STATISTICAL SUMMARIES OF WATER-QUALITY DATA FOR STREAMS DRAINING COAL-MINED AREAS, SOUTHEASTERN KANSAS

U.S. GEOLOGICAL SURVEY

HYDROLOGIC DATA

OPEN-FILE REPORT 80-350

Prepared in cooperation with the
Kansas Department of Health and Environment

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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By Hugh E. Bevans and Arthur M. Diaz

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ABSTRACT

Summaries of descriptive statistics are compiled for 14 data-collection sites located on streams draining areas that have been shaft mined and strip mined for coal in Cherokee and Crawford Counties in southeastern Kansas. These summaries include water-quality data collected from October 1976 through April 1979. Regression equations relating specific conductance and instantaneous streamflow to concentrations of bicarbonate, sulfate, chloride, fluoride, calcium, magnesium, sodium, potassium, silica, and dissolved solids are presented.

INTRODUCTION

The U.S. Geological Survey in cooperation with the Kansas Department of Health and Environment is investigating the quality of water in streams draining coal-mined areas of Cherokee and Crawford Counties in southeastern Kansas. This study began in October 1976 and is scheduled to conclude in September 1980.

The purpose of this report is to provide descriptive statistics and regression equations, relating concentrations of selected dissolved chemical constituents to specific conductance and to instantaneous streamflow, for water-quality data collected from streams draining the study area. The statistical summaries presented in the report include data collected from October 1976 to April 1979. This information will be useful in designing or modifying water-quality sampling or monitoring programs in the coal-fields of southeastern Kansas and similar areas.

Conversion Factors

Factors for converting inch-pound units, used in this report, to the International System (SI) of Units and the respective abbreviations are given below:

Multiply inch-pound units	by	To obtain SI units
mile (mi)	1.609	kilometer (km)
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)

STUDY AREA

The study area, shown in figure 1, is located in Cherokee and Crawford Counties of southeastern Kansas and includes the drainage basins of Lightning Creek, Deer Creek, Cherry Creek, and Cow Creek. Lightning Creek, with a drainage area of 232 mi^2, Deer Creek, with a drainage area of 12 mi^2, and Cherry Creek, with a drainage area of 114 mi^2 are tributaries of the Neosho River (see figures 2 and 3). Cow Creek has a drainage area of 251 mi^2 and is a tributary of the Spring River (see figure 4). Areas that have been strip mined and data-collection sites are shown on each drainage-basin map.

DATA COLLECTION

Initial field and laboratory data were obtained from samples of streamflow collected during a reconnaissance of 41 selected stream sites. The data were evaluated to design a comprehensive network of stations for water-quality sample collection and monitoring. Fourteen sites were designated for monthly collection of water-quality data (see table 1). Additional data were collected at these sites during periods of streamflow extremes. Continuous-recording streamflow gages were installed at four of the sites, equipment for recording high streamflow only was installed at four sites, and continuous-recording specific conductance monitors were installed at nine sites (figs. 2, 3, and 4). Streamflow data at the remaining sites were obtained by measurement at the time of sample collection. The data were collected according to U.S. Geological Survey, Water Resources Division procedures (Brown and others, 1970, Guy and Norman, 1970, Carter and Davidian, 1968).

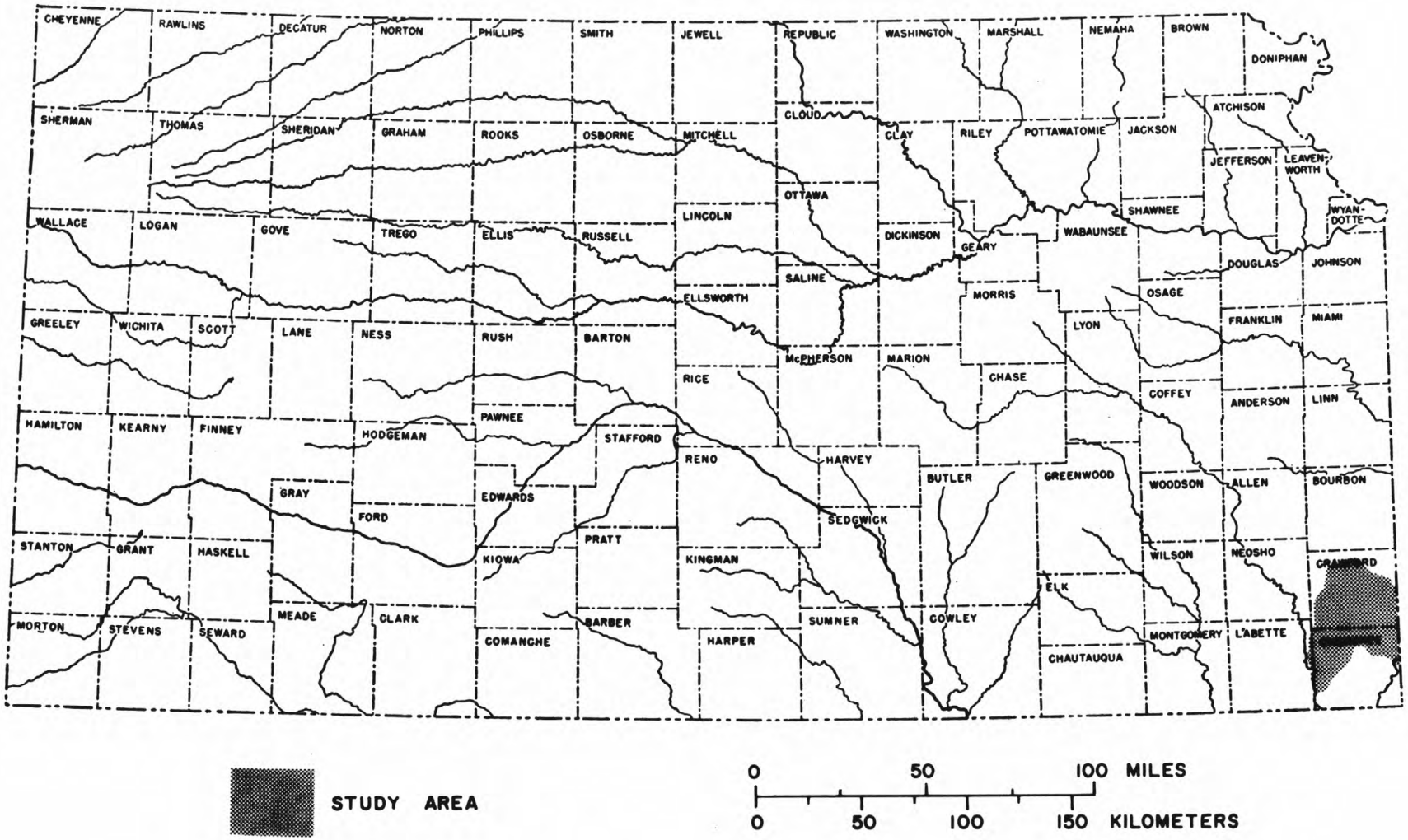

Figure 1.--Map of Kansas showing the geographic location of the study area.

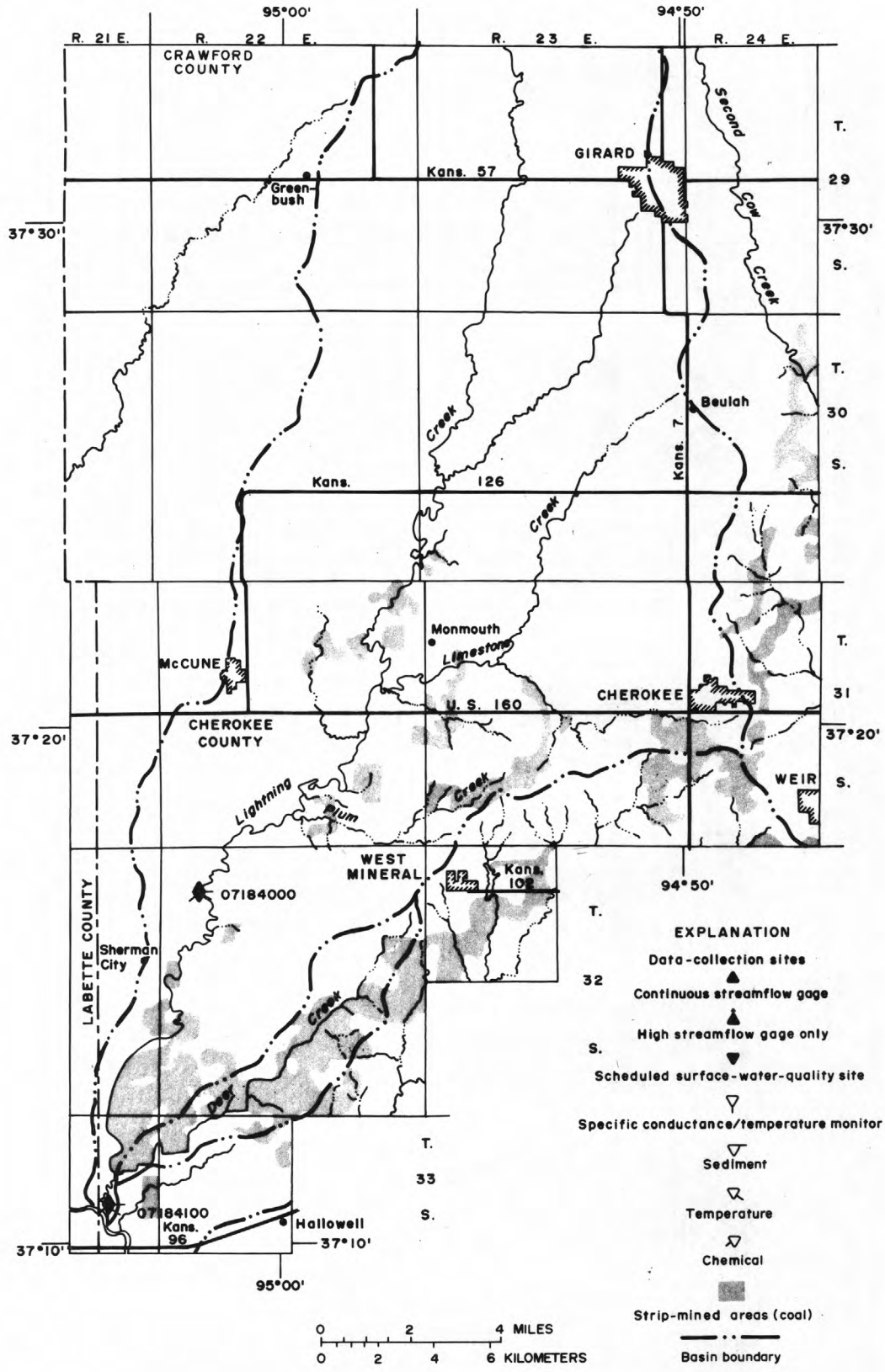

Figure 2.--Locations of data-collection sites in the Lightning Creek drainage basin.

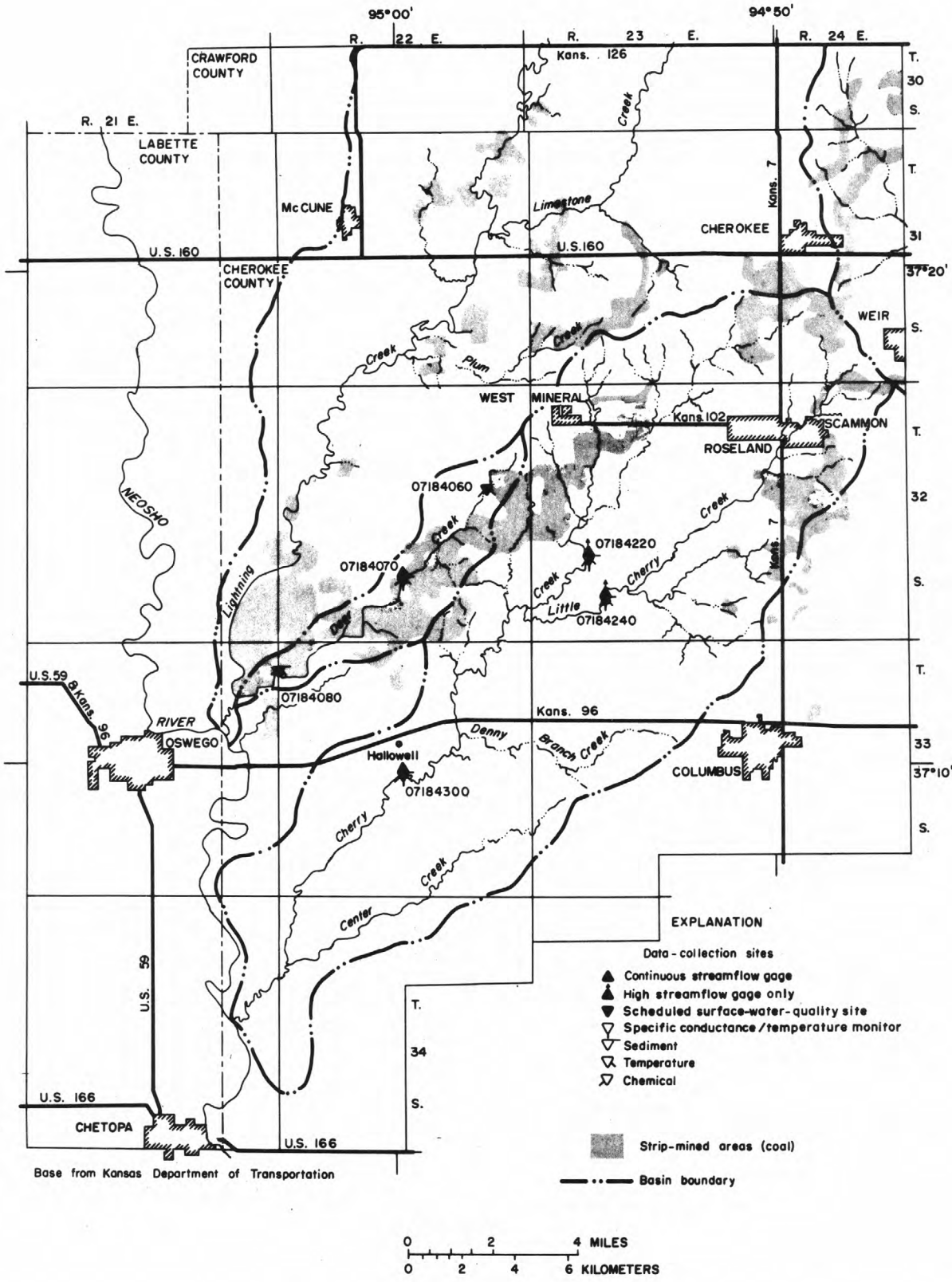

Figure 3.--Locations of data-collection sites in the Deer Creek and Cherry Creek drainage basins.

