HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS

U.S. GEOLOGICAL SURVEY

Water–Resources Investigations 78–87

Prepared in cooperation
with the Kansas Water Resources Board

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Selected hydrologic data collected in the Soldier Creek basin in Kansas are available on magnetic tape in card-image format. Data on the tape include water discharge in fifteen-minute and daily intervals; rainfall in fifteen-minute and daily time intervals; concentrations and particle sizes of suspended sediment; particles sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents.

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By W. J. Carswell, Jr.

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July 1978

UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

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CONVERSION TABLE

For those users of this report who may wish to convert U.S. customary units to metric units, the following factors and standard abbreviations are given:

U.S. customary units	Multiply by	Metric units
inch (in)	25.4	millimeter (mm)
foot (ft)	.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	4,047	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	.02832	cubic meter per second (m^3/s)
acre-feet per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
ton per day	.9072	ton per day

HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS

W. J. Carswell Jr.

ABSTRACT

Selected hydrologic data collected in the Soldier Creek basin in Kansas are available on magnetic tape in card-image format. Data on the tape include water discharge in fifteen-minute and daily time intervals; rainfall in fifteen-minute and daily time intervals; concentrations and particle sizes of suspended sediment; particle sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents.

INTRODUCTION

A hydrologic-data-collection system was designed and installed in the Soldier Creek basin in a rural area in northeastern Kansas. The major thrust of data collection began in the 1964 water year. The study was made by the U.S. Geological Survey in cooperation with the Kansas Water Resources Board with support from the Kansas Geological Survey and the Kansas Department of Health and Environment.

The data-collection system includes: (1) 7 recording streamflow stations; (2) 5 recording rainfall stations; (3) 51 nonrecording rainfall stations located within and adjacent to the basin; (4) 31 ground-water observation wells (two recording); and (5) intermittent chemical quality of water and sediment sampling sites.

Selected hydrologic data collected in the basin have been stored in card-image format on an accompanying magnetic tape. Data on the tape include water discharge in 15-minute and daily time intervals; rainfall in 15-minute and daily time intervals; concentrations and particle sizes of suspended sediment; particle sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents.

Examples of the information on magnetic tape for each type of data collected are presented in computer-printout format in the section following the "CARD-IMAGE FORMATS".

EXPLANATION OF RAINFALL RECORDS

Information on the quantity and areal distribution of rainfall during the period of study was collected at 56 sites in and adjacent to the Soldier Creek basin. Five of the rainfall-data sites were located at streamflow-gaging stations, and the remainder were located at selected sites in or adjacent to the basin.

Recording Gages

Dual-purpose installations for collecting rainfall data simultaneously with river-stage data were located at the streamflow-gaging stations (fig. 1), described in the following sections near Goff, Bancroft, Soldier, Circleville, and St. Clere. Both digital-punch recorders for collecting rainfall data and river-stage data at each station were operated by the same timer (15-minute punch interval) to eliminate time differences. Prior to April 1969, the rainfall at these gage installations was recorded to an accuracy of 0.02 inch. As a result of changing the drive ratios in April 1969, the accuracy was increased to 0.01 inch.

Nonrecording Gages

During the period of study, 51 nonrecording rainfall gages were installed at selected sites in or adjacent to the basin. These rainfall gages were operated by local observers on a daily basis, except during the winter months (November through March). All observers were instructed to read the gage as near to 7:00 a.m. as possible, record the rainfall to the nearest 0.01 inch for the preceding 24 hours on the day that the gage is read, and record the hours when it rained.

