rural water systems, and municipalities. Specifically, the study will concentrate on determining the availability of surface and ground-water resources, the operation of the hydrologic system as it influences availability, the quality of surface and ground water, and the effects on the hydrologic system of developing the water resources. Areas of current or potential hydrologic problems, as related to water use, will be identified.

Approach: Water resources will be evaluated using standard geologic and hydrologic techniques. Existing precipitation, streamflow, and well data will be collected. A well inventory will be completed during the first two field seasons. An observation-well network will be established and water samples collected for chemical analysis. Glacial and bedrock aquifers will be delineated and hydrologic characteristics described. Pump tests, using existing wells, will be run whenever feasible. Assistance from outside USGS will consist of a geologic study by the State Geological Survey and extensive test drilling by State drill rigs.

Progress and significant results during fiscal year 1984: Final report approved for publication.

QUALITY AND AVAILABILITY OF GROUND WATER IN THE BLACK HILLS AREA, SOUTH DAKOTA AND WYOMING (SD059)



Project leader: Kathy D. Peter

Project period: 1981-1984

Cooperators: South Dakota Department of Water and Natural Resources, Black Hills Conservancy Sub-District.

Problem: Increasing development in the Black Hills area is placing increased demands on the ground-water system. The data and interpretations at the scale necessary to make specific management decisions are not available. There is concern about the effects of unplugged or improperly plugged uranium test holes, concern about the effect proposed withdrawals from the Madison aquifer will have on streams and aquifers in South Dakota, and concern about the effect of the numerous septic systems on the quality of water in the Minnelusa Formation, the principal aquifer supplying water to the residents in the area.

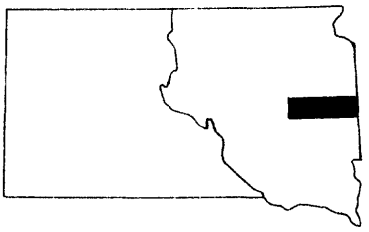
Objective: Evaluate the quality and quantity of ground-water resources of the sedimentary aquifers in the Black Hills area of South Dakota and eastern Wyoming. Evaluate the effects of septic systems on aquifers in the Piedmont Valley area. Develop the data base necessary for application of a digital model(s) to predict the effects of potential stress on the ground-water systems.

Approach: Streamflow and spring discharge data will be obtained as needed to evaluate net aquifer recharge. Water samples from wells in the Piedmont Valley area will be collected and analyzed. Additional wells will be inventoried and evaluated for prospective water-quality and water-level observation networks. The U.S. Geological Survey three-dimensional model will be used to predict the affects of stresses on the system and simulate recharge. Reports on quality and availability of ground water will be prepared.

Progress and significant results during fiscal year 1984: Development of two digital models was continued. Calibration of all layers was not reached and it was concluded the complexity of the aquifer system and the lack of data in some areas made modeling very difficult. All three major aquifers in the area, the Inyan Kara, Minnelusa, and Madison, have the potential of yielding more than 100 gallons per minute to wells. Water quality in all three aquifers is acceptable for most uses in general. In some areas, treatment may be required for fluoride, radium-226, iron, manganese, sulfate, or hardness before use. Reports are nearing completion.

Plans for 1985: Complete and publish reports.

WATER RESOURCES OF BROOKINGS AND KINGSBURY COUNTIES, SOUTH DAKOTA (SD060)



Project leader: Louis J. Hamilton

Project period: 1981-1986

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: The study will help to complete the overall water resources picture in eastern South Dakota. A complete knowledge of the hydrology of the aquifers will be valuable in future land-use planning and in the development of irrigation and rural water systems in the area. Identification of significant new sources of ground water would undoubtedly encourage some changes from dryland to irrigation farming. The counties are quite heavily populated in the rural areas where rural water systems may be developed. The recent drought conditions have increased local interest in irrigation development from ground-water sources.

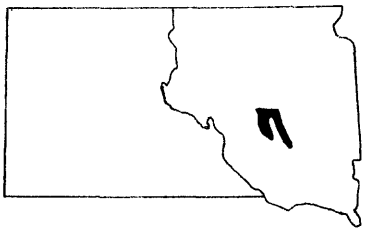
Objective: To provide the reliable and up-to-date hydrologic data and the analyses needed for water-resources evaluation and for the efficient use of these resources by agriculture, rural water systems, and municipalities. Specifically, the study will concentrate on determining the availability of surface and ground-water resources, the operation of the hydrologic system as it influences availability, the quality of surface and ground water, and the effects on the hydrologic system of developing the water resources. Areas of current or potential hydrologic problems as related to water use will be identified.

Approach: Water resources will be evaluated using standard geologic and hydrologic techniques. Glacial and bedrock aquifers will be delineated and hydrologic characteristics described. Pump tests, using existing wells, will be run whenever feasible. A geologic study will be made by the State Geological Survey and there will be extensive test drilling by State drill rigs. A preliminary report discussing the major aquifers will be prepared. A final report on the hydrology will be published by the USGS. A report on the geology of the counties will be prepared by a State Geological Survey geologist.

Progress and significant results during fiscal year 1984: Five major glacial aquifers of outwash sand and gravel have been discovered beneath half of Brookings and Kingsbury Counties at depths of from a few feet to more than 600 feet below land surface. A major intermediate-level aquifer underlies 350 square miles of Kingsbury County at a depth of about 300 feet.

Plans for 1985: Test drilling will continue and the observation-well network will be expanded. Water samples will be collected from 20 representative wells for chemical analysis. Preparation of illustrations and report writing will begin.

DIGITAL-MODEL STUDY OF THE GLACIAL AQUIFERS IN A PART OF THE JAMES RIVER BASIN IN EAST-CENTRAL SOUTH DAKOTA (SD064)



Project leader: Patrick J. Emmons

Period of project: 1982-1985

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: The drought in South Dakota from 1974-76, the curtailment of the planned Oahe Surface-Water Irrigation Project in 1978, and the near-drought conditions in 1980-81 have caused increased demands on the ground-water resources within many of the heavily agricultural areas of the James River basin. The South Dakota Department of Water and Natural Resources has requested that the U.S. Geological Survey cooperate with them in developing digital models of the aquifer system in part of the James River basin to be used as a basis for establishing a water-use management program.