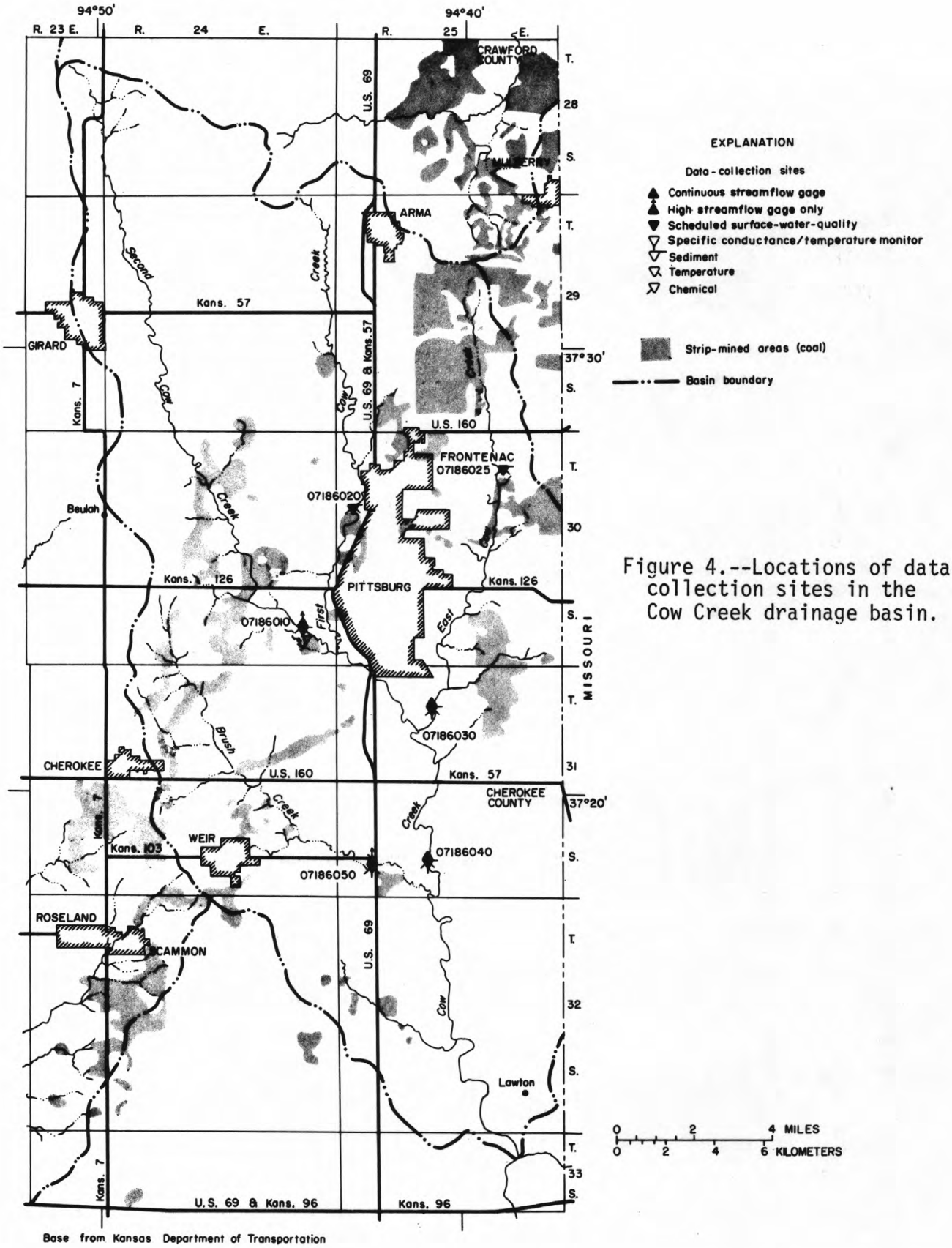

Figure 4.--Locations of data-collection sites in the Cow Creek drainage basin.

Table 1.--Data-collection sites in the study area

Station identification number	Station name
07184000	Lightning Creek near McCune, Kansas
07184060	Deer Creek near West Mineral, Kansas
07184070	Deer Creek near Hallowell, Kansas
07184080	Deer Creek near Oswego, Kansas
07184100	Lightning Creek near Oswego, Kansas
07184220	Cherry Creek near West Mineral, Kansas
07184240	Little Cherry Creek near West Mineral, Kansas
07184300	Cherry Creek near Hallowell, Kansas
07186010	Second Cow Creek at Pittsburg, Kansas
07186020	First Cow Creek at Frontenac, Kansas
07186025	East Cow Creek at Frontenac, Kansas
07186030	East Cow Creek near Pittsburg, Kansas
07186040	Cow Creek near Weir, Kansas
07186050	Brush Creek near Weir, Kansas

SAMPLE ANALYSES

On-site measurements of instantaneous streamflow, specific conductance, water temperature, pH, dissolved oxygen, alkalinity, and acidity were made at the time of sample collection. Chemical analyses of samples were made by the Division of Laboratories, Kansas Department of Health and Environment, Topeka, Kansas, in accordance with procedures outlined in "Standard Methods for the Examination of Water and Wastewater" (American Public Health Association, 1975). Sediment analyses were made by the sediment laboratory of the U.S. Geological Survey in Lawrence, Kansas, according to U.S. Geological Survey procedures (Guy, 1969). Water-quality parameters and chemical constituents determined on samples collected for this study are listed in table 2. Values for concentrations of dissolved chemical constituents were determined on samples that were filtered through 0.45-micron filters immediately following collection. Values for total concentrations were determined on unfiltered samples of the water-sediment mixture.

Table 2.--Water-quality parameters and chemical constituents presented in the statistical summaries

Constituent or parameter	Unit of measurement	Symbols used in regression equations
Streamflow, instantaneous	ft^3/s (cubic feet per second)	Q
Streamflow, mean daily	ft^3/s	
Specific conductance	µmhos/cm at 25°C (micromhos per centimeter at 25°C)	Sp. cond.
Specific conductance, mean daily	µmhos/cm at 25°C	
Temperature	°C (degrees Celsius)	
pH	pH units	
Oxygen, dissolved	mg/L (milligrams per liter)	
Oxygen, demand, chemcial (low level)	mg/L	
Oxygen, demand, chemical (high level)	mg/L	
Alkalinity (as $CaCO_3$)	mg/L	
Hardness (as $CaCO_3$)	mg/L	
Acidity, total (as H)	mg/L	
Acidity (as $CaCO_3$)	mg/L	
Calcium, dissolved (Ca)	mg/L	Ca
Magnesium, dissolved (Mg)	mg/L	Mg
Sodium, dissolved (Na)	mg/L	Na
Potassium, dissolved (K)	mg/L	K
Bicarbonate (HCO_3)	mg/L	HCO_3
Carbonate (CO_3)	mg/L	
Chloride, dissolved (Cl)	mg/L	Cl
Sulfate, dissolved (SO_4)	mg/L	SO_4
Fluoride, dissolved (F)	mg/L	F
Nitrogen, nitrate, dissolved (as N)	mg/L	
Nitrogen, ammonia, total (as N)	mg/L	
Phosphorus, total (as P)	mg/L	
Phosphorus, ortho, dissolved (as P)	mg/L	
Silica, dissolved (as SiO_2)	mg/L	SiO_2
Solids, sum of constituents, dissolved	mg/L	DS
Sediment, suspended	mg/L	
Aluminum, total recoverable (Al)*	µg/L (micrograms per liter)	
Aluminum, dissolved (Al)*	µg/L	
Arsenic, total (As)	µg/L	

Table 2.--Water-quality parameters and chemical constituents presented in the statistical summaries--Continued

Constituent or parameter	Unit of measurement	Symbols used in regression equations
Boron, dissolved (B)*	µg/L (micrograms per liter)	
Cadmium, total recoverable (Cd)*	µg/L	
Cadmium, dissolved (Cd)*	µg/L	
Chromium, total recoverable (Cr)*	µg/L	
Chromium, dissolved (Cr)*	µg/L	
Copper, total recoverable (Cu)*	µg/L	
Copper, dissolved (Cu)*	µg/L	
Iron, total recoverable (Fe)*	µg/L	
Iron, dissolved (Fe)*	µg/L	
Lead, total recoverable (Pb)*	µg/L	
Lead, dissolved (Pb)*	µg/L	
Manganese, total recoverable (Mn)*	µg/L	
Manganese, dissolved (Mn)*	µg/L	
Mercury, total recoverable (Hg)	µg/L	
Mercury, dissolved (Hg)	µg/L	
Zinc, total recoverable (Zn)*	µg/L	
Zinc, dissolved (Zn)*	µg/L	

* Where minimum concentrations are less than the limits of detection for the analytical method used (<10 µg/L), the values are reported as 0 µg/L

DATA PROCESSING

Water-quality and streamflow data for this study were published for 1976, 1977, and 1978 in the annual U.S. Geological Survey Water Data Report "Water Resources Data for Kansas."

The descriptive statistics presented in table 3 were tabulated by the means procedure of the SAS System (Barr and others, 1976, p. 180). The descriptive statistics include:

(1) N - the number of data values available for computing the descriptive statistics.

(2) Mean - the arithmetic mean of the data values.

(3) Minimum value - the minimum value of the data values.

(4) Maximum value - the maximum value of the data values.

(5) Standard deviation - a measure of the dispersion of the data values about their mean. The greater the dispersion about the mean, the larger the standard deviation. Extreme deviations from the mean have by far the greatest weight in determining the standard deviation. If a few of the data values are very extreme, the standard deviation could be misleading in that it may be unusually large (Blalock, 1972, p. 80).

(6) Skewness - a measure of the asymmetry of the frequency distribution of data values. A symmetrical distribution has a skewness value of zero. If low data values are bunched close to the mean but high data values extend far above it, the skewness will be positive. If high data values are bunched close to the mean, but low data values extend far below it, the skewness will be negative (Snedecor and Cochran, 1967, p. 86).

(7) Kurtosis - a measure of the peakedness of the frequency distribution of data values. For a normal distribution, Kurtosis is equal to three. If the Kurtosis value exceeds three, there is usually an excess of data values near the mean and far from it, with a corresponding depletion of the flanks of the distribution curve. A Kurtosis value of less than three indicates a distribution curve with a flatter top than the normal (Snedecor and Cochran, 1967, p. 86). For a discussion of the normal curve see "Statistical Methods," sixth edition, by Snedecor and Cochran, 1967, page 35.

The regression equations presented in table 3 were computed by the Graphplot procedure presented in the "Watstore User's Guide" (Morgan, 1976, volume 3, chapter IV). The relationships between specific conductance and dissolved constituents were computed by an arithmetic linear least-squares regression procedure and are expressed by the formula $y = mx + b$, where y is the dissolved constituent in milligrams per liter, m is the slope of the regression line, x is specific conductance in micromhos per centimeter at 25°C, and b is the y-intercept value. The relationships between instantaneous streamflow and dissolved constituents were computed by a $\log_{10}$ linear least-squares regression procedure and are expressed by the formula $y = bX^m$; where y is the constituent in milligrams per liter, b is the antilog of the y intercept, X is instantaneous streamflow in cubic feet per second, and m equals the slope of the regression line. The $\log_{10}$ linear least-squares regression procedure does not utilize data pairs that have x or y values of zero.