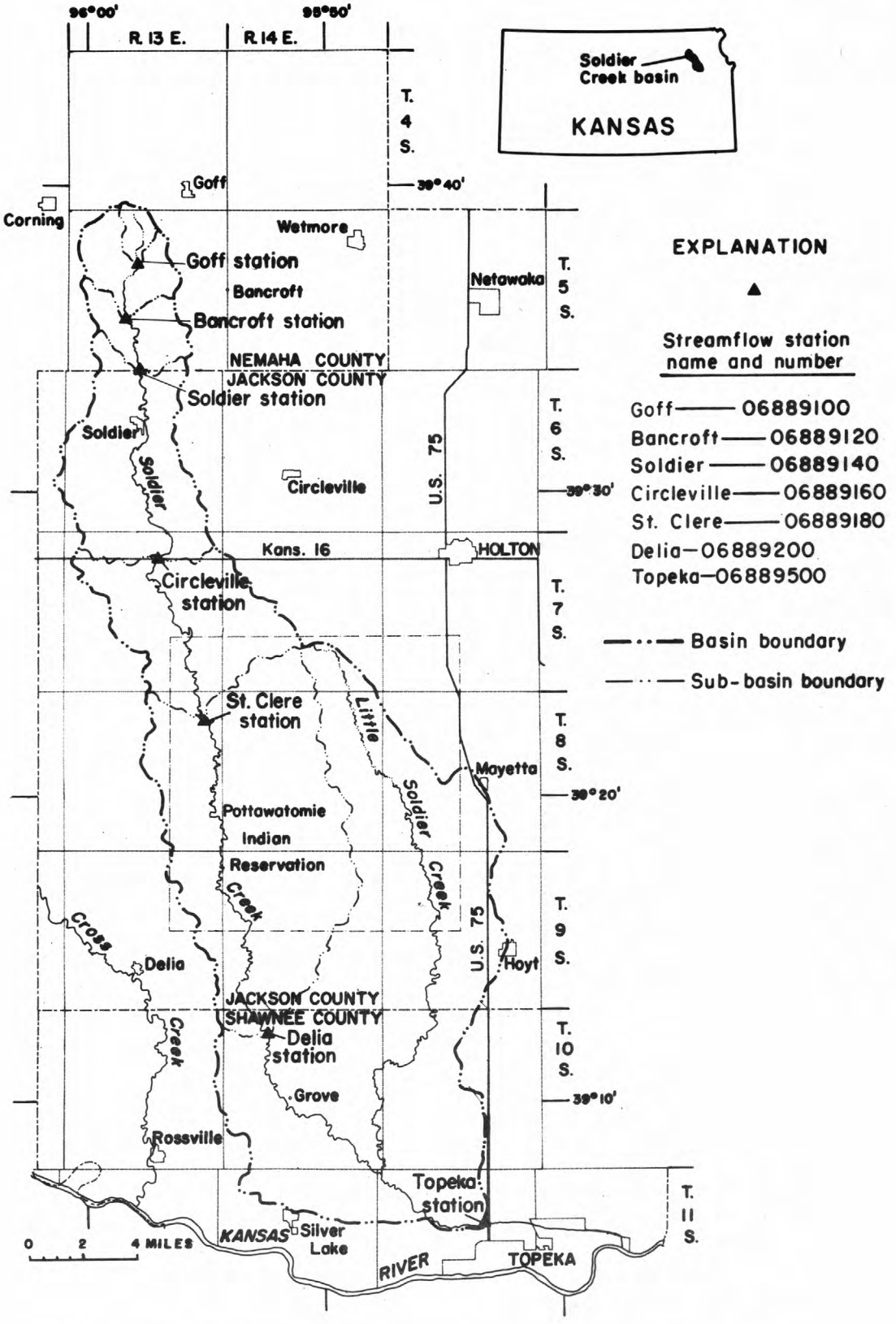

Figure 1.--Location of streamflow-gaging stations.

EXPLANATION OF WATER-DISCHARGE RECORDS

Collection and Computation of Data

The base data collected at the stream-gaging stations consisted of records of stage and measurements of discharge. In addition, observations of factors affecting the stage-discharge relation, weather records, and other information were collected to supplement base data in determining the daily flow. Records of stage were obtained from a water-stage recorder that provided either a continuous graph of the fluctuations or a tape punched at 15-minute time intervals. Measurements of discharge were made using the general methods adopted by the U.S. Geological Survey, as described by Carter and Davidian (1968), Buchanan and Somers (1968), and Buchanan and Somers (1969).

Stage-discharge relation curves were prepared for each stream-gaging station, and rating tables were computed to provide the discharge for any given stage. When rating curves were necessary to express discharge greater than measured, extensions were made on the basis of indirect measurements of peak discharge and logarithmic plotting. The instantaneous and daily mean discharges were computed from gage heights and rating tables. If the stage-discharge relation was subject to change because of frequent or continual change in the physical features that form the control, the discharge was computed by the shifting-control method in which correction factors, based on individual discharge measurements and notes by engineers and observers, were used in applying the gage heights to the rating tables.

The stage-discharge relation was affected by ice at times in the winter, and it was impossible to compute discharge in the usual manner. Discharge for periods of ice effect was computed on the basis of the gage-height record, occasional winter discharge measurements, available information of temperature and precipitation, notes by gage observers and hydrologists, and comparable records of discharge for other stations in the same or nearby basins.

There were periods when the recorded gage height was so faulty that the stage could not be used to compute discharge values. The daily discharges during these periods were estimated on the basis of recorded range in stage, prior and subsequent records, discharge measurements, weather records, and comparison with records for other stations in the same or nearby basins.

The description of each gaging station (table 1) gives the designated station number, location, drainage area, period of record, type and history of gages, general remarks, average discharge, and extremes of discharge. The location of the gaging station and the drainage area are obtained from the most accurate maps available. River mileage, given under "LOCATION", is the distance from the station to the mouth of Soldier Creek, as determined by the U.S. Army Corps of Engineers. Periods for which there are published records for the present station or for stations generally equivalent to the present one are given under "PERIOD OF RECORD."

Table 1.--Description of stream-gaging stations.