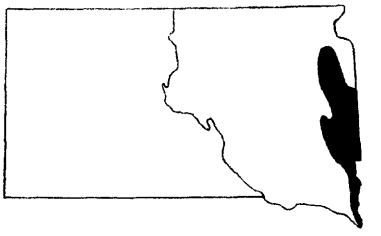
Objective: The purpose of this study is to utilize the modeling expertise of the U.S. Geological Survey to develop and calibrate finite-difference two-dimensional digital models of the ground-water system. The calibrated digital models will be used to assist in determining the long-term yield of the ground-water reservoir and the areal affects on water levels of selected water-use plans. Once developed, water agencies can use the models to help manage future ground-water use and recommend optimum pumping distribution.

Approach: The existing information base includes data and analyses from cooperative countywide water-resources studies in four counties. The study will require hydrologic data collection and some test drilling by the South Dakota Geological Survey, mostly in Beadle and Sanborn Counties. Updating of data will be required in Miner and Hanson Counties. The accepted U.S. Geological Survey digital model will be used and modifications will be made as needed. The model will be used to determine the long-term yield of the glacial aquifer system and to test selected water-use and pumping distribution plans with time.

Progress and significant results during fiscal year 1984: Several thousand well and test-hole logs were used to delineate the boundary, thickness, and composition of the shallow-glacial aquifer system in the four-county study area. Seven observation wells were drilled along the James River in Beadle and Sanborn Counties to aid in determining the degree of connection between the shallow aquifer system and the James River. Steady-state and transient ground-water flow models of Beadle County were developed and preliminary work was completed on expanding the models to cover the entire study area.

Plans for 1985: Conduct low-flow measurements on the James River. Install several drive-point wells in the James River. Complete the ground-water flow models of the study area and prepare a report describing the geohydrology of the aquifer system and model results.

WATER RESOURCES OF THE BIG SIOUX RIVER BASIN, SOUTH DAKOTA (SD065)



Project leader: Neil C. Koch

Period of project: 1982-1988

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: The Big Sioux River basin of eastern South Dakota represents a sizeable aquifer system of major importance to the economy of South Dakota. Management problems already exist and as development continues the problems continue to increase in number and complexity. Although it is possible to roughly estimate the amount of water in the basin, management is extremely difficult. The aquifers are complex, consisting of many small aquifers that are hydrologically associated with several large aquifers and the Big Sioux River. A comprehensive study is needed to aid in optimum development of water resources in the basin.

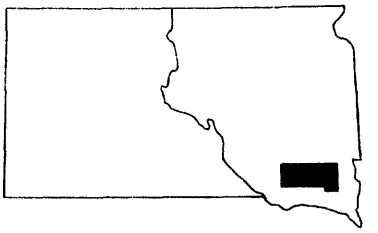
Objective: To provide a scientific basis for evaluation and efficient use of water resources and to explore the possibility of application of a solute transport model to describe rates and directions of movement. Information will be provided on the availability of surface-water and ground-water resources, operation of the hydrologic system, and the effect of water-resources development on the hydrologic system. The study will complete the gathering of all necessary hydrologic data within the basin. This data base will then be used to develop digital models of major aquifers.

Approach: The study will include hydrologic data collection and an extensive test-drilling program by the State Survey. Two-dimensional models of the Big Sioux aquifer will be developed and the feasibility of the application of a solute transport model to describe rates and directions of movement, and concentrations of both naturally occurring and artificially introduced organic and inorganic constituents will be determined. Development alternatives will be tested and analyzed for possible impacts on the hydrologic system. Reports will be prepared summarizing the hydrology and recommending needs for further study and data collection.

Progress and significant results during fiscal year 1984: Well inventory was completed in Grant County and started in Union County. Two stream-gaging stations were installed and operated. Test drilling was started in Codington County to define the hydrology. A major aquifer in glacial drift has been determined to overlie bedrock. Observation wells have been established in the Big Sioux aquifer in Codington, Grant, Hamlin, Minnehaha, and Lincoln Counties.

Plans for 1985: Complete well inventory. Continue test drilling in Codington County and start in Grant County. Complete the establishment of observation wells in the Big Sioux aquifer in Lincoln and Union Counties. Continue to operate stream-gaging stations.

WATER RESOURCES OF HUTCHINSON AND TURNER COUNTIES, SOUTH DAKOTA (SD066)



Project leader: Richard J. Lindgren

Period of project: 1982-1987

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: Several productive aquifers mapped during U.S. Geological Survey studies in adjacent counties probably extend into Hutchinson and Turner Counties. A knowledge of the hydrology of these aquifers will be valuable in future land-use planning and in the development of irrigation and rural water systems. Identification of significant new sources of ground water would undoubtedly encourage some changes from dryland to irrigation farming. Also, the counties are quite heavily populated in rural areas where rural water systems may be developed.

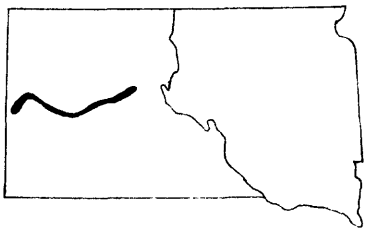
Objective: Provide the reliable and current hydrologic data and the analyses needed for water-resources evaluation and for the efficient use of these resources by agriculture, rural water systems, and municipalities. The study will determine the availability of surface and ground water, the operation of the hydrologic system as it influences availability, and the quality of surface and ground water. Current or potential problems related to development, such as declining water levels, decreased natural discharge, and changes in water quality due to induced recharge from materials adjacent to the aquifers, will be identified.

Approach: Water resources will be evaluated using standard geologic and hydrologic techniques. Existing precipitation, streamflow, and well data will be compiled. A well inventory will be conducted and a test drilling program will be completed during the first two field seasons. An observation-well network will be established and water samples collected for chemical analysis. Glacial and bedrock aquifers will be delineated and hydrologic characteristics described. Pump tests, using existing wells, will be run whenever feasible. There will be a geologic study by the State Survey and extensive test drilling by State drill rigs.