The statistical parameters computed for the regression equations include:

(1) N - the number of data pairs used to compute the regression equation.

(2) Correlation coefficient - a measure of linear relationship between two variables. The correlation coefficient, r, has an upper limit of $\pm$ 1.0. If all points fall on the straight line and the relation is positive, the value of r will be 1.0. If the relation is negative and all points fall on the regression line, r will be -1.0. If the points are randomly scattered, r will be zero. However, an r of zero or approaching zero only means there is no linear relationship; the relationship could be curvilinear (Blalock, 1972, p. 376).

(3) Standard error of estimate - this term is equivalent to the standard deviation of the observed data values about a regression line. It is an estimate of the error likely to be committed in making predictions from the regression equation (Kendall and Buckland, 1960, p. 277).

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow

07184000 LIGHTNING CREEK NEAR MCCUNE, KS

LOCATION.--Lat 37°16'54", long 95°01'56", in NE¼NE¼ sec.7, T.32 S., R.22 E., Cherokee County, Hydrologic Unit 11070205 at downstream side of highway bridge, 5.0 mi (8.0 km) south of McCune, 13.0 mi (20.9 km) southeast of Parsons, and at mile 12.6 (20.3 km).

Drainage area.--197 mi^2 (510 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	32	178	0.02	3,030	585	4.36	19.8
Streamflow, mean daily (ft^3/s)	990	124	0.00	7,040	500	8.91	103
Specific conductance (µmhos/cm at 25°C)	32	727	165	1,720	350	0.69	0.69
Temperature (°C)	32	14.0	0.0	26.5	9.2	-0.31	-1.38
pH (units)	25	7.4	6.5	7.8	0.3	-1.30	1.20
Oxygen, dissolved (mg/L)	24	6.4	1.0	12.7	2.9	0.32	-0.22
Oxygen demand, chemical (low level) (mg/L)	13	27	9	43	11	-0.04	-1.26
Oxygen demand, chemical (high level) (mg/L)	4	59	53	65	5	0.00	0.71
Alkalinity (mg/L as $CaCO_3$)	25	140	39	280	64	0.23	-0.27
Hardness (mg/L as $CaCO_3$)	24	330	73	650	180	0.26	-1.10
Hardness, noncarbonate (mg/L as $CaCO_3$)	24	180	11	410	130	0.44	-1.13
Acidity, total (mg/L as H)	22	0.3	0.1	0.6	0.2	1.27	0.83
Acidity (mg/L as $CaCO_3$)	22	13	6.0	31	7.0	1.47	1.60
Calcium, dissolved (mg/L)	24	76	20	160	40	0.37	-0.79
Magnesium, dissolved (mg/L)	24	33	3.3	70	21	0.30	-1.05
Sodium, dissolved (mg/L)	23	28	6.0	68	15	0.77	0.80
Potassium, dissolved (mg/L)	23	5	3	8	1.3	0.79	0.63
Bicarbonate (mg/L)	25	180	47	340	79	0.23	-0.31
Carbonate (mg/L)	25	0	0	0	0	.	.
Chloride, dissolved (mg/L)	25	16	3.2	41	8.6	1.43	2.23
Sulfate, dissolved (mg/L)	25	230	36	430	130	0.03	-1.33
Fluoride, dissolved (mg/L)	25	0.4	0.2	0.6	0.1	0.24	-0.99
Nitrogen, nitrate, dissolved (mg/L as N)	25	0.30	0.00	1.4	0.36	1.81	3.01
Nitrogen, ammonia, total (mg/L as N)	22	0.33	0.03	1.2	0.26	2.10	5.76
Phosphorus, total (mg/L as P)	20	0.18	0.02	0.52	0.14	1.00	0.34
Phosphorus, ortho, dissolved (mg/L as P)	20	0.03	0.00	0.15	0.04	1.68	2.27
Silica, dissolved (mg/L as SiO_2)	25	7.4	1.3	14	3.1	0.00	-0.19
Solids, sum of constituents, dissolved (mg/L)	23	471	121	901	239	0.18	-1.00
Sediment, suspended (mg/L)	12	138	37	410	120	1.40	1.16
Aluminum, total recoverable (µg/L)	25	3,800	0	18,000	5,600	1.60	1.26
Aluminum, dissolved (µg/L)	25	200	0	1,800	500	2.73	6.80
Arsenic, total (µg/L)	22	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	24	150	30	280	76	0.39	-0.64
Cadmium, total recoverable (µg/L)	23	0.00	0	0	0.00	.	.
Cadmium, dissolved (µg/L)	23	0.43	0	10	2.1	4.80	23.0

Chromium, total recoverable (µg/L)	25	2.0	0	30	6.4	3.84	15.8
Chromium, dissolved (µg/L)	25	0.80	0	20	4.0	5.00	25.0
Copper, total recoverable (µg/L)	25	2.0	0	10	4.1	1.60	0.59
Copper, dissolved (µg/L/)	25	1.2	0	10	3.3	2.49	4.56
Iron, total recoverable (µg/L)	25	2,100	180	7,500	2,200	1.38	0.68
Iron, dissolved (µg/L)	25	120	0	1,100	260	3.21	9.78
Lead, total recoverable (µg/L)	18	10	0	40	12	0.78	-0.03
Lead, dissolved (µg/L)	21	6.4	0	20	9.1	0.86	-1.27
Manganese, total recoverable (µg/L)	25	1,000	140	8,500	1,900	3.37	11.7
Manganese, dissolved (µg/L)	25	950	10	8,500	1,900	3.37	11.7
Mercury, total recoverable (µg/L)	20	0.00	0.0	0.0	0.00	.	.
Mercury, dissolved (µg/L)	2	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	25	9.2	0	80	20	2.44	5.45
Zinc, dissolved (µg/L)	25	0.00	0	0	0.00	.	.

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .1695 x Sp. cond. +51.3	25	0.82	47
SO_4 = .3216 x Sp. cond. -6.39	25	.93	49
Cl = .0033 x Sp. cond. +13.4	25	.15	8.6
F = .0001 x Sp. cond. +.32	25	.34	.12
Ca = .0921 x Sp. cond. +8.16	24	.89	18
Mg = .0504 x Sp. cond. -3.98	24	.94	7.2
Na = .0275 x Sp. cond. +8.09	23	.70	11
K = .0016 x Sp. cond. +3.94	23	.47	1.2
SiO_2 = .0001 x Sp. cond. +7.33	25	.02	3.2
DS = .5727 x Sp. cond. +59.9	23	.93	89

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 192 \times Q^{-.1264}$	25	-0.73	0.1622	45.3	31.2
$SO_4 = 241 \times Q^{-.1653}$	25	-.66	.2551	79.9	44.4
$Cl = 13.5 \times Q^{.0177}$	25	.10	.2345	71.6	41.7
$F = .40 \times Q^{-.0333}$	25	-.32	.1334	36.0	26.4
$Ca = 79.8 \times Q^{-.1317}$	24	-.66	.2051	60.4	37.6
$Mg = 34.5 \times Q^{-.1967}$	24	-.71	.2667	84.8	45.9
$Na = 29.9 \times Q^{-.1478}$	23	-.73	.1948	56.6	36.1
$K = 5.25 \times Q^{-.0420}$	23	-.54	.0933	24.0	19.3
$SiO_2 = 6.55 \times Q^{.0063}$	25	.04	.2420	74.6	42.7
$DS = 503 \times Q^{-.1361}$	23	-.71	.1929	55.9	35.9
Sp. cond. $= 822 \times Q^{-.1194}$	32	-.64	.1854	53.2	34.7

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184060 DEER CREEK NEAR WEST MINERAL, KS

LOCATION.--Lat 37°15'37", long 94°57'31", in SE¼SE¼NE¼ sec.14, T.32 S., R.22 E., Cherokee County, at downstream side of county road bridge, 2.5 mi (4.0 km) southwest of West Mineral.

DRAINAGE AREA.--1.5 mi^2 (3.9 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	29	4.6	0.03	81	15	4.70	23.2
Specific conductance (µmhos/cm at 25°C)	29	3,580	220	4,800	1,050	-1.34	2.45
Temperature (°C)	29	14.7	0.0	32.0	10.3	-0.06	-1.42
pH (units)	27	8.0	7.4	8.3	0.22	-1.26	1.33
Oxygen, dissolved (mg/L)	25	10.7	6.9	19.5	3.16	1.23	1.25
Oxygen demand, chemical (low level) (mg/L)	19	16	1	48	12	1.30	1.66
Oxygen demand, chemical (high level) (mg/L)	0	.	.	.	.	.	.
Alkalinity (mg/L as $CaCO_3$)	27	250	120	340	61	-0.19	-0.87
Hardness (mg/L as $CaCO_3$)	27	1,600	830	2,000	400	-0.79	-0.62
Hardness, noncarbonate (mg/L as $CaCO_3$)	26	1,400	590	1,700	340	-1.14	0.35
Acidity, total (mg/L as H)	23	0.4	0.1	0.9	0.2	0.71	0.02
Acidity (mg/L as $CaCO_3$)	23	17.7	5.0	45	10.6	0.83	0.44
Calcium, dissolved (mg/L)	27	310	110	400	86	-1.12	0.27
Magnesium, dissolved (mg/L)	27	200	99	260	46	-0.71	-0.37
Sodium, dissolved (mg/L)	25	360	170	510	94	-0.34	-0.13
Potassium, dissolved (mg/L)	25	14	9	18	2	-0.80	0.05
Bicarbonate (mg/L)	27	300	140	420	74	-0.19	-0.84
Carbonate (mg/L)	28	0	0	0	0	.	.
Chloride, dissolved (mg/L)	28	16	10	20	2.6	-0.53	0.00
Sulfate, dissolved (mg/L)	28	2,100	1,000	2,800	470	-0.86	0.50
Fluoride, dissolved (mg/L)	27	0.8	0.1	1.3	0.2	-1.28	5.41
Nitrogen, nitrate, dissolved (mg/L as N)	28	0.11	0.00	0.50	0.12	1.87	3.77
Nitrogen, ammonia, total (mg/L as N)	25	0.20	0.00	1.4	0.30	3.12	10.8
Phosphorus, total (mg/L as P)	22	0.03	0.00	0.15	0.04	2.47	5.97
Phosphorus, ortho, dissolved (mg/L as P)	22	0.01	0.00	0.05	0.01	2.33	5.16
Silica, dissolved (mg/L as SiO_2)	28	4.0	0.8	7.8	1.5	0.22	0.27
Solids, sum of constituents, dissolved (mg/L)	25	3,070	1,480	4,090	706	-0.76	0.20
Sediment, suspended (mg/L)	2	144	117	171	38	.	.
Aluminum, total recoverable (µg/L)	28	500	0	2,700	700	2.02	3.46
Aluminum, dissolved (µg/L)	28	70	0	1,500	300	5.09	26.5
Arsenic, total (µg/L)	24	0.42	0	10	2.0	4.90	24.0
Boron, dissolved (µg/L)	27	480	130	690	150	-0.51	-0.48
Cadmium, total recoverable (µg/L)	24	1.7	0	10	3.8	1.91	1.79
Cadmium, dissolved (µg/L)	24	1.2	0	10	3.4	2.42	4.21

Chromium, total recoverable (µg/L)	28	3.2	0	60	12	4.73	23.6
Chromium, dissolved (µg/L)	28	2.5	0	40	8.0	4.19	19.2
Copper, total recoverable (µg/L)	28	4.3	0	20	6.9	1.37	0.63
Copper, dissolved (µg/L)	28	3.9	0	20	6.8	1.53	1.08
Iron, total recoverable (µg/L)	28	410	160	1,400	280	1.85	4.13
Iron, dissolved (µg/L)	28	20	0	50	15	0.45	-0.88
Lead, total recoverable (µg/L)	23	60	0	120	40	0.23	-0.71
Lead, dissolved (µg/L)	22	50	0	120	30	0.17	0.12
Manganese, total recoverable (µg/L)	28	980	90	1,800	540	-0.09	-1.23
Manganese, dissolved (µg/L)	28	880	30	1,800	540	0.03	-1.25
Mercury, total recoverable (µg/L)	22	0.00	0.0	0.0	0.00	.	.
Mercury, dissolved (µg/L)	2	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	28	4.3	0	30	8.4	1.88	2.62
Zinc, dissolved (µg/L)	28	3.9	0	30	7.9	2.11	3.98

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0598 x Sp. cond. +79.0	27	0.80	45
SO_4 = .4189 x Sp. cond. +585	28	.90	210
Cl = .0015 x Sp. cond. +10.5	28	.58	2.2
F = .0001 x Sp. cond. +.44	27	.52	.19
Ca = .0590 x Sp. cond. +94.5	27	.70	62
Mg = .0389 x Sp. cond. +58.0	27	.86	24
Na = .0798 x Sp. cond. +80.0	25	.87	47
K = .0019 x Sp. cond. +7.64	25	.78	1.6
SiO_2 = -.0003 x Sp. cond. +5.17	28	-.21	1.5
DS = .6164 x Sp. cond. +906	25	.89	327

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value above regression line	Standard error of estimate in percentage of predicted value below regression line
$HCO_3 = 263 \times Q^{-.1002}$	27	-0.61	0.0936	24.0	19.4
$SO_4 = 1,862 \times Q^{-.1102}$	28	-.74	.0795	20.1	16.7
$Cl = 15.1 \times Q^{-.0400}$	28	-.40	.0719	18.0	15.2
$F = .80 \times Q^{.0134}$	27	.05	.2165	64.6	39.2
$Ca = 268 \times Q^{-.1009}$	27	-.50	.1401	38.1	27.6
$Mg = 176 \times Q^{-.1075}$	27	-.72	.0828	21.0	17.4
$Na = 321 \times Q^{-.1104}$	25	-.69	.0949	24.4	19.6
$K = 13.3 \times Q^{-.0802}$	25	-.76	.0555	13.6	12.0
$SiO_2 = 3.87 \times Q^{.0626}$	28	.24	.1990	58.1	36.8
$DS = 2,769 \times Q^{-.1055}$	25	-.73	.0819	20.8	17.2
Sp. cond. $= 2,746 \times Q^{-.2336}$	29	-.75	.1679	47.2	32.1

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184070 DEER CREEK NEAR HALLOWELL, KS

LOCATION.--Lat 37°13'50", long 94°59'41", in NE¼NE¼SE¼ sec.28, T.32 S., R.22 E., Cherokee County, at downstream side of county road bridge, 3.6 mi (5.8 km) north of Hallowell.