06889100 SOLDIER CREEK NEAR GOFF, KS

LOCATION.--Lat 39°37'27", long 95°57'57", in NW¼NW¼NE¼ sec.16, T.5 S., R.13 E., Nemaha County, Hydrologic Unit 10270102, 20 ft downstream from highway bridge, 3.3 mi southwest of Goff, and at mile 71.9.
DRAINAGE AREA.--2.06 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--March 1964 to September 1976.
GAGE.--Water-stage recorder. Datum of gage is 1,297.10 ft above NGVD of 1929.
REMARKS.--Records fair.
AVERAGE DISCHARGE.--12 years, 1.17 ft^3/s, 848 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,080 ft^3/s May 10, 1970, gage height, 15.18 ft, from rating curve extended above 250 ft^3/s on basis of slope-area measurement of peak flow; no flow at times in most years.

06889120 SOLDIER CREEK NEAR BANCROFT, KS

LOCATION.--Lat 39°35'42", long 95°58'16", in NE¼NW¼NW¼ sec.28, T.5 S., R.13 E., Nemaha County, Hydrologic Unit 10270102, at downstream side of highway bridge, 4.0 mi west of Bancroft, and at mile 68.7.
DRAINAGE AREA.--10.5 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--March 1964 to September 1976.
GAGE.--Water-stage recorder. Datum of gage is 1,239.50 ft above NGVD of 1929.
REMARKS.--Records fair.
AVERAGE DISCHARGE.--12 years, 5.91 ft^3/s, 4,280 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,100 ft^3/s May 10, 1970, gage height, 16.09 ft, from rating curve extended above 1,500 ft^3/s on basis of contracted-opening and flow-over-road measurement of peak flow; no flow at times in most years.

06889140 SOLDIER CREEK NEAR SOLDIER, KS

LOCATION.--Lat 39°33'57", long 95°57'45", in NW¼NE¼NE¼ sec.4, T.6 S., R.13 E., Jackson County, Hydrologic Unit 10270102, at downstream side of highway bridge, 2.0 mi north of Soldier, and at mile 65.7.
DRAINAGE AREA.--16.9 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--March 1964 to September 1976.
GAGE.--Water-stage recorder. Datum of gage is 1,206.02 ft above NGVD of 1929.
REMARKS.--Records fair.
AVERAGE DISCHARGE.--12 years, 9.02 ft^3/s, 6,530 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,700 ft^3/s May 10, 1970, gage height, 16.46 ft, from rating curve extended above 1,200 ft^3/s on basis of contracted-opening measurement of peak flow; no flow at times in 1966-68, 1972.

06889160 SOLDIER CREEK NEAR CIRCLEVILLE, KS

LOCATION.--Lat 39°27'47", long 95°57'00", in NW¼NW¼NE¼ sec.10, T.7 S., R.13 E., Jackson County, Hydrologic Unit 10270102, 160 ft downstream from bridge on State Highway 16, 5.8 mi southwest of Circleville, and at mile 55.2.
DRAINAGE AREA.--49.3 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--March 1964 to September 1976.
GAGE.--Water-stage recorder. Datum of gage is 1,094.58 ft above NGVD of 1929.
REMARKS.--Records fair.
AVERAGE DISCHARGE.--12 years, 30.3 ft^3/s, 21,950 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,570 ft^3/s May 10, 1970, gage height, 19.95 ft; minimum, 0.14 ft^3/s Mar. 7, 1967.

06889180 SOLDIER CREEK NEAR ST. CLERE, KS

LOCATION.--Lat 39°22'33", long 95°55'05", in NW¼NE¼NW¼ sec.12, T.8 S., R.13 E., Jackson County, Hydrologic Unit 10270102, at upstream side of highway bridge, 7.8 mi east of St. Clere, and at mile 44.5.
DRAINAGE AREA.--80 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--March 1964 to September 1976.
GAGE.--Water-stage recorder. Datum of gage is 1,023.04 ft above NGVD of 1929.
REMARKS.--Records fair.
AVERAGE DISCHARGE.--12 years, 51.0 ft^3/s, 36,950 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,430 ft^3/s June 12, 1967, gage height, 21.41 ft; maximum gage height, 21.54 ft Sept. 21, 1965; no flow for part of Apr. 9, 1964 (result of beaver activity upstream).

06889200 SOLDIER CREEK NEAR DELIA, KS

LOCATION.--Lat 39°12'08", long 95°52'25", in NE¼NW¼NE¼ sec.8, T.10 S., R.14 E., Shawnee County, Hydrologic Unit 10270102, at upstream side of highway bridge, 5.1 mi upstream from Walnut Creek, 5.5 mi southeast of Delia, and at mile 21.9.
DRAINAGE AREA.--157 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--October 1958 to September 1976.
GAGE.--Water-stage recorder. Datum of gage is 931.34 ft above NGVD of 1929.
REMARKS.--Records good.
AVERAGE DISCHARGE.--18 years, 89.0 ft^3/s, 64,480 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,580 ft^3/s June 12, 1967, gage height, 21.45 ft; maximum gage height, 21.57 ft Aug. 10, 1968; no flow Sept. 10-12, 1976.
EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum stage known since at least 1909, about 24 ft June 21, 1951 from floodmarks and information by local residents.