Progress and significant results during fiscal year 1984: A well inventory, including field analysis of water quality, was completed and the data were entered into the Ground Water Site Inventory data base. The well inventory data were analyzed in terms of water use and water quality. Test drilling to determine the location, extent, and thickness of aquifers in the study area was continued. Observation wells were installed and monitored at selected locations to provide water-level data. Geologic cross sections and preliminary aquifer thickness and altitude of the top of the aquifer were completed. Municipal and irrigation water use data was collected. Drainage areas, average annual flows, and flood frequency characteristics were determined for 30 streams in the study area. Available surface-water-quality data was collected.

Plans for 1985: Test drilling will continue and additional observation wells will be installed. Water levels in observation wells will be measured periodically. Analysis of data to determine the location, extent, and thickness of aquifers, as well as relationships between aquifers, will continue. Water-quality samples will be collected and analyzed. The surface-water and water-use portions of the planned reports will be written and the corresponding illustrations prepared.

INVESTIGATION OF HAZARDOUS WASTES ALONG WHITEWOOD CREEK AND THE BELLE FOURCHE AND CHEYENNE RIVERS, SOUTH DAKOTA (SD067)



Project leader: Kimball E. Goddard

Period of project: 1982-1984

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: For approximately 100 years, until the late 1970's, huge volumes of mining and milling wastes were discharged into Whitewood Creek and its tributaries at Lead, South Dakota. The waste material contains non-metallic and metallic minerals associated with the gold and silver deposits at Lead. In addition, mercury and cyanide have been, or are currently being used in the milling processes and may also be present in the wastes. There is evidence that contaminants continue to degrade the surface and ground waters. Of particular concern is the possible contamination of the alluvial aquifers.

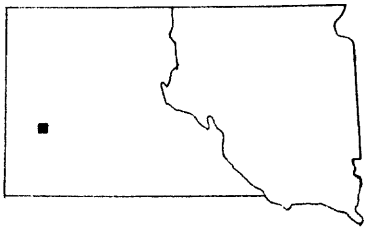
Objective: To define the areal extent and the general physical and chemical characteristics of significant waste deposits. Identify any current downstream movement of the wastes or any resultant leachate in the surface flow of Whitewood Creek and the Belle Fourche and Cheyenne Rivers. Identify ground-water contamination of the alluvial aquifer caused by leaching of waste deposits along Whitewood Creek and the Belle Fourche and Cheyenne Rivers. Identify and locate past and present contaminant point-sources and determine continuing contribution of present sources.

Approach: Evalute existing reports and maps. Field inspect areas affected by waste deposits and define the chemical, physical, and mineralogic characteristics of the deposits. Obtain background data on surface-water chemistry and sediment concentration. Determine discharge, bottom-material chemistry, and surface-water chemistry profiles. Determine temporal variations in water chemistry and sediment concentration and the variations resulting from high flows. Locate and sample existing wells in the alluvial aquifer. Drill and sample monitoring wells. Locate past and present contaminant point-sources, review monitoring data, and recommend needed changes or additional monitoring sites.

Progress and significant results during fiscal year 1984: All data-collection activities were completed. Data-collection activities included analysis for total recoverable arsenic in about 1,200 soil samples collected following a stratified random sampling design; surface-water flow; sediment, and water chemistry data obtained during both normal and storm runoff periods at 11 sites; and the drilling and water-quality sampling of 38 monitoring wells. Although arsenic derived from the mill tailings is widely distributed throughout the lower Cheyenne River basin, significant impacts to surface- and ground-water quality are limited to Whitewood Creek and a portion of the Belle Fourche River.

Plans for 1985: Complete and publish basic data and interpretive reports.

EVALUATION OF POTENTIAL GROUND WATER SUPPLY FROM THE BEDROCK AQUIFERS IN THE RAPID CITY, SOUTH DAKOTA AREA (SD071)



Project leader: Kathy D. Peter

Project period: 1983-1984

Cooperator: U.S. Bureau of Reclamation.

Problem: There is no currently valid, comprehensive water-supply study available for the Rapid City area. In view of this, the U.S. Bureau of Reclamation has initiated a study to determine the long-range multiple-purpose water supply needs of the metropolitan and regional Rapid City area and to assess the capability of presently available supplies to meet the long-term needs. As a part of the study, the Bureau requested the South Dakota District to study and prepare a report describing the potential for municipal water supply from the Madison, Minnelusa, and Inyan Kara aquifers in the area.

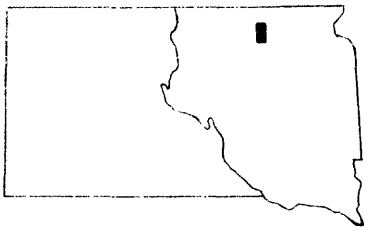
Objective: Interpret existing data and the results of previous investigations to prepare a report describing the potential for municipal water supply from the Madison, Minnelusa, and Inyan Kara aquifers in the Rapid City area.

Approach: The proposed study will rely almost entirely on existing data and the results of previous investigations as applied specifically to the Rapid City area. The model being developed for the Black Hills Hydrology Project will be used to estimate a ground-water budget and the possible well yields from the three aquifers. The report will include a general discussion of ground water-surface water relationships and recommendations for possible further studies.

Progress and significant results during fiscal year 1984: By assuming reasonable values for aquifer characteristics and boundary conditions, potential drawdown-discharge ratios for a well tapping the Madison aquifer were estimated. These estimates and reported well yields indicate that 5 to 10 cubic feet per second of water could be supplied by less than 5 wells, if they were constructed similarly to existing wells. A report was prepared and reviewed by the U.S. Bureau of Reclamation and the U.S. Geological Survey and is pending Director's approval.

Plans for 1985: Publish report.

HYDROLOGY OF THE GLACIAL AQUIFERS, ABERDEEN AREA, SOUTH DAKOTA (SD072)



Project leader: Patrick J. Emmons

Project period: 1983-1987

Cooperator: South Dakota Department of Water and Natural Resources.

Problem: Two glacial outwash aquifers in Brown County, the Elm and Middle James aquifers, can provide a major source of water in the area. With the anticipated large increases in water use from these aquifers, there is a need to better define the hydrologic system of these aquifers and to evaluate the effects of increased water demand on the water resources in this area.