DRAINAGE AREA.--7.0 mi^2 (18.1 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	37	22	0.03	210	49	3.00	8.54
Specific conductance (µmhos/cm at 25°C)	35	3,070	1,670	4,000	705	-0.68	-0.73
Specific conductance, mean daily (µmhos/cm at 25°C)	571	2,864	1,240	3,930	646	-0.26	-1.32
Temperature (°C)	36	15.6	0.0	31.5	9.8	-0.28	-1.15
pH (units)	34	7.8	6.7	8.3	0.4	-1.62	3.12
Oxygen, dissolved (mg/L)	30	10.2	6.6	14.6	2.5	0.50	-1.05
Oxygen demand, chemical (low level) (mg/L)	17	22	4	48	14	0.62	-0.66
Oxygen demand, chemical (high level) (mg/L)	3	74	60	90	15	0.59	.
Alkalinity (mg/L as $CaCO_3$)	33	160	78	230	40	-0.31	-0.70
Hardness (mg/L as $CaCO_3$)	32	1,600	720	2,400	560	-0.20	-1.44
Hardness, noncarbonate (mg/L as $CaCO_3$)	32	1,400	640	2,300	530	-0.09	-1.38
Acidity, total (mg/L as H)	30	0.2	0.1	0.7	0.2	2.10	4.01
Acidity (mg/L as $CaCO_3$)	30	10.5	4.0	34	7.2	2.27	4.75
Calcium, dissolved (mg/L)	32	300	110	430	100	-0.44	-1.28
Magnesium, dissolved (mg/L)	32	210	84	340	76	-0.12	-1.12
Sodium, dissolved (mg/L)	30	200	88	290	47	-0.52	0.35
Potassium, dissolved (mg/L)	30	11	6	14	2	0.00	-0.86
Bicarbonate (mg/L)	33	200	95	280	49	-0.30	-0.70
Carbonate (mg/L)	33	0	0	0	0	.	.
Chloride, dissolved (mg/L)	33	15	10	24	2.8	0.42	1.53
Sulfate, dissolved (mg/L)	33	1,800	860	2,600	550	-0.47	-1.08
Fluoride, dissolved (mg/L)	32	0.8	0.5	1.2	0.2	0.06	0.47
Nitrogen, nitrate, dissolved (mg/L as N)	33	0.31	0.00	1.8	0.45	2.04	3.87
Nitrogen, ammonia, total (mg/L as N)	28	0.17	0.00	0.59	0.14	1.33	2.24
Phosphorus, total (mg/L as P)	27	0.08	0.00	0.53	0.12	2.72	8.18
Phosphorus, ortho, dissolved (mg/L as P)	26	0.01	0.00	0.10	0.02	3.54	14.2
Silica, dissolved (mg/L as SiO_2)	33	3.8	0.8	7.3	1.7	0.00	-0.76
Solids, sum of constituents, dissolved (mg/L)	30	2,620	1,280	3,640	773	-0.43	-1.21
Sediment, suspended (mg/L)	12	236	44	1,320	354	3.05	9.79
Aluminum, total recoverable (µg/L)	34	2,300	0	34,000	5,850	5.12	28.1
Aluminum, dissolved (µg/L)	34	50	0	1,300	230	5.35	29.7
Arsenic, total (µg/L)	31	0.35	0	10	1.8	5.48	30.3
Boron, dissolved (µg/L)	32	340	50	550	110	-0.45	0.03

Cadmium, total recoverable (µg/L)	29	1.0	0	10	3.1	2.75	5.96
Cadmium, dissolved (µg/L)	29	0.52	0	10	2.0	4.20	18.1
Chromium, total recoverable (µg/L)	34	3.5	0	30	7.7	2.19	4.02
Chromium, dissolved (µg/L)	34	2.1	0	20	5.4	2.64	6.22
Copper, total recoverable (µg/L)	34	4.1	0	20	6.1	1.21	0.56
Copper, dissolved (µg/L)	34	2.7	0	20	5.1	1.80	2.70
Iron, total recoverable (µg/L)	34	1,400	160	16,000	2,700	4.90	26.1
Iron, dissolved (µg/L)	34	20	0	80	17	1.15	1.96
Lead, total recoverable (µg/L)	27	50	0	200	40	1.59	3.99
Lead, dissolved (µg/L)	26	39	0	120	30	0.95	1.11
Manganese, total recoverable (µg/L)	34	570	10	1,200	290	0.42	-0.02
Manganese, dissolved (µg/L)	34	440	90	1,100	280	0.61	-0.48
Mercury, total recoverable (µg/L)	27	0.11	0.0	1.6	0.36	3.42	11.74
Mercury, dissolved (µg/L)	4	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	34	30	0	780	130	5.72	33.1
Zinc, dissolved (µg/L)	34	3.2	0	20	5.9	1.69	2.01

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0565 x Sp. cond. +22.5	33	0.84	27
SO_4 = .7193 x Sp. cond. -378	33	.94	188
Cl = .0014 x Sp. cond. +11.0	33	.35	2.7
F = .0002 x Sp. cond. +.38	32	.71	.12
Ca = .1152 x Sp. cond. -53.9	32	.83	57
Mg = .0953 x Sp. cond. -82.2	32	.91	32
Na = .0530 x Sp. cond. +37.5	30	.81	28
K = .0025 x Sp. cond. +3.21	30	.81	1.3
SiO_2 = -.0002 x Sp. cond. +4.35	33	-.07	1.7
DS = 1.0334 x Sp. cond. -489	30	.96	220

Regression equation	N	Correlation coefficient	Standard error of estimate in $\log_{10}$ units	Standard error of estimate in percentage of predicted value above regression line	Standard error of estimate in percentage of predicted value below regression line
$HCO_3 = 201 \times Q^{-.0698}$	33	-0.61	0.0953	24.5	19.7
$SO_4 = 1{,}929 \times Q^{-.1223}$	33	-.84	.0822	20.8	17.2
$Cl = 15.4 \times Q^{-.0223}$	33	-.28	.0797	20.1	16.8
$F = .87 \times Q^{-.0586}$	32	-.67	.0664	16.5	14.2
$Ca = 307 \times Q^{-.1135}$	32	-.69	.1267	33.9	25.3
$Mg = 220 \times Q^{-.1450}$	32	-.85	.0951	24.5	19.7
$Na = 200 \times Q^{-.0544}$	30	-.49	.1069	27.9	21.8
$K = 11.0 \times Q^{-.0650}$	30	-.76	.0606	15.0	13.0
$SiO_2 = 3.35 \times Q^{.0047}$	33	.02	.2517	78.5	44.0
$DS = 2{,}760 \times Q^{-.1127}$	30	-.84	.0807	20.4	17.0
Sp. cond. $= 3{,}232 \times Q^{-.0865}$	35	-.79	.0698	17.4	14.8

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184080 DEER CREEK NEAR OSWEGO, KS

LOCATION.--Lat 37°12'03", long 95°02'59", in NE¼NE¼SE¼ sec.1, T.33 S., R.21 E., Cherokee County, at downstream side of county road bridge, 4.1 mi (6.6 km) northeast of Oswego.

DRAINAGE AREA.--12.0 mi^2 (31.1 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	28	18	0.01	246	51	3.93	16.2
Specific conductance (µmhos/cm at 25°C)	28	2,900	1,290	4,100	675	-0.70	0.14
Temperature (°C)	28	14.6	0.0	31.5	10.4	-0.02	-1.32
pH (units)	28	7.6	7.1	8.1	0.3	-0.29	-0.36
Oxygen, dissolved (mg/L)	27	9.5	4.7	13.6	2.6	0.05	-0.98
Oxygen demand, chemical (low level) (mg/L)	17	16	2.0	31	9.4	0.19	-1.34
Oxygen demand, chemical (high level) (mg/L)	2	54	54	55	0.7	.	.
Alkalinity (mg/L as $CaCO_3$)	28	150	58	220	36	-0.71	0.77
Hardness (mg/L as $CaCO_3$)	27	1,500	570	2,300	450	-0.44	-0.81
Hardness, noncarbonate (mg/L as $CaCO_3$)	27	1,400	510	2,100	414	-0.47	-0.76
Acidity, total (mg/L as H)	24	0.3	0.1	0.7	0.2	0.96	-0.13
Acidity (mg/L as $CaCO_3$)	24	15	5.4	36	8.5	1.10	0.20
Calcium, dissolved (mg/L)	27	300	98	420	93	-0.93	-0.34
Magnesium, dissolved (mg/L)	27	180	59	300	59	-0.33	-0.55
Sodium, dissolved (mg/L)	25	180	79	250	50	-0.52	-0.47
Potassium, dissolved (mg/L)	25	9	5	13	1.7	0.04	0.45
Bicarbonate (mg/L)	28	180	71	270	44	-0.66	0.64
Carbonate (mg/L)	28	0	0	0	0	.	.
Chloride, dissolved (mg/L)	28	18	9.0	30	4.4	0.47	1.26
Sulfate, dissolved (mg/L)	28	1,700	660	2,600	470	-0.69	0.17
Fluoride, dissolved (mg/L)	27	0.8	0.3	1.2	0.2	-0.80	1.50
Nitrogen, nitrate, dissolved (mg/L as N)	28	0.16	0.00	1.0	0.22	2.30	6.49
Nitrogen, ammonia, total (mg/L as N)	25	0.15	0.00	0.58	0.14	1.66	2.65
Phosphorus, total (mg/L as P)	22	0.05	0.00	0.16	0.04	1.07	0.26
Phosphorus, ortho, dissolved (mg/L as P)	20	0.01	0.00	0.07	0.02	3.59	14.2
Silica, dissolved (mg/L as SiO_2)	28	4.1	1.3	7.8	1.8	0.44	-0.60
Solids, sum of constituents, dissolved (mg/L)	25	2,460	985	3,400	641	-0.81	-0.03
Sediment, suspended (mg/L)	6	251	43	1,150	440	2.44	5.96
Aluminum, total recoverable (µg/L)	28	1,200	0	4,100	1,300	1.12	0.17
Aluminum, dissolved (µg/L)	28	50	0	1,300	250	5.20	27.3
Arsenic, total (µg/L)	25	0.40	0	10	2.0	5.00	25.0
Boron, dissolved (µg/L)	26	280	110	440	100	-0.15	-1.09
Cadmium, total recoverable (µg/L)	24	1.2	0	20	4.5	3.80	14.6

Cadmium, dissolved (µg/L)	24	1.7	0	20	4.8	3.07	9.46
Chromium, total recoverable (µg/L)	28	0.71	0	20	3.8	5.29	28.0
Chromium, dissolved (µg/L)	28	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	28	2.5	0	10	4.4	1.22	-0.55
Copper, dissolved (µg/L)	28	2.5	0	10	4.4	1.22	-0.55
Iron, total recoverable (µg/L)	28	880	230	2,800	690	1.39	1.34
Iron, dissolved (µg/L)	28	40	0	280	54	3.48	14.6
Lead, total recoverable (µg/L)	22	50	0	150	35	0.77	1.76
Lead, dissolved (µg/L)	21	44	0	120	31	0.44	0.18
Manganese, total recoverable (µg/L)	28	600	90	1,700	340	1.65	3.44
Manganese, dissolved (µg/L)	28	500	60	1,600	340	1.65	3.23
Mercury, total recoverable (µg/L)	22	0.26	0.0	5.0	1.1	4.55	21.0
Mercury, dissolved (µg/L)	2	0.15	0.0	0.3	0.2	.	.
Zinc, total recoverable (µg/L)	28	9.3	0	70	17	2.38	5.46
Zinc, dissolved (µg/L)	27	4.4	0	50	11	3.25	11.2