06889500 SOLDIER CREEK NEAR TOPEKA, KS

LOCATION.--Lat 39°06'00", long 95°43'27", in SW¼NW¼NW¼ sec.14, T.11 S., R.15 E., Shawnee County, Hydrologic Unit 10270102, at downstream side of highway bridge, 1.5 mi upstream from Halfday Creek, 4.0 mi northwest of Topeka, and at mile 6.0.
DRAINAGE AREA.--290 mi^2.

Water-Discharge Records

PERIOD OF RECORD.--May 1929 to September 1932, August 1935 to September 1976. Prior to October 1935, published as "at Topeka". Records for October 1932 to July 1935, published in WSP 746, 761, and 786, have been found to be unreliable and should not be used.
GAGE.--Water-stage recorder. Datum of gage is 862.95 ft above NGVD of 1929. Prior to July 27, 1935, chain gage at site 2.0 mi downstream at different datum. Aug. 1, 1935, to June 16, 1958, nonrecording gage and June 17, 1958, to May 24, 1960, water-stage recorder, at present site and datum 4.0 ft higher. May 25, 1960, to June 8, 1961, nonrecording gage at site 1.1 mi downstream at datum 1.79 ft lower.
REMARKS.--Records good.
AVERAGE DISCHARGE.--44 years, 136 ft^3/s, 98,530 acre-ft/yr.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,800 ft^3/s Oct. 11, 1973, gage height, 23.91 ft, backwater from Kansas River; maximum gage height, 29.06 ft July 12, 1951, datum then in use, from floodmark, backwater from Kansas River; no flow at times in 1931, 1935-40, 1953-57, 1966.

The type of gage currently in use, the datum of the present gage, and a condensed history of the types, locations, and datums of previous gages used during the period of record are given under "GAGE." References to datum of gage denote NGVD (National Geodetic Vertical Datum) of 1929.

Accuracy of Field Data and Computed Results

The accuracy of streamflow data depends primarily on (1) the stability of the stage-discharge relation, or the frequency of discharge measurements if the control is unstable, and (2) the accuracy of observations of stage, measurements of discharge, and interpretations of records.

The station description under "REMARKS" states the degree of accuracy of the records. "Good" means that about 95 percent of the discharges are within 10 percent; and "fair" within 15 percent.

Figures of daily mean discharge and instantaneous discharge in this report are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to 3 significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the figure, rather than on accuracy. In the 1975 and 1976 water years, some instantaneous discharges of less than 100 ft^3/s are shown to hundredths of a cubic foot per second, as a result of a format change that does not indicate accuracy.

EXPLANATION OF WATER-QUALITY RECORDS

Collection and Analysis of Data

Water-quality samples, collected and analyzed for this study, were obtained intermittently at selected sites throughout the basin. The methods used for collecting and analyzing water samples are described in Brown, Skougstad and Fishman (1970). The water quality of a stream at a given time can be defined adequately from one sample if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream.

Data on water quality in this report are considered to be the most representative values available for the stations. The values reported represent physical and chemical conditions at the time of sampling, consistent with the limitations of available sampling techniques and methods of analysis. Concentrations of selected chemical constituents are listed in mg/L (milligrams per liter) or in ug/L (micrograms per liter).

Sediment Analysis

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers and single-stage samplers. The methods used for collecting and analyzing the sediment samples are described by Guy (1969) and Guy and Norman (1970). Data collected periodically represent conditions only at the time of observations. In addition to the records showing the concentrations of suspended sediment, records of periodic collection and analysis of the particle-size distribution of the suspended sediment and bed material are included.

EXPLANATION OF GROUND-WATER RECORDS

In August 1963, observation wells were installed to measure the water-table altitude in the alluvial deposits beneath the flood plain of Soldier Creek. At the streamflow-gaging sites near Goff, Bancroft, Soldier, Circleville, St. Clere, and Delia, wells were located in a line approximately perpendicular to the stream. Holes were bored to bedrock, and 1.00- or 1.25-inch pipes with 2-foot lengths of screen generally were installed for water-level measurements on a monthly basis. Two wells at the St. Clere site were cased with 5-inch pipe and equipped with floats connected to graphic recorders for continuous measurements. Measurements of water levels in observation wells are referenced to LSD (land-surface datum), which is approximately the land surface at each well. Measurements were made from a fixed point, which may be a short distance above or below land surface, and adjusted so that the water levels are reported in feet below LSD.