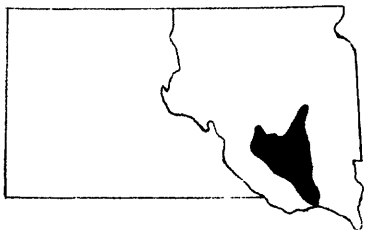
Objective: The objectives of the study are to define the ground-water system of the Elm and James River aquifers, and determine the hydrologic effects of the anticipated increases in water use in the aquifers.

Approach: Evaluate existing data and develop maps showing aquifer response to historical stress. Obtain current aquifer data and determine rates of recharge and discharge from existing hydrographs and precipitation records. Prepare maps of prepumping and current water tables, saturated aquifer thickness, and areal distribution of hydraulic coefficients. Prepare a hydrologic budget and develop a digital model to simulate the aquifer system. The USGS model will be used and modified as needed. The calibrated model will be used to determine long-term yield of the aquifer and to test selected pumping distribution plans. Prepare a report discussing the model and the evaluation of the ground-water system.

Progress and significant results during fiscal year 1984: The existing data on the glacial-aquifer system was compiled. Thirty-two test holes were drilled of which 22 were cased as observation wells. Twenty-four irrigation and other high-capacity wells were inventoried. An observation-well network of 22 wells was established.

Plans for 1985: Complete the inventory of irrigation and other high-capacity wells. Expand the observation-well network. Conduct an aquifer test, if possible. Make low-flow measurements on Elm Creek and the James River. Develop a conceptual model of the aquifer system and begin formating the aquifer data into a form which can be used to develop a 3-dimensional ground-water flow model of the study area.

CHANNEL CAPACITY OF THE JAMES RIVER FROM OLIVET, SOUTH DAKOTA, TO THE MOUTH (SD073)



Project leader: John R. Little

Project period: 1983-1984

Cooperator: Lower James Conservancy Sub-District.

Problem: Flooding frequently occurs along the James River in the 64-mile reach between Olivet and the mouth. It was anticipated that, with the closing of Gavins Point Dam on the Missouri River above Yankton, the Missouri River channel would cut deeper near the mouth of the James River and allow the James to degrade, improve its channel capacity, and reduce flooding. The degradation of the river bed has not occurred as far upstream as was expected so flooding is still a problem. Local government agencies have requested studies to attempt to define the causes of flooding in hopes of obtaining assistance from State, Federal, and other sources to reduce flooding.

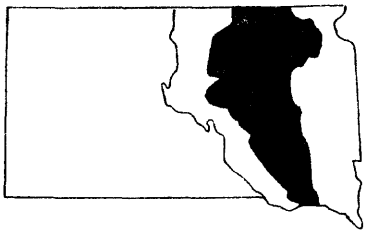
Objective: (1) Determine the capacity of the James River channel from Olivet, South Dakota, to its mouth near Yankton; (2) determine if constrictions occur in the channel and if so, their locations; and (3) determine the distance degradation of the bed has moved upstream from the mouth.

Approach: The USGS step-backwater computer program will be used to determine the elevations of the water-surface profiles at various discharges throughout the reach from Olivet to the mouth. This, in conjunction with cross-section data, will give an indication of how the channel capacity varies in the reach. Changes in the slope of the water-surface profiles should indicate the general locations of channel constrictions. An abrupt change in the slope of the water-surface profile may indicate the location of the end of bed degradation above the mouth. The final report will be a series of maps.

Progress and significant results during fiscal year 1984: Data collection completed and report near completion.

Plans for 1985: Complete and publish report.

DATA DEVELOPMENT AND ANALYSIS FOR USE IN THE U.S. BUREAU OF RECLAMATION MODEL ON THE JAMES RIVER IN SOUTH DAKOTA (SD074)



Project leader: Rick D. Benson

Project period: 1983-1984

Cooperator: U.S. Bureau of Reclamation.

Problem: The James River planning-flow model that will be developed by the U.S. Bureau of Reclamation will require, as input data, the non-regulated and regulated discharges at a number of locations along the James River.

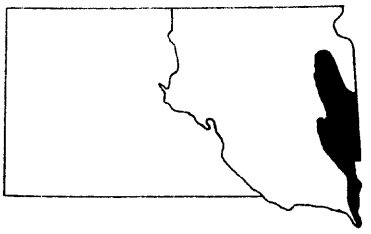
Objective: The purpose of this study will be to compile and analyze the monthly discharge data needed as input to the planning-flow model. Specific objectives are to: (1) Compute a regulated discharge for the period 1953-82 for two partial-record stations (Stratford and Mitchell), (2) compute unregulated discharge for eight James River locations, and (3) characterize the period of record in terms of the recorded climatological record.

Approach: Record extension will be accomplished by developing log-log regression between the monthly flows of James River at Ashton and near Stratford plus near Forestburg and near Mitchell. The unregulated flows will be computed by determining the effect of Sand Lake National Wildlife Refuge and then subtracting or adding the monthly effect to the regulated flows at stations downstream of the Refuge. Trend analyses will be used to characterize the 1953-82 climatic record in relation to the entire record.

Progress and significant results during fiscal year 1984: Monthly discharge data for the James River in South Dakota, needed for the planning flow model developed by the U.S. Bureau of Reclamation, was compiled and analyzed. A regulated discharge for two partial-record stations (Stratford and Mitchell) was computed, an unregulated discharge for eight locations on the James River was developed, a detailed mass balance computation on Sand Lake National Wildlife Refuge was completed, and the long-term climatological record was analyzed in order to characterize the period of record (1953-82).

Plans for 1985: Complete the report and attend meetings of the James River Technical Committee.

DETERMINATION OF DRAINAGE-BASIN AREA, BIG SIOUX RIVER BASIN, SOUTH DAKOTA (SD075)



Project leader: Neil C. Koch

Project period: 1984

Cooperator: U.S. Bureau of Reclamation.

Problem: The Big Sioux River basin contains a surface-water supply important to the economy of South Dakota. To aid in planning for development, an accurate determination of drainage areas for all basins and sub-basins is needed.

Objective: Delineate drainage basins and compute drainage-basin areas.