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0586 x Sp. cond. +15.8	28	0.89	20
SO_4 = .6661 x Sp. cond. -196	28	.96	133
Cl = .0041 x Sp. cond. +5.93	28	.63	3.4
F = .0002 x Sp. cond. +.17	27	.85	.10
Ca = .0937 x Sp. cond. +30.6	27	.69	69
Mg = .0797 x Sp. cond. -47.0	27	.93	22
Na = .0689 x Sp. cond. -17.2	25	.91	21
K = .0018 x Sp. cond. +4.05	25	.68	1.3
SiO_2 = -.0004 x Sp. cond. +5.38	28	-.17	1.8
DS = .9351 x Sp. cond. -186	25	.96	186

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 186 \times Q^{-.0577}$	28	-0.47	0.1111	29.2	22.6
$SO_4 = 1{,}751 \times Q^{-.0793}$	28	-.57	.1193	31.6	24.0
$Cl = 17.3 \times Q^{-.0034}$	28	-.03	.1119	29.4	22.7
$F = .86 \times Q^{-.0725}$	27	-.57	.0977	25.2	20.1
$Ca = 303 \times Q^{-.1010}$	27	-.60	.1400	38.0	27.6
$Mg = 181 \times Q^{-.0671}$	27	-.42	.1524	42.0	29.6
$Na = 176 \times Q^{-.0583}$	25	-.44	.1304	35.0	25.9
$K = 9.16 \times Q^{-.0251}$	25	-.31	.0838	21.3	17.5
$SiO_2 = 3.62 \times Q^{.0321}$	28	.16	.2065	60.9	37.8
$DS = 2{,}482 \times Q^{-.0754}$	25	-.59	.1132	29.8	22.9
Sp. cond. $= 2{,}925 \times Q^{-.0599}$	28	-.52	.1027	26.7	21.0

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184100 LIGHTNING CREEK NEAR OSWEGO, KS

LOCATION.--Lat 37°10'49", long 95°04'11", in SE¼SE¼SE¼ sec.11, T.33 S., R.21 E., Cherokee County, on left bank of upstream side of county road bridge 2.4 mi (3.9 km) northeast of Oswego and at mile 0.3.

DRAINAGE AREA.--250 mi^2 (648 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	34	204	0.16	1,440	380	2.37	5.13
Specific conductance (µmhos/cm at 25°C)	33	1,330	400	2,500	558	0.33	-0.65
Specific conductance, mean daily (µmhos/cm at 25°C)*	394	1,220	128	2,400	572	0.11	-0.78
Temperature (°C)	30	15.0	0.0	32.0	10.5	-0.04	-1.34
pH (units)	29	7.7	7.2	8.3	0.3	0.07	-0.51
Oxygen, dissolved (mg/L)	25	9.9	6.1	14.6	2.4	0.24	-0.99
Oxygen demand, chemical (low level) (mg/L)	16	20	9	39	10	0.88	-0.34
Oxygen demand, chemical (high level) (mg/L)	2	56	56	56	0.0	.	.
Alkalinity (mg/L as $CaCO_3$)	28	140	80	200	40	0.21	-1.23
Hardness (mg/L as $CaCO_3$)	27	670	150	1,300	320	0.21	-0.92
Hardness, noncarbonate (mg/L as $CaCO_3$)	27	530	60	1,100	280	0.21	-0.75
Acidity, total (mg/L as H)	24	0.2	0.0	0.3	0.1	-0.05	-0.13
Acidity (mg/L as $CaCO_3$)	24	7.9	0.0	17	3.9	0.38	0.68
Calcium, dissolved (mg/L)	27	150	43	270	71	0.12	-1.25
Magnesium, dissolved (mg/L)	27	70	9.9	140	33	0.10	-0.50
Sodium, dissolved (mg/L)	25	70	14	140	31	0.18	0.07
Potassium, dissolved (mg/L)	25	6	4	8	1	-0.09	0.35
Bicarbonate (mg/L)	28	170	97	250	49	0.23	-1.22
Carbonate (mg/L)	28	0	0	0	0	.	.
Chloride, dissolved (mg/L)	28	14	8.0	26	3.9	1.23	1.82
Sulfate, dissolved (mg/L)	28	690	99	1,300	330	-0.02	-0.93
Fluoride, dissolved (mg/L)	27	0.6	0.3	0.8	0.1	-0.01	-0.02
Nitrogen, nitrate, dissolved (mg/L as N)	28	0.26	0.00	1.4	0.31	2.32	6.61
Nitrogen, ammonia, total (mg/L as N)	26	0.18	0.00	0.45	0.12	0.57	-0.29
Phosphorus, total (mg/L as P)	22	0.07	0.00	0.26	0.06	1.82	4.06
Phosphorus, ortho, dissolved (mg/L as P)	20	0.03	0.00	0.20	0.05	3.27	12.2
Silica, dissolved (mg/L as SiO_2)	28	6.2	0.4	12	2.3	-0.24	1.62
Solids, sum of constituents, dissolved (mg/L)	25	1,030	234	2,000	464	0.21	-0.55
Sediment, suspended (mg/L)	9	1,060	137	3,600	1,260	1.44	0.85
Aluminum, total recoverable (µg/L)	29	1,800	0	9,900	2,400	1.95	4.04
Aluminum, dissolved (µg/L)	29	60	0	1,000	190	4.72	23.9
Arsenic, total (µg/L)	26	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	27	200	0	340	75	-0.20	0.93

Cadmium, total recoverable (µg/L)	26	2.3	0	20	5.1	2.26	4.78
Cadmium, dissolved (µg/L)	26	1.5	0	30	6.1	4.44	20.8
Chromium, total recoverable (µg/L)	29	0.00	0	0	0.00	.	.
Chromium, dissolved (µg/L)	29	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	29	2.4	0	20	5.8	2.37	4.74
Copper, dissolved (µg/L)	29	1.4	0	20	4.4	3.43	12.0
Iron, total recoverable (µg/L)	29	1,100	80	5,500	1,300	2.02	4.07
Iron, dissolved (µg/L)	29	30	0	140	33	1.69	2.83
Lead, total recoverable (µg/L)	24	20	0	120	30	1.69	2.89
Lead, dissolved (µg/L)	21	11	0	50	15	1.14	0.52
Manganese, total recoverable (µg/L)	29	400	130	850	170	1.04	0.68
Manganese, dissolved (µg/L)	29	280	20	750	190	0.81	0.29
Mercury, total recoverable (µg/L)	23	0.83	0.0	15	3.2	4.36	19.6
Mercury, dissolved (µg/L)	5	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	29	10	0	150	30	3.50	13.2
Zinc, dissolved (µg/L)	29	1.4	0	20	4.4	3.43	12.0

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0736 x Sp. cond. +63.5	28	0.83	28
SO_4 = .5804 x Sp. cond. -128	28	.97	84
Cl = .0024 x Sp. cond. +11.0	28	.35	3.7
F = .0002 x Sp. cond. +.32	27	.78	.08
Ca = .1197 x Sp. cond. -13.3	27	.91	31
Mg = .0599 x Sp. cond. -12.1	27	.98	6.8
Na = .0582 x Sp. cond. -7.76	25	.97	7.0
K = .0016 x Sp. cond. +3.98	25	.81	.62
SiO_2 = -.0009 x Sp. cond. +7.44	28	-.21	2.3
DS = .8751 x Sp. cond. -128	25	.97	116

Regression equation	N	Correlation coefficient	Standard error of estimate in $\log_{10}$ units	Standard error of estimate in percentage of predicted value above regression line	Standard error of estimate in percentage of predicted value below regression line
$HCO_3 = 198 \times Q^{-.0828}$	28	-0.61	0.1059	27.6	21.6
$SO_4 = 1{,}029 \times Q^{-.2199}$	28	-.75	.1902	55.0	35.5
$Cl = 13.8 \times Q^{.0034}$	28	.03	.1112	29.2	22.6
$F = .71 \times Q^{-.0900}$	27	-.80	.0626	15.5	13.4
$Ca = 204 \times Q^{-.1673}$	27	-.69	.1777	50.6	33.6
$Mg = 104 \times Q^{-.2117}$	27	-.77	.1784	50.8	33.7
$Na = 96.5 \times Q^{-.1761}$	25	-.72	.1750	49.6	33.2
$K = 7.01 \times Q^{-.0554}$	25	-.73	.0534	13.1	11.6
$SiO_2 = 6.29 \times Q^{-.0542}$	28	-.19	.2823	91.6	40.9
$DS = 1{,}443 \times Q^{-.1761}$	25	-.75	.1599	44.5	30.8
Sp. cond. $= 1{,}844 \times Q^{-.1369}$	32	-.71	.1467	40.2	28.7

* Data through September 1978

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184220 CHERRY CREEK NEAR WEST MINERAL, KS

LOCATION.--Lat 37°14'14", long 94°55'04", in NE¼NW¼NW¼ sec.29, T.32 S., R.23 E., Cherokee County, at downstream side of county road bridge, 3.0 mi (4.8 km) south of West Mineral.

DRAINAGE AREA.--27.0 mi^2 (69.9 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	46	157	0.08	1,570	378	3.18	9.47
Streamflow, mean daily (ft^3/s)*	193	32	4	926	104	5.95	41.3
Specific conductance (µmhos/cm at 25°C)	42	1,690	340	3,210	930	-0.11	-1.41
Specific conductance, mean daily (µmhos/cm at 25°C)	136	1,990	215	3,160	766	-0.73	-0.29
Temperature (°C)	36	14.0	0.0	26.0	8.5	-0.41	-1.19
pH (units)	33	7.4	6.9	7.9	0.25	-0.16	-0.56
Oxygen, dissolved (mg/L)	28	7.3	2.7	12.5	2.7	0.33	-0.67
Oxygen demand, chemical (low level) (mg/L)	18	19	0.0	38	10	0.29	-0.35
Oxygen demand, chemical (high level) (mg/L)	5	71	50	120	26	1.69	3.12
Alkalinity (mg/L as $CaCO_3$)	32	140	25	230	65	-0.44	-1.11
Hardness (mg/L as $CaCO_3$)	31	1,200	140	2,000	590	-0.43	-1.18
Hardness, noncarbonate (mg/L as $CaCO_3$)	31	1,000	110	1,800	540	-0.40	-1.24
Acidity, total (mg/L as H)	29	0.3	0.1	0.7	0.2	0.99	0.21
Acidity (mg/L as $CaCO_3$)	29	16	4.8	35	8.2	1.05	0.24
Calcium, dissolved (mg/L)	31	270	34	460	140	-0.43	-1.29
Magnesium, dissolved (mg/L)	31	120	14	210	60	-0.50	-0.97
Sodium, dissolved (mg/L)	29	76	12	120	32	-0.82	-0.56
Potassium, dissolved (mg/L)	29	7	4	10	1.6	-0.11	-0.52
Bicarbonate (mg/L)	32	170	30	280	79	-0.44	-1.12
Carbonate (mg/L)	32	0	0	0	0	.	.
Chloride, dissolved (mg/L)	32	11	6.0	19	2.6	0.92	1.81
Sulfate, dissolved (mg/L)	32	1,200	130	2,000	570	-0.63	-0.78
Fluoride, dissolved (mg/L)	31	0.8	0.2	1.2	0.2	-0.33	-0.38
Nitrogen, nitrate, dissolved (mg/L as N)	32	0.21	0.00	1.2	0.25	2.93	9.56
Nitrogen, ammonia, total (mg/L as N)	29	0.17	0.00	0.37	0.10	0.59	-0.43
Phosphorus, total (mg/L as P)	26	0.09	0.00	0.39	0.12	1.69	1.76
Phosphorus, ortho, dissolved (mg/L as P)	26	0.01	0.00	0.10	0.02	2.62	6.85
Silica, dissolved (mg/L as SiO_2)	32	7.0	1.8	12	2.8	-0.07	-0.88
Solids, sum of constituents, dissolved (mg/L)	29	1,750	235	2,800	836	-0.54	-1.00
Sediment, suspended (mg/L)	20	613	24	2,000	667	1.20	-0.05
Aluminum, total recoverable (µg/L)	33	1,800	0	11,000	3,000	1.98	2.93
Aluminum, dissolved (µg/L)	33	120	0	1,900	360	4.27	20.0
Arsenic, total (µg/L)	30	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	31	190	30	390	90	-0.04	-0.12
Cadmium, total recoverable (µg/L)	29	2.1	0	20	4.9	2.44	5.74
Cadmium, dissolved (µg/L)	29	2.1	0	40	7.7	4.58	22.3

Chromium, total recoverable (µg/L)	33	0.91	0	10	2.9	2.98	7.34
Chromium, dissolved (µg/L)	33	0.61	0	10	2.4	3.86	13.7
Copper, total recoverable (µg/L)	33	3.3	0	20	6.4	1.79	2.01
Copper, dissolved (µg/L)	33	2.4	0	20	5.0	2.02	3.59
Iron, total recoverable (µg/L)	33	1,200	20	5,300	1,500	1.88	2.30
Iron, dissolved (µg/L)	33	60	0	390	80	3.09	12.0
Lead, total recoverable (µg/L)	27	28	0	140	33	1.84	4.15
Lead, dissolved (µg/L)	24	26	0	120	29	1.84	4.19
Manganese, total recoverable (µg/L)	33	900	100	2,700	540	0.99	2.10
Manganese, dissolved (µg/L)	33	840	80	2,600	550	0.90	1.73
Mercury, total recoverable (µg/L)	27	0.30	0.0	5.0	1.0	4.12	18.0
Mercury, dissolved (µg/L)	2	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	33	30	0	150	40	1.45	1.63
Zinc, dissolved (µg/L)	33	10	0	100	22	2.33	6.61