SPECIFICATIONS OF HYDROLOGIC-DATA TAPE

9-Track	ASCII
800 BPI	80 BYTE Records
Block Size = 4,000 BYTES	60,799 Records (Card Images)
Labeled	

INDEX OF STATION RECORDS

Goff Streamflow Gage

Data type	Record number
Fifteen-minute rainfall	1-1630
Fifteen-minute discharge	1631-3899
Daily rainfall	3900-4104
Daily discharge	4105-4708
Suspended-sediment concentration	4709-4785
Particle-size analysis; suspended sediment	4786-4791
Particle-size analysis; bed material	4792-4794
Ground-water level	4795-4938

Bancroft Streamflow Gage

Fifteen-minute rainfall	4939-7093
Fifteen-minute discharge	7094-10251
Daily rainfall	10252-10491
Daily discharge	10492-11095
Suspended-sediment concentration	11096-11194
Particle-size analysis; suspended-sediment	11195-11201
Particle-size analysis; bed material	11202-11204
Ground-water level	11205-11372

Soldier Streamflow Gage

Fifteen-minute rainfall	11373-13422
Fifteen-minute discharge	13423-17214
Daily rainfall	17215-17449
Daily discharge	17450-18053
Suspended-sediment concentration	18054-18146
Particle-size analysis; suspended sediment	18147-18150
Particle-size analysis; bed material	18151-18153
Ground-water level	18154-18334

Circleville Streamflow Gage

Fifteen-minute rainfall	18335-20066
Fifteen-minute discharge	20067-25212
Daily rainfall	25213-25429
Daily discharge	25430-26033
Suspended-sediment concentration	26034-26155
Particle-size analysis; suspended sediment	26156-26165
Particle-size analysis; bed material	26166-26169
Ground-water level	26170-26351

St. Clere Streamflow Gage

Data type	Record number
Fifteen-minute rainfall	26352-27973
Fifteen-minute discharge	27974-34014
Daily rainfall	34015-34209
Daily discharge	34210-34813
Suspended-sediment concentration	34814-34906
Particle-size analysis; suspended sediment	34907-34919
Particle-size analysis; bed material	34920-34922
Ground-water level	34923-35432

Delia Streamflow Gage

Fifteen-minute discharge	35433-43363
Daily discharge	43364-44227
Chemical quality of water	44228-44991
Suspended-sediment concentration	44992-45063
Particle-size analysis; suspended sediment	45064-45075
Particle-size analysis; bed material	45076-45078
Ground-water level	45079-45276

Topeka Streamflow Gage

Fifteen-minute discharge	45277-52672
Daily discharge	52673-54792
Supended-sediment concentration	54793-54799
Particle-size analysis; suspended sediment	54800-54802
Particle-size analysis; bed material	54803

Observer Rainfall Gages

Daily rainfall	54804-60307

Chemical Quality of Water

Physical characteristics and chemical concentrations	60308-60799

Fifteen-Minute Rainfall

Column	Explanation
1-8	Station number
9-10	Last two digits of the calendar year
11-12	Month number
13-14	Day
15-16	Time increment - 15 minutes
17-18	Sequence number

Sequence no.	Time period
01	0015 hrs through 0300 hrs
02	0315 0600
03	0615 0900
04	0915 1200
05	1215 1500
06	1515 1800
07	1815 2100
08	2115 2400

19-78	Rainfall data, one value for each 5 columns. Data are right justified in field without decimal; i.e., 115 indicates 1.15 inches of rainfall occurred in that 15-minute time period. If 999 is in the field, the data are missing. If no data appear between a series of 999's, then no data are available for that period.
79	Blank
80	Data type - 1 indicates unit rainfall.

Daily Rainfall; Recording Gage

1-8	Station number
9-10	Last two digits of the calendar year
11-12	Month number
13	Sequence number - the number 1 is used for the first 16 days of month and number 2 for the remaining days of the month.
14-77	Daily rainfall is listed without decimal to hundredths of an inch for first 16 days of the month on sequence number 1 and daily rainfall for remaining days of the month on sequence number 2 using 4 columns for each day, right justified.
78-79	Blank
80	Data type - 3 indicates daily rainfall.

Observer Daily Rainfall

Column	Explanation
1-8	Station number
9-10	Last two digits of the calendar year
11-12	Month number
13	Sequence number - the number 1 is used for the first 16 days of the month and number 2 for the remaining days of the month.
14-77	Daily rainfall is listed with decimal to hundredths of an inch for first 16 days of the month on sequence number 1 and daily rainfall for remaining days of the month on sequence number 2 using 4 columns for each day, right justified.
78-80	Blank

Fifteen-Minute Discharge

1-8	Station number
9-10	Last two digits of the calendar year
11-12	Month number
13-14	Day
15-16	Time increment - 15 minutes
17-18	Sequence number

Sequence no.	Time period
01	0015 hrs through 0300 hrs
02	0315 0600
03	0615 0900
04	0915 1200
05	1215 1500
06	1515 1800
07	1815 2100
08	2115 2400

19-78	Discharge data, one value for each 5 columns. Data are right justified in field. Decimal is used if required for values less than 10 ft^3/s. A field with 999 indicates no data are available.
79	Blank
80	Data type - 2 indicates unit discharge.