Approach: Using 7½-minute USGS topographic maps, delineate the three major basins, the sub-basins, and the noncontributing areas within the Big Sioux River basin in South Dakota. Areas will be determined by planimeter. A report will be prepared which describes the delineation process and tabulates the data keyed to a map of the drainage basins. The original 7½-minute topographic maps will be retained for future use by local, State, and Federal officials in planning water development.

Progress and significant results during fiscal year 1984: The drainage basins within the Big Sioux River basin were delineated and basin areas planimetered. A table was prepared giving the drainage basin name and area.

Plans for 1985: Complete and publish drainage basin map.

OTHER ACTIVITIES

Research and Technical Support

The national water-research program of the Geological Survey focuses on the ground- and surface-water systems. The program is active in the areas of water chemistry, geochemistry, ground-water hydrology, geomorphic and sediment processes, ecology, hydraulics, and hydrologic modeling. The knowledge and methodologies derived from the research effort are helpful in solving local water-resources problems and anticipating future water problems. In addition, the scientists and engineers engaged in research are available to Survey Districts and at no cost to state cooperators for consultation on local water problems in their field of expertise.

Instrumentation

Highly specialized instruments and instrumentation are an important aspect of hydrologic studies. The Water Resources Division is a recognized leader in the development of hydrologic instruments and sophisticated instrumentation techniques. The Survey's instrumentation services are focused at its Hydrologic Instrumentation Facility at the Gulf Coast Hydroscience Center, Bay St. Louis, Mississippi. The Center is responsible for all aspects of instrumentation including inventory; testing, repair and maintenance; evaluation of commercially available products; and overseeing the development of new instruments and equipment necessary to support USGS programs. The facility, which encompasses 40,000 square feet of space, employs about 50 full-and part-time employees. It is organizationally divided into a Technical Services Section, Repair and Calibration Section, Test and Evaluation Section, Instrument Development Laboratory, and a Field Service and Supply Section. As with the training and research activities, the Instrumentation Facility and its instrumentation expertise are available for consultation and advice to Survey Districts and cooperators.

Training

Many parts of the nationally recognized Water Resources Division training program at the U.S. Geological Survey National Training Center near Denver are available at no cost to cooperator personnel. The program consists of structured training courses, conferences and meetings, and self-paced video tape training. The objective of the program is to provide specialized training in many phases of hydrology and other subjects related to water-resources investigations which are not readily available from other sources.

The training courses are structured to include lectures, workshop problems, and field trips. The courses are of short duration, 2 days to 2 weeks in length, and are designed to present the maximum amount of instruction in the least amount of time. The subject matter of the courses pertains directly to activities of the student's job, therefore, instructor and student motivation in the classroom is extremely high.

The area around Denver provides the Center with field conditions representative of both plains and mountain environment. Thus, a wide variety of geologic and hydrologic characteristics is available for field trips and field problems.

Water Resources Division scientists and engineers serve as the main training staff for the training sessions. Experts from other divisions of the Geological Survey, other government agencies, universities, and industries, also serve as lecturers and special consultants.

Reports

Reports are the U.S. Geological Survey's most important products from hydrologic studies and data-collection activities. Knowledge acquired through research and investigation has no value to the public if it remains in office files or in the minds of scientists and engineers who did the work. Reports record the most significant information that has been collected and present the interpretations and conclusions reached. They form a permanent record and can be used by those who cannot come in personal contact with the people involved in the project.

Widespread respect for the U.S. Geological Survey is the result of its integrity and impartiality and its ability to release results of its investigations in a manner that serves the whole public rather than the interest of any special group or individual. For this purpose, the Geological Survey has devoted itself to the publication of reports that preserve and disseminate its findings. The publication outlets available to Water Resources Division authors include the Geological Survey's Federal book series, the map series, and slide cassettes or video-tape presentations. Authors also are encouraged to use non-survey outlets, such as scientific journals or privately published books.

Although there is usually a charge to the general public for copies of these reports, cooperating agencies are supplied with copies for their use at no charge.

PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY

General Information

The U.S. Geological Survey announces all its publications in a monthly report "New Publications of the Geological Survey." Subscriptions to this monthly listing are available upon request to the U.S. Geological Survey, 582 National Center, Reston, VA 22092. All publications are for sale unless specifically stated otherwise. Prices, which are subject to change, are not included here. Prepayment is required and information on price and availability should be obtained from listed sales offices before placing an order.

The "U.S. Geological Survey Yearbook" provides a comprehensive description of the Federal Government's largest earth-science agency; copies are available for fiscal years beginning with 1975 and may be purchased at the address where professional papers are sold (see below). Summaries of research in progress and results of completed investigations were formerly published each fiscal year in the professional paper series "Geological Survey Research" (see under heading "Professional Papers"). This series was discontinued in 1984. A pamphlet entitled "Geologic and Water-Supply Reports and Maps for South Dakota," which lists reports on the geology and water resources of South Dakota, is available upon request to the U.S. Geological Survey, 420 National Center, Reston, VA 22092.

Water-Resources Information

A monthly summary of the national water situation presented in the "National Water Conditions" (formerly called "Water Resoruces Review") is available on request to the U.S. Geological Survey, 420 National Center, Reston, VA 22092. Water-resources activity reports (similar to this one) are available for each of the 50 States and Puerto Rico and the Virgin Islands.

Beginning with the 1971 water year, streamflow data, water-quality data for surface and ground water, and ground-water level data for each State are combined and published in the annual series "U.S. Geological Survey Water-Data Reports." See section "U.S. Geological Survey Water-Data Reports available only through NTIS" for listing of these reports.

Records of discharge of streams, and contents (or stage) of lakes and reservoirs were first published in a series of USGS water-supply papers entitled, "Surface Water Supply of the United States." Through September 30, 1960, these water-supply papers were in an annual series and then in a multiyear series for 1961-65 and 1966-70. Records of chemical quality, water temperatures, and suspended sediment were published from 1941 to 1970 in an annual series of water-supply papers entitled, "Quality of Surface Waters of the United States." Records of ground-water levels were published from 1935 to 1974 in a series of water-supply papers entitled, "Ground-water levels in the United States." Water-supply papers may be consulted in the libraries of the principal cities in the United States or may be purchased from the Eastern Distribution Branch, U.S. Geological Survey, 604 South Pickett St., Alexandria, VA 22304. Pamphlets (mentioned under "General Information") listing the reports for each State by number and title may be obtained on request from that address also.