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0819 x Sp. cond. +6.73	32	0.89	43
SO_4 = .6716 x Sp. cond. -134	32	.96	160
Cl = .0011 x Sp. cond. +8.86	32	.36	2.4
F = .0002 x Sp. cond. +.27	31	.85	.12
Ca = .1493 x Sp. cond. -25.7	31	.89	64
Mg = .0685 x Sp. cond. -13.9	31	.94	21
Na = .0374 x Sp. cond. +3.25	29	.95	10
K = .0014 x Sp. cond. +4.10	29	.75	1.0
SiO_2 = -.0002 x Sp. cond. +7.51	32	-.07	2.8
DS = .9688 x Sp. cond. -139	29	.96	250

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 179 \times Q^{-.2226}$	32	-0.89	0.1317	35.4	26.2
$SO_4 = 1,293 \times Q^{-.2831}$	32	-.95	.1011	26.2	20.8
$Cl = 11.2 \times Q^{-.0307}$	32	-.35	.0929	23.8	19.2
$F = .80 \times Q^{-.1225}$	31	-.85	.0884	22.6	18.4
$Ca = 288 \times Q^{-.2751}$	31	-.94	.1177	31.1	23.7
$Mg = 132 \times Q^{-.2887}$	31	-.97	.0896	22.9	18.6
$Na = 84.1 \times Q^{-.2341}$	29	-.93	.1042	27.1	21.3
$K = 7.27 \times Q^{-.0746}$	29	-.81	.0629	15.6	13.5
$SiO_2 = 6.39 \times Q^{.0038}$	32	.02	.2072	61.1	37.9
$DS = 1,929 \times Q^{-.2690}$	29	-.96	.0950	24.4	19.6
Sp. cond. $= 2,142 \times Q^{-.2386}$	42	-.96	.0945	24.3	19.6

* High streamflow gage

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184240 LITTLE CHERRY CREEK NEAR WEST MINERAL, KS

LOCATION.--Lat 37°13'31", long 94°50'13", in NW¼NE¼NW¼ sec.32, T.32 S., R.23 E., Cherokee County, at downstream side of county road bridge, 4.1 mi (6.6 km) south of West Mineral.

DRAINAGE AREA.--34.0 mi^2 (88.1 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	38	125	0.40	1,210	277	2.75	7.36
Streamflow, mean daily (ft^3/s)*	156	109	74	1,060	113	6.46	44.8
Specific conductance (µmhos/cm at 25°C)	36	1,180	115	2,140	579	-0.40	-0.98
Specific conductance, mean daily (µmhos/cm at 25°C)	183	1,380	130	1,980	439	-1.11	0.41
Temperature (°C)	32	13.6	0.0	26.5	8.7	-0.23	-1.31
pH (units)	30	4.1	3.1	7.0	1.0	1.62	2.12
Oxygen, dissolved (mg/L)	27	9.1	5.9	14.0	2.2	0.54	-0.65
Oxygen demand, chemical (low level) (mg/L)	18	18	3.0	48	12	1.78	3.11
Oxygen demand, chemical (high level) (mg/L)	2	90	87	92	3.5	.	.
Alkalinity (mg/L as $CaCO_3$)	30	2	0.0	22	5	2.53	6.22
Hardness (mg/L as $CaCO_3$)	29	610	37	990	260	-0.73	-0.51
Hardness, noncarbonate (mg/L $CaCO_3$)	29	610	25	990	260	-0.76	-0.46
Acidity, total (mg/L as H)	28	1.2	0.1	8.0	1.4	4.03	19.0
Acidity (mg/L as $CaCO_3$)	28	48	5.0	110	28	0.41	-0.45
Calcium, dissolved (mg/L)	29	170	10	260	75	-0.73	-0.75
Magnesium, dissolved (mg/L)	29	46	3.0	83	19	-0.54	0.19
Sodium, dissolved (mg/L)	27	49	2.9	70	19	-1.16	0.47
Potassium, dissolved (mg/L)	27	5	3	6	0.8	0.41	-0.58
Bicarbonate (mg/L)	30	3	0	27	6.6	2.52	6.07
Carbonate (mg/L)	30	0	0	0	0	.	.
Chloride, dissolved (mg/L)	30	10	4.0	15	2.5	-0.61	0.85
Sulfate, dissolved (mg/L)	30	760	47	1,200	310	-0.93	0.16
Fluoride, dissolved (mg/L)	29	0.7	0.3	0.9	0.2	-0.87	0.19
Nitrogen, nitrate, dissolved (mg/L as N)	30	0.21	0.00	1.5	0.33	3.39	11.1
Nitrogen, ammonia, total (mg/L as N)	27	0.62	0.07	1.3	0.26	0.00	1.25
Phosphorus, total (mg/L as P)	24	0.05	0.00	0.39	0.10	2.84	7.58
Phosphorus, ortho, dissolved (mg/L as P)	24	0.01	0.00	0.07	0.02	2.71	7.11
Silica, dissolved (mg/L as SiO_2)	30	22	5.8	33	7.4	-0.73	-0.53
Solids, sum of constituents, dissolved (mg/L)	27	1,040	86	1,560	426	-0.87	-0.13
Sediment, suspended (mg/L)	12	842	3	2,420	854	0.95	-0.21
Aluminum, total recoverable (µg/L)	30	4,900	800	13,000	3,000	1.02	0.26
Aluminum, dissolved (µg/L)	30	4,000	0	9,400	2,800	0.60	-0.44
Arsenic, total (µg/L)	27	0.44	0	10	2.0	4.91	24.7
Boron, dissolved (µg/L)	29	180	20	390	85	-0.07	0.30
Cadmium, total recoverable (µg/L)	26	1.2	0	10	3.3	2.56	4.91
Cadmium, dissolved (µg/L)	26	1.3	0	10	3.3	2.35	4.04

Chromium, total recoverable (µg/L)	30	0.33	0	10	1.8	5.48	30.0
Chromium, dissolved (µg/L)	30	0.33	0	10	1.8	5.48	30.0
Copper, total recoverable (µg/L)	30	2.7	0	10	4.5	1.11	-0.82
Copper, dissolved (µg/L)	30	2.3	0	10	4.3	1.33	-0.26
Iron, total recoverable (µg/L)	30	2,000	90	6,600	1,700	0.95	0.19
Iron, dissolved (µg/L)	30	1,400	20	5,000	1,400	0.95	-0.15
Lead, total recoverable (µg/L)	23	16	0	60	16	1.01	1.19
Lead, dissolved (µg/L)	21	13	0	40	11	0.22	-0.41
Manganese, total recoverable (µg/L)	30	6,200	290	11,000	2,700	-0.64	0.04
Manganese, dissolved (µg/L)	30	6,100	140	11,000	2,700	-0.65	0.10
Mercury, total recoverable (µg/L)	24	0.00	0.0	0.1	0.02	4.90	24.0
Mercury, dissolved (µg/L)	3	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	30	180	50	320	60	0.26	-0.14
Zinc, dissolved (µg/L)	30	170	0	320	70	-0.24	0.18

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = -.0099 x Sp. cond. +16.3	30	-0.73	4.6
SO_4 = .6036 x Sp. cond. -53.7	30	.94	107
Cl = .0022 x Sp. cond. +7.09	30	.43	2.3
F = .0003 x Sp. cond. +.22	29	.94	.06
Ca = .1353 x Sp. cond. -10.0	29	.86	39
Mg = .0367 x Sp. cond. -2.64	29	.94	6.4
Na = .0375 x Sp. cond. +.72	27	.93	7.1
K = .0008 x Sp. cond. +3.63	27	.50	.66
SiO_2 = .0110 x Sp. cond. +7.46	30	.71	5.3
DS = .8572 x Sp. cond. -63.4	27	.94	154

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 1.16 \times Q^{-.4488}$	9	0.75	0.3721	136	93.7
$SO_4 = 1{,}181 \times Q^{-.3700}$	30	-.88	.1569	43.5	30.3
$Cl = 11.0 \times Q^{-.0725}$	30	-.44	.1169	30.9	23.6
$F = .80 \times Q^{-.1284}$	29	-.75	.0965	24.9	19.9
$Ca = 267 \times Q^{-.3746}$	29	-.89	.1549	42.8	30.0
$Mg = 69.7 \times Q^{-.3286}$	29	-.87	.1483	40.7	28.9
$Na = 78.1 \times Q^{-.3456}$	27	-.88	.1562	43.3	30.2
$K = 5.22 \times Q^{-.0678}$	27	-.79	.0434	10.5	9.5
$SiO_2 = 25.9 \times Q^{-.1783}$	30	-.58	.1554	43.0	30.1
$DS = 1{,}627 \times Q^{-.3361}$	27	-.88	.1491	41.0	29.1
Sp. cond. $= 1{,}933 \times Q^{-.3029}$	36	-.89	.1512	41.6	29.4

* High streamflow gage

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07184300 CHERRY CREEK NEAR HALLOWELL, KS

LOCATION.--Lat 37°09'46", long 94°59'43", in NE¼NE¼NE¼ sec.21, T.33 S., R.22 E., Cherokee County, Hydrologic Unit 11070205, at downstream side of highway bridge, 0.6 mi (1.0 km) south of Hallowell.

DRAINAGE AREA.--90 mi^2 (233 km^2), approximately.

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	60	290	0.01	2,520	459	2.56	8.64
Streamflow, mean daily (ft^3/s)	747	56	0.01	2,390	199	6.96	61.3
Specific conductance (µmhos/cm at 25°C)	57	929	115	2,320	614	0.38	-1.16
Specific conductance, mean daily (µmhos/cm at 25°C)	425	1,490	50	7,030	900	1.22	4.81
Temperature (°C)	46	14.5	0.0	27.5	7.9	-0.55	-0.70
pH (units)	36	6.6	4.6	7.5	0.65	-1.76	3.35
Oxygen, dissolved (mg/L)	30	8.0	3.9	12.6	2.0	0.54	0.02
Oxygen demand, chemical (low level) (mg/L)	15	19	5	42	10	0.79	0.18
Oxygen demand, chemical (high level) (mg/L)	4	79	62	99	16	0.39	-1.89
Alkalinity (mg/L as $CaCO_3$)	33	32	3	150	28	2.34	7.77
Hardness (mg/L as $CaCO_3$)	32	570	33	1,300	350	0.04	-1.10
Hardness, noncarbonate (mg/L as $CaCO_3$)	32	540	20	1,200	340	0.05	-1.30
Acidity, total (mg/L as H)	31	0.3	0.1	1.0	0.2	2.33	5.80
Acidity (mg/L as $CaCO_3$)	31	12	4.0	42	8.2	2.32	5.99
Calcium, dissolved (mg/L)	32	140	9.0	320	90	0.02	-1.38
Magnesium, dissolved (mg/L)	32	50	2.5	110	30	-0.07	-0.98
Sodium, dissolved (mg/L)	30	45	4.0	90	24	-0.24	-1.09
Potassium, dissolved (mg/L)	30	5	3	8	1.4	0.35	-0.18
Bicarbonate (mg/L)	33	39	4	180	34	2.34	7.81
Carbonate (mg/L)	33	0	0	0	0	.	.
Chloride, dissolved (mg/L)	33	9.7	5.0	15	2.8	0.06	-0.91
Sulfate, dissolved (mg/L)	33	640	45	1,300	380	-0.18	-1.34
Fluoride, dissolved (mg/L)	31	0.6	0.2	1.1	0.2	0.06	-0.87
Nitrogen, nitrate, dissolved (mg/L as N)	33	0.26	0.00	0.90	0.25	1.10	0.98
Nitrogen, ammonia, total (mg/L as N)	29	0.41	0.07	1.1	0.27	1.12	0.50
Phosphorus, total (mg/L as P)	27	0.12	0.00	1.1	0.24	3.09	10.3
Phosphorus, ortho, dissolved (mg/L as P)	27	0.01	0.00	0.18	0.03	4.61	22.6
Silica, dissolved (mg/L as SiO_2)	33	12	0.2	27	7.0	0.26	-0.83
Solids, sum of constituents, dissolved (mg/L)	30	878	82	1,700	507	-0.16	-1.43
Sediment, suspended (mg/L)	32	661	7	2,170	582	0.91	0.16
Aluminum, total recoverable (µg/L)	36	3,500	0	21,000	5,200	1.78	2.90
Aluminum, dissolved (µg/L)	36	390	0	5,900	1,100	4.19	19.7
Arsenic, total (µg/L)	33	0.03	0	1	0.17	5.74	33.0
Boron, dissolved (µg/L)	32	160	0	380	95	0.15	-0.20