Daily Discharge

Column	Explanation
1	Data type - 3 in this column indicates daily discharge.
2-16	Station identification number right justified.
17-20	Calendar year
21-22	Month number
23-24	Sequence number - A two-digit number representing the days of the month for which data are given. This number represents the days as follows:

Sequence no.	Days
01	1-8
02	9-16
03	17-24
04	25-31

25-80	Daily values - Eight seven-column fields in which the daily values are listed for the designated days. The value in ft^3/s is listed with decimal point and significant digits to the right of the decimal point where needed.

Quality of Water

1	Data type - 2 indicates chemical quality of water data
2-16	Station number
17-18	Last two digits of the calendar year
19-20	Month number
21-22	Day
23-28	Blank
29-32	Time of sample collection (24-hour time)
33-37, 45-49, 57-61, 69-73	Parameter code. (See parameter code list on following page)
38-41, 62-65, 74-77	Data value. Data are entered in field 50-53, without decimal. Implied decimal is to left of field; i.e., 2600 indicates .2600.
42-43, 54-55, 66-67, 78-79	Exponent, base 10, for data value; i.e., 04 indicates 10^4.
44,56, 68,80	Blank

Parameter Codes

Parameter code	Constituents
00010	Temperature of water, in degrees Celsius (C)
00027	Sample collected by U.S. Geological Survey
00028	Sample analyzed by Kansas Department of Health and Environment
00061	Instantaneous stream discharge in ft^3/s
00070	Turbidity in Jackson Turbidity Units
00095	Specific conductance (Micromhos per centimeter at 25°C)
00400	pH in standard units
00410	Total alkalinity as $CaCO_3$ mg/L
00440	Bicarbonate (HCO_3) mg/L
00445	Carbonate (CO_3) mg/L
00650*	Dissolved phosphate (PO_4) mg/L
00651	Total phosphate (PO_4) mg/L
00900	Hardness as $CaCO_3$ (Ca,Mg) mg/L
00902	Noncarbonate hardness as $CaCO_3$ mg/L
00915	Dissolved calcium (Ca) mg/L
00925	Dissolved magnesium (Mg) mg/L
00930	Dissolved sodium (Na) mg/L
00935	Dissolved potassium (K) mg/L
00940	Dissolved chloride (Cl) mg/L
00945	Dissolved sulfate (SO_4) mg/L
00950	Dissolved fluoride (F) mg/L
00955	Dissolved silica (SiO_2) mg/L
01020	Dissolved boron (B) ug/L
01046	Dissolved iron (Fe) ug/L
01056	Dissolved manganese (Mn) ug/L
70300	Dissolved solids (Residue on evaporation at 180°C) mg/L
70301	Dissolved solids (Sum of constituents) mg/L
71851**	Dissolved nitrate (NO_3) mg/L

* To convert phosphate (PO_4) to phosphorus (P) use 0.3261
** To convert nitrate (NO_3) to nitrogen (N) use 0.2259

Suspended-Sediment Concentration

Column	Explanation
1-8	Station number
9-10	Last two digits of the calendar year
11-12	Month number
13-14	Day
15	Blank
16-19	Time sample was taken (24-hour time)
20-21	Blank
22-25	Water temperature in degrees Celsius (C)
26-28	Blank
29-37	Discharge in cubic feet per second at the time of the sample
38	Blank
39-44	Suspended-sediment concentration in milligrams per liter
45	Blank
46-56	Suspended-sediment discharge in tons per day
57-80	Blank

Particle-Size Analysis; Suspended Sediment

1	Data type - 1 indicates particle-size analysis of suspended sediment.
2-9	Station number
10-11	Last two digits of the calendar year
12-13	Month number
14-15	Day
16-19	Time sample was taken (24-hour time)
20-23	Water temperature in degrees Celsius (C)
24-33	Discharge in cubic feet per second at the time of the sample
34-40	Suspended-sediment concentration in milligrams per liter
41-73	Percentage of sample with fall diameter finer than indicated size in millimeters. Columns 41-43, finer than 0.002; 44-46, finer than 0.004; 47-49, finer than 0.008; 50-52, finer than 0.016; 53-55, finer than 0.032; 56-58, finer than 0.062; 59-61, finer than 0.125; 62-64, finer than 0.250; 65-67, finer than 0.500; 68-70, finer than 1.000; and 71-73, finer than 2.000.
74-78	Method of analysis of sample. C, chemically dispersed; P, pipet; V, visual accumulation tube; W, in distilled water.
79-80	Blank

Particle-Size Analysis; Bed Material

Column	Explanation
1	Data type - B indicates particle-size analysis of bed material or bank material sample.
2-9	Station number
10-11	Last two digits of the calendar year
12-13	Month number
14-15	Day
16-19	Time sample was taken (24-hour time)
20-23	Water temperature in degrees Celsius (C)
24-33	Discharge in cubic feet per second at the time of the sample.
34-35	Number of sampling points from which the analysis is run.
36-53	Percentage of sample with fall diameter finer than indicated size in millimeters. Columns 36-38, finer than 0.004; 39-41, finer than 0.062; 42-44, finer than 0.125; 45-47, finer than 0.250; 48-50, finer than 0.500; and 51-53, finer than 1.000.
54-68	Percentage of sample with sieve diameter finer than indicated size in millimeters. Columns 54-56, finer than 2.000; 57-59, finer than 4.000; 60-62, finer than 8.000; 63-65, finer than 16.000; and 66-68, finer than 32.000.
69-73	Method of analysis of sample. C, chemically dispersed; P, pipet; S, sieve; V, visual accumulation tube; W, in distilled water.
74-80	General location sample was taken. Channel - sample taken of bed material in the low-water channel. L. Bank - sample taken of material representative of the left bank. R. Bank - sample taken of material representative of the right bank.