SELECTED LITERATURE ON WATER RESOURCES

Because the number of publications pertaining to water resources in South Dakota is large, the publications listed below were selected to show the types of information available to those interested in or in need of water facts. Many of these publications are available for inspection at the offices of the Geological Survey in Huron, Rapid City, and Pierre, and at large public and university libraries. The publications are grouped as follows: Publications of the U.S. Geological Survey (USGS); publications of State agencies prepared by or in cooperation with the U.S. Geological Survey; other publications, such as technical journals.

USGS Professional Papers.--Professional Papers are sold by the U.S. Geological Survey, Branch of Distribution, 604 South Pickett Street, Alexandria, VA 22304.

P 600-D. Temperature variations of deep flowing wells in South Dakota, by D. G. Adolphson and E. F. LeRoux, in Geological Survey Research 1968, Chap. D, by U.S. Geological Survey, p. D60-D62. 1968.

P 650-B. Effects of reservoir filling on a buried aquifer of glacial origin in Campbell County, South Dakota, by N. C. Koch, in Geological Survey Research 1969, Chap. B, by U.S. Geological Survey, p. B169-B173. 1969.

P 813-B. Summary appraisals of the Nation's ground-water resources--Upper Mississippi Region, by R. M. Bloyd, Jr. 1975.

P 813-K. Summary appraisals of the Nation's ground-water resources--Souris-Red-Rainy Region, by Harold O. Reeder. 1978.

P 813-Q. Summary appraisals of the Nation's ground-water resources--Missouri Basin Region, by O. James Taylor. 1978.

P 877. The Black Hills--Rapid City flood of June 9-10, 1972: A description of the storm and the flood, by F. K. Schwarz, M. S. Peterson, and others. 1975.

P 1015. Proceedings of the first annual William Pecora Memorial Symposium, October 1975, Sioux Falls, South Dakota, by P. W. Woll and W. A. Fischer, editors. 1977.

USGS Water-Supply Papers.--Water-Supply Papers are sold at the above-listed Alexandria, Va., address.

W 1137-A. Missouri River basin floods of April-May 1950 in North and South Dakota, by R. E. Oltman and others. 1951.

W 1260-B. Floods of April 1952 in the Missouri River basin. 1955.

W 1298. Reconnaissance of geology and ground water in the lower Grand River valley, South Dakota, by P. C. Tychsen and R. C. Vorhis, with a section on Chemical quality of the ground water, by E. R. Jochens. 1955.

W 1425. Ground water in the Crow Creek--Sand Lake area, Brown and Marshall Counties, South Dakota, by F. C. Koopman. 1957.

W 1460-G. Ground-water resources of the lower Niobrara River and Ponca Creek basins, Nebraska and South Dakota, by T. G. Newport, with a section on Chemical quality of the water, by R. A. Krieger. 1959.

W 1475-D. Geology and occurrence of ground water at Jewel Cave National Monument, South Dakota, by C. F. Dyer. 1961.

W 1531. Hydrology of the Upper Cheyenne River basin, by R. C. Culler, R. F. Hadley, and S. A. Schumm. 1961.

W 1534. Progress report on wells penetrating artesian aquifers in South Dakota, by R. W. Davis, C. F. Dyer, and J. E. Powell. 1961.

W 1539-T. Geology and ground-water resources of the Lake Dakota plain area, South Dakota, by W. B. Hopkins and L. R. Petri. 1963.

W 1769. Chemical quality of surface waters, and sedimentation in the Grand River drainage basin, North and South Dakota, by C. H. Hembree, R. A. Krieger, and P. R. Jordan. 1964.

W 1800. The role of ground water in the national water situation, by C. L. McGuinness. 1963.

W 1865. Water resources and geology of Mount Rushmore National Memorial, South Dakota, by J. E. Powell, J. J. Norton, and D. G. Adolphson. 1973.

W 2024. Water resources of the Big Sioux River valley near Sioux Falls, South Dakota, by D. G. Jorgensen and E. A. Ackroyd. 1973.

W 2090. Ground-water levels in the United States, 1967-71--north-central States. 1973.

W 2163. Ground-water levels in the United States, 1972-74, north-central States. 1977.

USGS Circulars.--Single copies of circulars still in print are available free from the above-listed Alexandria, Va., address.

C 54. Geology and ground-water hydrology of the Angostura irrigation project, South Dakota, by R. T. Littleton, with a section on Mineral quality of the waters, by H. A. Swenson. 1949.

C 201. Ground-water resources of the Rapid Valley unit, Cheyenne Division, South Dakota, by A. J. Rosier, with a section on Surface waters of Rapid Valley, by L. J. Snell. 1953.

C 270. Chemical quality of water and sedimentation in the Moreau River drainage basin, South Dakota, by B. R. Colby, C. H. Hembree, and E. R. Jochens. 1953.

C 676. Estimated use of water in the United States in 1970, by C. R. Murray and E. B. Reeves. 1972.

C 765. Estimated use of water in the United States in 1975, by C. R. Murray and E. B. Reeves. 1977.

C 1001. Estimated use of water in the United States in 1980, by W. B. Solley, E. B. Chase, and W. B. Mann IV. 1983.

Water-Resources Investigations Reports (WRIR) of the U.S. Geological Survey.--Reports in this series are available for inspection at the South Dakota and Reston, Va., offices of the U.S. Geological Survey. Selected reports may be purchased either as microfilm or hard copy from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161; the NTIS ordering number is given in parenthesis at the end of the citation. Reports not listing an NTIS ordering number can be purchased from the Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225. Further information about these reports may be obtained from the District Chief, WRD, Huron, South Dakota.