Cadmium, total recoverable (µg/L)	34	2.6	0	20	5.1	1.82	2.70
Cadmium, dissolved (µg/L)	34	1.0	0	10	3.0	2.73	6.05
Chromium, total recoverable (µg/L)	36	0.28	0	10	1.7	6.00	36.0
Chromium, dissolved (µg/L)	36	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	36	3.3	0	20	6.3	1.75	1.95
Copper, dissolved (µg/L)	36	1.7	0	20	4.5	2.80	7.89
Iron, total recoverable (µg/L)	36	2,300	130	12,000	3,400	1.65	1.62
Iron, dissolved (µg/L)	36	160	0	2,400	390	5.60	32.7
Lead, total recoverable (µg/L)	30	16	0	100	28	1.92	1.19
Lead, dissolved (µg/L)	27	7.5	0	20	9.8	0.56	-1.82
Manganese, total recoverable (µg/L)	36	3,400	280	16,000	3,600	1.71	3.17
Manganese, dissolved (µg/L)	36	3,300	70	16,000	3,700	1.70	3.05
Mercury, total recoverable (µg/L)	29	0.00	0.0	0.1	0.02	5.39	29.0
Mercury, dissolved (µg/L)	6	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	36	80	0	290	70	1.22	1.54
Zinc, dissolved (µg/L)	36	60	0	290	73	1.64	2.47

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = -.0045 x Sp. cond. +44.8	33	-0.08	35
SO_4 = .6034 x Sp. cond. -83.7	33	.98	68
Cl = .0031 x Sp. cond. +6.00	33	.67	2.1
F = .0003 x Sp. cond. +.25	31	.91	.10
Ca = .1384 x Sp. cond. -19.0	32	.96	27
Mg = .0469 x Sp. cond. -5.25	32	.98	5.7
Na = .0393 x Sp. cond. +.68	30	.96	6.8
K = .0015 x Sp. cond. +3.41	30	.64	1.1
SiO_2 = .0071 x Sp. cond. +3.30	33	.63	5.5
DS = .8419 x Sp. cond. -71.9	30	.99	.10

Regression equation	N	Correlation coefficient	Standard error of estimate		
			in $\log_{10}$ units	in percentage of predicted value: above regression line	in percentage of predicted value: below regression line
HCO_3 = 31.3 x $Q^{-.0481}$	33	-0.16	0.3781	139	58.1
SO_4 = 727 x $Q^{-.2013}$	33	-.63	.3140	106	51.5
Cl = 10.1 x $Q^{-.0414}$	33	-.38	.1270	34.0	25.4
F = .79 x $Q^{-.1112}$	31	-.72	.1224	32.6	24.6
Ca = 167 x $Q^{-.2079}$	32	-.65	.3076	103	50.8
Mg = 59.9 x $Q^{-.2235}$	32	-.68	.3104	104	51.1
Na = 55.0 x $Q^{-.1950}$	30	-.71	.2547	79.8	44.4
K = 5.82 x $Q^{-.0751}$	30	-.79	.0762	19.2	16.1
SiO_2 = 10.2 x $Q^{-.0586}$	33	-.18	.4070	155	60.8
DS = 1,020 x $Q^{-.1836}$	30	-.64	.2878	94.0	48.4
Sp. cond. = 1,445 x $Q^{-.2023}$	57	-.70	.2570	80.7	44.7

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07186010 SECOND COW CREEK AT PITTSBURG, KS

LOCATION.--Lat 37°23'49", long 94°44'30", in SW¼SW¼SW¼ sec.25, T.30 S., R.24 E., Crawford County, at downstream side of county road bridge, 2.2 mi (3.5 km) southwest of Pittsburg.

DRAINAGE AREA.--60.0 mi^2 (155 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	43	390	0.01	2,800	651	2.29	5.61
Streamflow, mean daily (ft^3/s)*	432	41	0.00	1,900	153	7.49	70.6
Specific conductance (µmhos/cm at 25°C)	42	1,040	118	3,500	885	1.10	0.50
Specific conductance, mean daily (µmhos/cm at 25°C)	598	1,550	129	3,500	773	0.58	-0.13
Temperature (°C)	32	16.6	0.0	28.0	8.3	-0.81	-0.31
pH (units)	28	7.5	7.1	8.3	0.3	0.97	1.11
Oxygen, dissolved (mg/L)	25	8.5	4.0	14.0	2.7	0.54	-0.38
Oxygen demand, chemical (low level) (mg/L)	14	25	8	43	11	0.14	-0.71
Oxygen demand, chemical (high level) (mg/L)	5	79	55	110	19	0.52	1.89
Alkalinity (mg/L as $CaCO_3$)	27	140	21	270	68	0.03	-0.72
Hardness (mg/L as $CaCO_3$)	26	680	45	2,200	550	1.22	1.31
Hardness, noncarbonate (mg/L as $CaCO_3$)	26	540	14	2,000	500	1.49	2.18
Acidity, total (mg/L as H)	26	0.3	0.1	0.9	0.2	2.24	5.55
Acidity (mg/L as $CaCO_3$)	26	14	5.0	43	8.8	2.04	4.46
Calcium, dissolved (mg/L)	26	140	14	380	100	0.82	-0.19
Magnesium, dissolved (mg/L)	26	81	2.5	310	75	1.63	2.92
Sodium, dissolved (mg/L)	25	59	3.7	290	66	2.34	6.17
Potassium, dissolved (mg/L)	25	6	3	13	2.5	2.09	4.49
Bicarbonate (mg/L)	27	170	25	330	83	0.03	-0.71
Carbonate (mg/L)	27	0	0	0	0	.	.
Chloride, dissolved (mg/L)	27	18	6	69	14	2.77	7.97
Sulfate, dissolved (mg/L)	27	690	34	2,100	560	0.96	0.64
Fluoride, dissolved (mg/L)	27	0.6	0.2	1.0	0.2	0.13	0.23
Nitrogen, nitrate, dissolved (mg/L as N)	27	0.28	0.00	0.80	0.23	0.79	-0.11
Nitrogen, ammonia, total (mg/L as N)	22	0.34	0.07	1.3	0.25	2.91	10.6
Phosphorus, total (mg/L as P)	25	0.21	0.02	1.3	0.32	2.71	7.07
Phosphorus, ortho, dissolved (mg/L as P)	25	0.06	0.00	0.48	0.11	2.80	8.71
Silica, dissolved (mg/L as SiO_2)	27	6.8	1.3	13	3.1	0.10	-0.80
Solids, sum of constituents, dissolved (mg/L)	25	989	94	2,950	724	0.83	0.53
Sediment, suspended (mg/L)	20	1,370	27	9,120	2,090	3.07	10.5
Aluminum, total recoverable (µg/L)	28	3,600	0	29,000	7,000	2.76	7.61
Aluminum, dissolved (µg/L)	28	140	0	1,700	380	3.49	12.4
Arsenic, total (µg/L)	25	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	26	190	0	690	150	1.63	4.07
Cadmium, total recoverable (µg/L)	26	4.6	0	80	16	4.50	21.4
Cadmium, dissolved (µg/L)	26	1.2	0	10	3.3	2.56	4.91

Chromium, total recoverable (µg/L)	27	1.5	0	10	3.6	2.10	2.59
Chromium, dissolved (µg/L)	28	0.36	0	10	1.9	5.29	28.0
Copper, total recoverable (µg/L)	28	11	0	220	40	5.11	26.7
Copper, dissolved (µg/L)	28	2.1	0	10	4.2	1.47	0.18
Iron, total recoverable (µg/L)	28	2,200	200	14,000	3,300	2.83	7.94
Iron, dissolved (µg/L)	28	130	0	1,500	280	4.76	24.1
Lead, total recoverable (µg/L)	23	30	0	140	36	1.58	2.53
Lead, dissolved (µg/L)	22	21	0	100	28	1.66	2.42
Manganese, total recoverable (µg/L)	28	770	190	3,100	670	1.99	4.60
Manganese, dissolved (µg/L)	28	670	0	3,100	710	1.93	4.29
Mercury, total recoverable (µg/L)	25	0.08	0.0	2.0	0.40	5.00	25.0
Mercury, dissolved (µg/L)	4	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	28	28	0	230	58	2.36	5.29
Zinc, dissolved (µg/L)	28	15	0	300	57	4.94	25.2

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0806 x Sp. cond. +60.0	27	0.89	38
SO_4 = .6001 x Sp. cond. -139	27	.99	96
Cl = .0073 x Sp. cond. +7.82	27	.48	12
F = .0002 x Sp. cond. +.30	27	.86	.11
Ca = .1068 x Sp. cond. -3.17	26	.95	34
Mg = .0774 x Sp. cond. -23.4	26	.94	26
Na = .0581 x Sp. cond. -14.3	25	.73	46
K = .0017 x Sp. cond. +3.59	25	.54	2.2
SiO_2 = -.0010 x Sp. cond. +8.08	27	-.29	3.0
DS = .8678 x Sp. cond. -107	25	.99	114

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 180 \times Q^{-.1535}$	27	-0.84	0.1555	43.0	30.1
$SO_4 = 628 \times Q^{-.2585}$	27	-.83	.2749	88.3	46.9
$Cl = 17.7 \times Q^{-.1241}$	27	-.80	.1460	40.0	28.6
$F = .60 \times Q^{-.0919}$	27	-.74	.1297	34.8	25.8
$Ca = 135 \times Q^{-.1978}$	26	-.78	.2532	79.1	44.2
$Mg = 71.1 \times Q^{-.2508}$	26	-.77	.3277	113	53.0
$Na = 54.2 \times Q^{-.2907}$	25	-.93	.1866	53.7	34.9
$K = 5.97 \times Q^{-.0786}$	25	-.78	.1023	26.6	21.0
$SiO_2 = 5.85 \times Q^{.0133}$	27	.09	.2446	75.6	43.1
$DS = 985 \times Q^{-.2195}$	25	-.84	.2277	68.9	40.8
Sp. cond. = $1,363 \times Q^{-.2206}$	42	-.87	.2043	60.1	37.5

* High streamflow gage

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07186020 FIRST COW CREEK AT FRONTENAC, KS

LOCATION.--Lat 37°26'25", long 94°42'54", in SE¼SE¼SW¼ sec.7, T.30 S., R.25 E., Crawford County, at upstream side of county road bridge, 0.2 mi (0.3 km) southwest of Frontenac.

DRAINAGE AREA.--30.0 mi^2 (77.7 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	32	101	0.10	1,650	337	3.98	16.2
Specific conductance (µmhos/cm at 25°C)	32	1,420	114	2,180	606	-0.59	-0.81
Temperature (°C)	32	13.6	0.0	27.5	9.7	-0.08	-1.50
pH (units)	32	7.5	6.9	8.2	0.3	0.27	-0.04
Oxygen, dissolved (mg/L)	30	6.9	1.6	13.2	3.2	0.56	-0.02
Oxygen demand, chemical (low level) (mg/L)	19	26	12	46	11	0.48	-0.77
Oxygen demand, chemical (high level) (mg/L)	3	79	60	110	24	1.35	.
Alkalinity (mg/L as $CaCO_3$)	32	160	32	320	77	0.01	-0.58
Hardness (mg/L as $CaCO_3$)	31	600	42	1,100	320	-0.02	-1.43
Hardness, noncarbonate (mg/L as $CaCO_3$)	31	430	0	880	300	0.09	-1.37
Acidity, total (mg/L as H)	29	0.3	0.1	0.6	0.1	0.92	0.74
Acidity (mg/L as $CaCO_3$)	29	14	3.0	30	6.1	0.86	0.48
Calcium, dissolved (mg/L)	31	120	11	220	63	0.10	-1.40
Magnesium, dissolved (mg/L)	31	76	3.5	140	43	-0.06	-1.47
Sodium, dissolved (mg/L)	29	79	3.6	150	44	-0.16	-1.07
Potassium, dissolved (mg/L)	29	8	0.9	16	4	0.26	-0.38
Bicarbonate (mg/L)	32	200	39	390	95	-0.02	-0.61
Carbonate (mg/L)	32	0	0	0	0	.	.
Chloride, dissolved (mg/L)	32	56	6.0	150	42	0.95	-0.02
Sulfate, dissolved (mg/L)	32	560	49	1,000	330	-0.15	-1.55
Fluoride, dissolved (mg/L)	31	0.6	0.2	0.9	0.2	-0.41	-0.36
Nitrogen, nitrate, dissolved (mg/L as N)	32	1.0	0.00	6.6	1.4	2.90	9.02
Nitrogen, ammonia, total (mg/L as N)	28	1.4	0.08	9.0	2.3	2.43	5.20
Phosphorus, total (mg/L as P)	26	1.6	0.09	9.3	2.0	2.98	9.61
Phosphorus, ortho, dissolved (mg/L as P)	26	1.3	0.02	8.4	1.8	2.94	9.53
Silica, dissolved (mg/L as SiO_2)	32	7.4	0.0	19	4.8	0.73	0.18
Solids, sum of constituents, dissolved (mg/L)	29	968	107	1,620	482	-0.15	-1.30
Sediment, suspended (mg/L)	5	260	57	931	376	2.20	4.86
Aluminum, total recoverable (µg/L)	32	1,700	0	21,000	4,200	3.66	14.7
Aluminum, dissolved (µg/L)	32	80	0	1,200	240	3.95	16.9
Arsenic, total (µg/L)	29	0.34	0	10	1.9	5.39	29.0
Boron, dissolved (µg/L)	30	300	0	660	160	0.56	0.21
Cadmium, total recoverable (µg/L)	26	1.5	0	20	4.6	3.22	10.5
Cadmium, dissolved (µg/L)	28	1.1	0	20	4.2	4.13	17.4