Ground-Water Level

Type I Format

Column

1-2 State code - 18 indicates Kansas.

3-4 County code - 43 Jackson County
66 Nemaha County
89 Shawnee County

5-11 Latitude - Lat. 39°27'29"N will appear as follows:

col.	5	6	7	8	9	10	11
Lat.	3	9	2	7	2	9	N

12-18 Longitude - Long. 95°58'02" will appear as follows:

col.	12	13	14	15	16	17	18
Long.	0	9	5	5	8	0	2

19 Sequential well number. Number 1 is given to the first well for which a record is obtained in the quadrangle designated by the latitude and longitude. (Normally this will be a 1-second square quadrangle.) Additional inventoried wells that are referenced to the same coordinates are numbered sequentially.

20-33 Township, range, and section location. Columns 20-22 are for the township; 23-27 are for the range; 28-29 are for the section. Columns 30-32 are used as follows: first letter. 160-acre tract (quarter section); second letter, 40-acre (quarter-quarter section); third letter, 10-acre tract (quarter-quarter-quarter section). The 160-acre, 40-acre, and 10-acre tracts are designated A, B, C, and D in a counterclockwise direction beginning in the northeast corner. For example, well 5-13E-9CDD is in the SE¼SE¼SW¼ sec.9, T.5 S., R.13 E. Column 33 is used for the sequential number. When two or more wells are located in the same 10-acre tract, the wells are numbered serially in the order they were inventoried.

34-55 Owner

56-60 Distance, in feet, and direction that well is located from the wire-weight gage, which is located on the bridge approximately above the low-water channel.

61-67 Altitude of land surface datum in hundredths of feet above mean sea level. For example, 101236 means 1012.36 feet.

68 Water table or artesian well. "W" for water table, "A" for artesian.

69 The purpose for which water from the well is used. Water use codes are: H, domestic; I, irrigation; S, stock supply; U. used; Z, other.

70 The principal use of the well, or purpose for which the hole was drilled. Use of well codes are: O, observation; T, test hole; U, unused; Z, destroyed.

71-76 Geologic unit - Columns 71-73 show value 014 designating Wisconsin age; 74-76 show value 010 designating terrace deposit.
77-79 Blank
80 Column 80 contains a 1.

Type 2 Format

1-19 Columns 1-19 designate location as on format type 1.
20-24 Columns 20-24 indicate the depth of the well in tenths of feet. For example, 543 means 54.3 feet.
25-29 Columns 25-29 indicate the distance of the measuring point in in hundredths of feet above land surface at the well. For example, 237 means 2.37 feet.
30-77 These columns show the years for which data are available, identified by the last two digits of the calendar year. The first year is coded in columns 31 and 32. If a comma (,) follows a designated year and the comma is in turn followed by another year, data are not available for the years between those separated by the comma. If a dash (-) is between two years, data are available for those years and all years in between. If a year is followed by a dash (-) and the dash is followed by blanks, data are available from the initial year through 1976.
78-79 Blank
80 Column 80 contains a 2.

Type 3 Format

1-19 Columns 1-19 designate location as on format types 1 and 2.
21-70 Columns 21-70 are used for descriptive data concerning the well.
71-78 Blank
79-80 Columns 79-80 designate card-image sequence numbers beginning with 3. Columns 79-80 are left blank on the last card image of the descriptive data.

Type 4 Format

Column	
1-19	Columns 1-19 designate location as on format types 1, 2, and 3.
20-25, 34-39, 48-53, 62-67	Date of water-level measurement coded by month, day, and last two digits of calendar year. Numbers are right justified.
26,40, 54,68	Indicate whether subsequent water level is above (+ sign) or below (column blank) land surface.
29-32, 43-46, 57-60, 71-74	Distance to the water level measured to the 0.01 foot below land land surface. For example, 1035 means 10.35 feet. If accuracy is less than hundredths, unused columns are blank.
33,47, 61,75	Indicate the status of the well at the time of measurement. Blank, undisturbed water level; F, dry; and J, malfunction of recording equipment.
76	Column 76 indicates type of measurement. An A in this column indicates measured accuracy within 1 foot.
77	Column 77 indicates frequency of measurements. An I in this column indicates intermittent or irregular measurements.
78-80	Columns 78-80 are used for card-image sequence numbers beginning with 101. Columns 78-80 are left blank on the last card image of the water level data.