WRIR 35-74. A method for estimating magnitude and frequency of floods in South Dakota, by L. D. Becker. 1974. (PB-239 831/AS)

WRIR 80-80. Techniques for estimating flood peaks, volumes, and hydrographs on small streams in South Dakota, by L. D. Becker. 1980. (PB-81 136 145)

WRIR 80-100. Appraisal of the water resources of the Big Sioux aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota, by N. C. Koch. 1980. (PB-81 164 584)

WRIR 82-31. Magnitude and frequency of floods from selected drainage basins in South Dakota, by L. D. Becker. 1982. (PB 82-237470)

WRIR 82-4064. A digital-computer model of the Big Sioux aquifer in Minnehaha County, South Dakota, by N. C. Koch. 1983.

WRIR 83-4077. A preliminary assessment of the hydrologic characteristics of the James River in South Dakota, by R. D. Benson. 1983.

WRIR 83-4108. Water resources of Hanson and Davison Counties, South Dakota, by D. S. Hansen. 1983.

WRIR 83-4175. A two-dimensional, finite-difference model of the High Plains aquifer in southern South Dakota, by K. E. Kolm and H. L. Case III. 1983.

WRIR 83-4234. Evaluation of the response of the Big Sioux aquifer to extreme drought conditions in Minnehaha County, South Dakota, by N. C. Koch. 1983.

WRIR 84-4078. Appraisal of the water resources of the eastern part of the Tulare aquifer, Beadle, Hand, and Spink Counties, South Dakota, by L. K. Kuiper. 1984.

WRIR 84-4312. Effects of artificial recharge on the Big Sioux aquifer in Minnehaha County, South Dakota, by N. C. Koch. 1984.

USGS Water-Data Reports available only throught NTIS.--The water-data reports listed below may be purchased as hard copy or microfiche only from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161. They are available for inspection only at the South Dakota and Reston, Va., offices of the U.S. Geological Survey. The PB number in parenthesis is the NTIS ordering number.

SD-75-1 Water resources data for South Dakota--water year 1975, by U.S. Geological Survey. 1976. (PB-251 861/AS)

SD-76-1 Water resources data for South Dakota--water year 1976, by U.S. Geological Survey. 1977. (PB-266 453/AS)

SD-77-1 Water resources data for South Dakota--water year 1977, by U.S. Geological Survey. 1978. (PB-281 757)

SD-78-1 Water resources data for South Dakota--water year 1978, by U.S. Geological Survey. 1979. (PB-296 426)

SD-79-1 Water resources data for South Dakota--water year 1979, by U.S. Geological Survey. 1980. (PB80-195936)

SD-80-1 Water resources data for South Dakota--water year 1980, by U.S. Geological Survey. 1981. (PB82-101338)

SD-81-1 Water resources data South Dakota--water year 1981, by U.S. Geological Survey. 1982. (PB83-102715)

SD-82-1 Water resources data South Dakota--water year 1982, by U.S. Geological Survey. 1983. (PB84-117175)

SD-83-1 Water resources data South Dakota--water year 1983, by U.S. Geological Survey. 1984.

USGS Hydrologic Investigations Atlases.--Hydrologic Investigations Atlases (and other maps of areas west of the Mississippi River) are sold by the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

HA-195. Hydrogeology of the glacial drift in the Skunk Creek--Lake Madison drainage basin, southeastern South Dakota, by M. J. Ellis and D. G. Adolphson. 1965.

HA-311. Hydrology of a part of the Big Sioux drainage basin, eastern South Dakota, by M. J. Ellis, D. G. Adolphson, and R. E. West. 1968.

HA-355. Hydrology of the Rosebud Indian Reservation, South Dakota, by M. J. Ellis, J. H. Ficken, and D. G. Adolphson. 1971.

HA-357. Hydrology of the Pine Ridge Indian Reservation, South Dakota, by M. J. Ellis and D. G. Adolphson. 1971.

HA-499. Geohydrology of Crow Creek and Lower Brule Indian Reservations, South Dakota, by L. W. Howells. 1974.

HA-511. Flood of June 9-10, 1972, at Rapid City, South Dakota, by O. J. Larimer. 1973.

HA-585. Geohydrology of the Cheyenne River Indian Reservation, South Dakota, by L. W. Howells. 1979.

HA-644. Geohydrology of the Standing Rock Indian Reservation, North and South Dakota, by L. W. Howells. 1982.

USGS Hydrologic Unit Maps.--Hydrologic Unit Maps are sold at the above-listed Denver address.

U.S. Geological Survey, 1976, Hydrologic unit map--1974 State of South Dakota.

USGS Open-File Reports and Maps.--Open-file reports which may be in manuscript form generally are not reproduced and distributed in quantity. These reports are available for inspection in the Huron, South Dakota, and Reston, Va., offices of the U.S. Geological Survey. Most numbered open-file reports may be purchased from the Open-File Services Section (OFSS), Western Distribution Branch, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225. Information on the availability of the unnumbered reports may be obtained from the District Chief, USGS, Water Resources Division, Huron, South Dakota.

USGS Numbered Open-File Reports.--

70-194. A proposed streamflow-data program for South Dakota, by O. J. Larimer. 1970.

79-563. A geohydrologic overview for the Pecora Symposium field trip, June 1979, by N. C. Koch. 1979.

81-222. Water-level records for the Big Sioux aquifer, Minnehaha County, South Dakota, by W. L. Bradford. 1981.

81-627. Water levels in bedrock aquifers in South Dakota, by W. L. Bradford. 1981.

81-924. Records of water levels in unconsolidated deposits in eastern South Dakota, by W. L. Bradford. 1981.

82-1020. Records of water levels in the Big Sioux aquifer, Minnehaha County, South Dakota, by D. R. Winter. 1982.

83-207. Summary of water withdrawals in the United States, 1950-80, by W. B. Mann IV, W. B. Solley, and E. B. Chase. 1983.

83-754. Water resources investigations of the U.S. Geological Survey in South Dakota, project status summary, July 1, 1983, by E. F. LeRoux and E. M. Decker. 1983.

83-773. Streamflow and sediment data collected at seven stream-gaging stations in the James River basin downstream from Forestburg, S. Dak., from October 1, 1981, to September 30, 1983, by J. R. Little. 1983.

84-148. Geologic and hydrologic data from a test-drilling program in the High Plains area of South Dakota, 1979-80, by C. L. Loskot, H. L. Case, and D. G. Hern. 1984.

84-432. Flow-duration hydrographs for selected streamflow stations on South Dakota streams, by J. R. Little. 1984.

USGS Unnumbered Open-File Reports.--

Adolphson, D. G., and LeRoux, E. F., 1971, Head fluctuations in artesian wells in the northern Black Hills, South Dakota.

----- 1974, Water resources of the proposed Rockyford area additions to the Badlands National Monument, Shannon County, South Dakota.

----- 1974, Water-supply sites for Wind Cave National Park, Custer County, South Dakota.

Dingman, R. J., 1952, Supplement to the geology and ground-water hydrology of the Angostura irrigation project, South Dakota, with special emphasis on the drainage problem of Harrison Flats.

Ellis, M. J., and Adolphson, D. G., 1965, Ground-water resources at three towns on the Standing Rock Indian Reservation in South Dakota.

McCabe, J. A., and Crosby, O. A., 1959, Floods in North and South Dakota, frequency and magnitude.

Maclay, R. W., 1952, Occurrence of ground water in the Cheyenne River and Standing Rock Indian Reservations, North and South Dakota.

Powell, J. E., and Jorgensen, D. G., 1971, Approximate optimum yield of ground water from glacial outwash between Sioux Falls and Dell Rapids, South Dakota.

Rosier, A. J., 1952, Reconnaissance of the geology and ground-water hydrology of the Belle Fourche irrigation project, South Dakota.

Publications of the South Dakota Geological Survey prepared in cooperation with the U.S. Geological Survey.--Inquiries about these reports should be addressed to the South Dakota Geological Survey, Science Center, University of South Dakota, Vermillion, SD 57069.

Hamilton, L. J., 1982, Geology and water resources of McPherson, Edmunds, and Faulk Counties, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 26.

----- 1982, Geology and water resources of Clark County, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 29.

Howells, L. W., and Stephens, J. C., 1968, Water resources of Beadle County, South Dakota: South Dakota Geological Survey Bulletin 18.

Jorgensen, D. G., 1971, Geology and water resources of Bon Homme County, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 21.

Koch, N. C., 1970, Geology and water resources of Campbell County, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 20.

----- 1975, Geology and water resources of Marshall County, South Dakota: South Dakota Geological Survey Bulletin 23.

----- 1980, Geology and water resources of Hand and Hyde Counties, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 28.

Koch, N. C., and Bradford, Wendell, 1976, Geology and water resources of Brown County, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 25.

Kume, Jack, 1976, Geology and water resources of Charles Mix and Douglas Counties, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 22.

Lee, K. Y., and Powell, J. E., 1961, Geology and ground-water resources of the Flandreau area, Brookings, Moody, and Lake Counties, South Dakota: South Dakota Geological Survey Report of Investigations 87.

Rothrock, E. P., and Otten, E. G., 1947, Ground-water resources of the Sioux Falls area, South Dakota: South Dakota Geological Survey Report of Investigations 56, pts. 1 and 2.

Steece, F. V., and Howells, Lewis, 1965, Geology and ground-water supplies in Sanborn County, South Dakota: South Dakota Geological Survey Bulletin 17.

Stephens, J. C., 1967, Geology and water resources of Clay County, South Dakota--Pt. 2, Water resources: South Dakota Geological Survey Bulletin 19.

Other publications.--Address inquiries about the availability of these reports to the publishers.

Bugliosi, Edward F., 1980, Delineation of glaciofluvial aquifers using Landsat color composite imagery: Fifteenth International Symposium of Remote Sensing of Environment Proceedings.

Kerr, F. F., and others, 1968, How wells affect shallow ground-water supplies in South Dakota: Cooperative Extension Service Pamphlet EC667.

Koch, Neil C., 1970, A graphic presentation of stream gain or loss as an aid in understanding streamflow characteristics: Water Resources Research, v. 6, no. 1, p. 239-245.

----- 1983, Irrigation-water classification diagram for South Dakota: South Dakota Academy of Science Proceedings, v. 62, p. 107-114.

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Reports Pending Publication

In addition to the published reports listed above, the following reports have been approved and are in various stages of the publication process. Information on the avail ability of these reports can be obtained by contacting the District Chief, USGS, Water Resources Division, Huron, South Dakota:

Water-Resources Investigations Reports (WRIR) of the U.S. Geological Survey.

WRIR 84-4030. Water resources of Aurora and Jerauld Counties, South Dakota, by L. J. Hamilton.

WRIR 84-4069. Water resources of Deuel and Hamlin Counties, South Dakota, by Jack Kume.

WRIR 84-4195. Water resources of Hughes County, South Dakota, by L. J. Hamilton.

WRIR 84-4209. Water resources of Lake and Moody Counties, South Dakota, by D. S. Hansen.

WRIR 84-4241. Water resources of Yankton County, South Dakota, by E. F. Bugliosi.

WRIR 85-4015. Water resources of Walworth County, South Dakota, by Jack Kume and L. W. Howells.

WRIR 85-4021. Evaluation of techniques for mapping land and crops irrigated by center pivots from computer-enhanced Landsat imagery in part of the James River basin near Huron, South Dakota, by K. E. Kolm.

WRIR 85-4022. Availability and quality of water from the bedrock aquifers in the Rapid City area, South Dakota, by K. D. Peter.

WRIR 85-4053. Map showing the geological structure and the altitude of the top of the Minnelusa Formation in the northern Black Hills, South Dakota and Wyoming, and in the Bear Lodge Mountains, Wyoming, by K. D. Peter and D. P. Kyllonen.

WRIR 85-4069. Geochemical survey to determine water-quality characteristics of the Big Sioux aquifer in eastern South Dakota, by N. F. Leibbrand.

Publications of the South Dakota Geological Survey prepared in cooperation with the U.S Geological Survey.

Availability and quality of water from major aquifers in Hughes County, South Dakota, by L. J. Hamilton.

Major aquifers in Lake and Moody Counties, South Dakota, by D. S. Hansen.

Other publications.

A possible relation between lineaments and leakage through confining layers in South Dakota, by K. E. Kolm and K. D. Peter.

Geochemistry of lower Cretaceous sandstone aquifers in the northern Great Plains, by K. D. Peter.

Hydrology of the Inyan Kara and Dakota-Newcastle aquifer systems in South Dakota, by H. L. Case, III.