EXAMPLES OF SOLDIER CREEK DATA TAPE

Fifteen-Minute Rainfall

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 068891006505051501                                                      12 1
 068891006505051502                  2    2                              1
 068891006505051506                                    2                 1
 068891006505141501             2   10    2    2   16                     1
 068891006505181501                                                24   16 1
```

Daily Rainfall; Recording Gage

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 0688910064042   0   0  20 100   0  82   0   0  14 198   4  26   0   0          3
 0688910064051  50   0   0   0  12  34  28   2   0   0  12   0   0   0   0   0 3
 0688910064052   0   0   0   0   0   8  10  28   0  88  76   0   0   0   0     3
 0688910064061   0   0   0 214   0   0  28  14   2   6 140  86   0 130   0   0 3
 0688910064062   0   2   0   0 138  92   2   0   0   0   0   0   0   0         3
```

Observer Daily Rainfall

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 813E01CC75072          1.05     .07     .60
 813E01CC75081    .15                .20                    .301.00 .10
 813E01CC75082 .25                              .80          .26 .10
 813E01CC75091               2.50                          .75 .07
 813E01CC75092 .10                                           .56     .30
```

Fifteen-Minute Discharge

Discharge Data

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 06889100680716150 3   48    57    63    61    56    50    43    36    30    26    22    20 2
 06889100680716150 4   18    16    14    13    11   9.6   8.3   7.3   6.4   5.7   4.8   4.0 2
 06889100680716150 5  3.6   2.9   2.7   2.5   2.1   1.8   1.5   1.5   1.3   1.2   1.1   .89 2
 06889100680716150 6  .80   .70   .65   .60   .50   .45   .40   .35   .30   .28   .26   .26 2
 06889100680716150 7  .22   .22   .20   .18   .18   .16   .14   .14   .12   .12   .12   .10 2
```

Daily Discharge

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 3       0688910019650203   0.20   0.20   0.20   0.20   0.20   0.10   0.10   0.10
 3       0688910019650204   0.10   0.10   8.10  23.00
 3       0688910019650301  28.00   0.70   0.60   0.40   0.30   0.20   0.10   0.20
 3       0688910019650302   0.40   0.30   0.20   0.20   0.10   0.10   0.10   1.40
 3       0688910019650303   9.10   0.40   0.20   0.20   0.10   0.10   0.10   0.10
```

Chemical Quality of Water

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 2       06889200661125          00930290002 00935520001 00440351003 00445000000
 2       06889200661125          00650200000 01020240003 70300520003 70303710000
 2       06889200661125          70302335001 00900379003 00902910002 00931600000
 2       06889200661125          00095830003 00400790001 00010994401 00932140002
 2       06889200661125          00410288003
```

Suspended-Sediment Concentration

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 06889100701015 1510   9.5          .08      99          .02
 06889100701111 1435   6.0          .05     514          .07
 06889100701208 1030   2.0          .08     130          .03
 06889100710210 1020   0.0          .09     104          .02
 06889100710215 1500                18.      566         28.
```

PARTICLE-SIZE ANALYSIS; Suspended Sediment

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 I06889100670605053O          85.    10700 41 48    68    97 98 99100      VPWC
 I06889100700510125O        1300.    23600 33 37    58   100               VPWC
 I06889100700722121S            .05   7550 46 52    74    99100            VPWC
 I06889100700916151S          18.     2970 47 48    76    98100            VPW
```

PARTICLE-SIZE ANALYSIS; Bed Material

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 B06889100761005163O                 1 23 86 92 98100                  SVWP L BANK
 B06889100761005163O           0.    1 13 29 31 35 49 55 88 99100      SVWP CHANNEL
 B06889100761005163O                 1 24 84 89 93 95100               SVWP R BANK
```

GROUND-WATER LEVEL

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 1866393729N09558021     5 13E 9CDD  USGS + KGS GOFF     392W 131275WU0014010
 1866393729N09558021     25S 25  63-
 1866393729N09558021     5-13E-9CDD.  OBSERVATION WELL LOCATED 392 FEET WEST
 1866393729N09558021     OF CENTER OF BRIDGE AT GOFF STREAMFLOW GAGE.
 1866393729N09558021     WELL BORED IN ALLUVIAL DEPOSITS; 1.25-INCH PIPE
 1866393729N09558021     INSTALLED TO MEASURE WATER-TABLE ALTITUDES.
 1866393729N09558021     DEPTH (1963) 25.5 FEET.  MEASURING POINT, TOP OF
 1866393729N09558021     PIPE 2.5 FEET ABOVE LAND SURFACE.
```

GROUND-WATER LEVEL

```
0....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8

 1866393729N09558021070263   1035 072463   1169 092463   1330 110763   1363 AI101
 1866393729N09558021120563   1208 020664   1283 031364   1303 041364   1260 AI102
 1866393729N09558021041464   1280 050764   1248 051964   1159 060264   1185 AI103
 1866393729N09558021070964   1063 072264   1198 100264   1440 100664   1466 AI104
```

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