Chromium, total recoverable (µg/L)	32	0.31	0	10	1.8	5.66	32.0
Chromium, dissolved (µg/L)	32	0.31	0	10	1.8	5.66	32.0
Copper, total recoverable (µg/L)	32	1.6	0	10	3.7	1.99	2.08
Copper, dissolved (µg/L)	32	1.6	0	20	4.5	3.05	9.43
Iron, total recoverable (µg/L)	32	1,200	140	11,000	2,100	3.90	17.2
Iron, dissolved (µg/L)	32	70	0	470	110	3.03	9.41
Lead, total recoverable (µg/L)	23	24	0	160	43	2.73	6.94
Lead, dissolved (µg/L)	24	21	0	150	38	2.70	7.19
Manganese, total recoverable (µg/L)	32	670	70	3,200	680	2.22	5.56
Manganese, dissolved (µg/L)	32	600	14	3,100	660	2.21	5.64
Mercury, total recoverable (µg/L)	26	0.00	0.0	0.0	0.00	.	.
Mercury, dissolved (µg/L)	2	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	31	26	0	120	36	1.64	1.70
Zinc, dissolved (µg/L)	32	13	0	100	24	2.68	7.06

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .1090 x Sp. cond. +47.9	32	0.70	69
SO_4 = .4827 x Sp. cond. -128	32	.89	153
Cl = .0230 x Sp. cond. +23.2	32	.33	40
F = .0002 x Sp. cond. +.34	31	.64	.15
Ca = .0905 x Sp. cond. -10.6	31	.88	31
Mg = .0651 x Sp. cond. -15.4	31	.93	16
Na = .0502 x Sp. cond. +11.0	29	.70	32
K = .0015 x Sp. cond. +5.96	29	.24	3.9
SiO_2 = -.0010 x Sp. cond. +8.86	32	-.13	4.8
DS = .7720 x Sp. cond. -84.1	29	.98	97

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value above regression line	Standard error of estimate in percentage of predicted value below regression line
$HCO_3 = 208 \times Q^{-.2103}$	32	-0.88	0.1287	34.5	25.6
$SO_4 = 473 \times Q^{-.1368}$	32	-.40	.3509	124	55.5
$Cl = 52.2 \times Q^{-.2894}$	32	-.87	.1882	54.2	35.2
$F = .66 \times Q^{-.1118}$	31	-.77	.1036	26.9	21.2
$Ca = 109 \times Q^{-.1565}$	31	-.58	.2560	80.3	44.5
$Mg = 69.9 \times Q^{-.1930}$	31	-.59	.3015	100	50.1
$Na = 81.5 \times Q^{-.3046}$	29	-.89	.1815	51.9	34.2
$K = 7.66 \times Q^{-.1285}$	29	-.49	.2674	85.1	46.0
$SiO_2 = 6.16 \times Q^{-.0634}$	31	-.18	.3965	134	59.9
$DS = 962 \times Q^{-.1803}$	29	-.69	.2221	66.8	40.0
Sp. cond. = $1,437 \times Q^{-.1989}$	32	-.76	.1942	56.4	36.1

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07186025 EAST COW CREEK AT FRONTENAC, KS

LOCATION.--Lat 37°27'18", long 94°38'48", in SW¼SW¼SW¼ sec.2, T.30 S., R.25 E., Crawford County, at upstream side of culvert on county road, 2.0 mi (3.2 km) east of Frontenac.

DRAINAGE AREA.--7.5 mi^2 (19.4 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	25	24	0.04	450	90	4.78	23.4
Specific conductance (µmhos/cm at 25°C)	25	1,970	300	3,300	706	-0.25	0.23
Temperature (°C)	25	15.1	0.0	34.0	11.1	0.01	-1.31
pH (units)	23	7.8	7.0	8.2	0.28	-0.70	0.84
Oxygen, dissolved (mg/L)	23	11.2	7.5	14.6	1.9	-0.54	-0.38
Oxygen demand, chemical (low level) (mg/L)	17	20	5	45	11	0.72	-0.21
Oxygen demand, chemical (high level) (mg/L)	0	.	.	.	.	.	.
Alkalinity (mg/L as $CaCO_3$)	24	170	78	280	55	0.39	-0.35
Hardness (mg/L as $CaCO_3$)	23	1,100	460	2,000	440	0.47	-0.45
Hardness, noncarbonate (mg/L as $CaCO_3$)	23	950	380	1,800	400	0.55	-0.40
Acidity, total (mg/L as H)	22	0.2	0.1	0.6	0.2	1.25	1.27
Acidity (mg/L as $CaCO_3$)	22	12	4.0	32	7.6	1.29	1.47
Calcium, dissolved (mg/L)	23	240	100	440	100	0.40	-0.68
Magnesium, dissolved (mg/L)	23	130	51	230	48	0.37	-0.24
Sodium, dissolved (mg/L)	21	68	26	120	26	0.45	-0.26
Potassium, dissolved (mg/L)	21	6	4	11	1.7	1.03	1.74
Bicarbonate (mg/L)	24	210	95	340	68	0.39	-0.35
Carbonate (mg/L)	24	0	0	0	0	.	.
Chloride, dissolved (mg/L)	24	12	6	50	8.4	4.54	21.6
Sulfate, dissolved (mg/L)	24	1,100	420	2,000	403	0.52	-0.07
Fluoride, dissolved (mg/L)	24	0.7	0.3	1.1	0.2	0.08	0.61
Nitrogen, nitrate, dissolved (mg/L as N)	24	0.12	0.00	0.50	0.13	1.56	2.53
Nitrogen, ammonia, total (mg/L as N)	21	0.13	0.00	0.44	0.12	1.36	1.76
Phosphorus, total (mg/L as P)	19	0.03	0.00	0.15	0.03	2.49	7.56
Phosphorus, ortho, dissolved (mg/L as P)	19	0.01	0.00	0.06	0.02	3.13	10.1
Silica, dissolved (mg/L as SiO_2)	24	5.1	0.4	11	2.8	0.39	-0.43
Solids, sum of constituents, dissolved (mg/L)	21	1,580	684	2,860	548	0.44	-0.09
Sediment, suspended (mg/L)	3	92	37	200	94	1.73	.
Aluminum, total recoverable (µg/L)	24	350	0	2,000	500	2.11	4.35
Aluminum, dissolved (µg/L)	24	60	0	1,300	260	4.81	23.4
Arsenic, total (µg/L)	21	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	23	210	80	410	90	0.24	-0.57
Cadmium, total recoverable (µg/L)	22	1.4	0	10	3.5	2.28	3.50
Cadmium, dissolved (µg/L)	22	1.4	0	10	3.5	2.28	3.50

Chromium, total recoverable (µg/L)	24	0.00	0	0	0.00	.	.
Chromium, dissolved (µg/L)	24	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	24	1.2	0	10	3.4	2.42	4.21
Copper, dissolved (µg/L)	24	1.2	0	10	3.4	2.42	4.21
Iron, total recoverable (µg/L)	24	420	100	1,100	260	1.50	1.98
Iron, dissolved (µg/L)	24	30	0	80	23	0.43	-0.76
Lead, total recoverable (µg/L)	20	30	0	80	27	0.74	-0.56
Lead, dissolved (µg/L)	20	24	0	80	26	1.19	0.52
Manganese, total recoverable (µg/L)	24	570	30	1,500	400	0.82	-0.28
Manganese, dissolved (µg/L)	24	540	10	1,500	400	0.86	-0.09
Mercury, total recoverable (µg/L)	18	0.00	0.0	0.0	0.00	.	.
Mercury, dissolved (µg/L)	2	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	24	20	0	180	40	3.50	13.9
Zinc, dissolved (µg/L)	24	15	0	140	30	3.30	12.0

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0930 x Sp. cond. +19.4	24	0.86	35
SO_4 = .6297 x Sp. cond. -186	24	.98	80
Cl = .0004 x Sp. cond. +10.6	24	.03	8.6
F = .0002 x Sp. cond. +.24	24	.74	.12
Ca = .1356 x Sp. cond. -37.1	23	.87	51
Mg = .0740 x Sp. cond. -23.4	23	.98	9.1
Na = .0401 x Sp. cond. -10.6	21	.92	10
K = .0016 x Sp. cond. +3.04	21	.54	1.5
SiO_2 = -.0011 x Sp. cond. +7.41	24	-.25	2.8
DS = .8951 x Sp. cond. -169	21	.98	118

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value above regression line	Standard error of estimate in percentage of predicted value below regression line
$HCO_3 = 193 \times Q^{-.1363}$	24	-0.79	0.0930	23.9	19.3
$SO_4 = 916 \times Q^{-.1716}$	24	-.88	.0807	20.4	17.0
$Cl = 10.3 \times Q^{-.0325}$	24	-.17	.1701	47.9	32.4
$F = .63 \times Q^{-.1107}$	24	-.75	.0847	21.5	17.7
$Ca = 212 \times Q^{-.1566}$	23	-.71	.1401	38.1	27.6
$Mg = 114 \times Q^{-.1743}$	23	-.86	.0921	23.6	19.1
$Na = 62.6 \times Q^{-.1788}$	21	-.89	.0826	20.9	17.3
$K = 5.88 \times Q^{-.0905}$	21	-.67	.0904	23.1	18.8
$SiO_2 = 4.13 \times Q^{.0550}$	24	.14	.3413	119	54.4
$DS = 1,481 \times Q^{-.1592}$	21	-.89	.0741	18.6	15.7
Sp. cond. $= 1,818 \times Q^{-.1861}$	25	-.87	.1097	28.7	22.3

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07186030 EAST COW CREEK NEAR PITTSBURG, KS

LOCATION.--Lat 37°22'04", long 94°40'30", in NW¼NW¼NE¼ sec.9, T.31 S., R.25 E., Crawford County, at downstream side of county road bridge, 3.4 mi (5.5 km) southeast of Pittsburg.

DRAINAGE AREA.--43.0 mi^2 (111 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	36	108	0.01	660	161	1.75	2.96
Specific conductance (µmhos/cm at 25°C)	37	1,100	296	2,300	585	0.22	-1.25
Temperature (°C)	27	14.8	0.0	27.5	9.6	-0.40	-1.32
pH (units)	24	6.9	5.8	8.0	0.5	-0.17	0.52
Oxygen, dissolved (mg/L)	21	8.4	3.5	12.7	2.4	0.11	-0.12
Oxygen demand, chemical (low level) (mg/L)	14	21	6	47	9	1.52	4.38
Oxygen demand, chemical (high level) (mg/L)	1	99	99	99	.	.	.
Alkalinity (mg/L as $CaCO_3$)	23	32	11	58	12	0.04	-0.65
Hardness (mg/L as $CaCO_3$)	23	680	110	1,200	280	-0.12	-0.49
Hardness, noncarbonate (mg/L as $CaCO_3$)	23	640	94	1,100	270	-0.11	-0.68
Acidity, total (mg/L as H)	22	0.3	0.1	0.6	0.15	0.79	-0.62
Acidity (mg/L as $CaCO_3$)	23	15	6.0	31	7.5	0.98	-0.33
Calcium, dissolved (mg/L)	23	140	26	230	59	-0.28	-0.99
Magnesium, dissolved (mg/L)	23	78	11	140	32	-0.17	-0.21
Sodium, dissolved (mg/L)	20	60	10	85	20	-0.90	0.62
Potassium, dissolved (mg/L)	21	8	4	46	9	4.45	20.2
Bicarbonate (mg/L)	23	39	14	71	15	0.07	-0.60
Carbonate (mg/L)	23	0	0	0	0	.	.
Chloride, dissolved (mg/L)	23	18	9.0	40	6.8	1.64	4.29
Sulfate, dissolved (mg/L)	23	770	120	1,300	320	-0.36	-0.45
Fluoride, dissolved (mg/L)	23	0.7	0.3	1.1	0.2	-0.67	0.08
Nitrogen, nitrate, dissolved (mg/L as N)	23	0.25	0.07	0.80	0.18	1.53	2.66
Nitrogen, ammonia, total (mg/L as N)	19	0.53	0.00	1.2	0.33	0.77	0.15
Phosphorus, total (mg/L as P)	21	0.06	0.00	0.66	0.16	3.27	10.4
Phosphorus, ortho, dissolved (mg/L as P)	21	0.01	0.00	0.07	0.02	3.90	16.2
Silica, dissolved (mg/L as SiO_2)	23	9.0	1.4	15	3.8	-0.36	-0.74
Solids, sum of constituents, dissolved (mg/L)	21	1,070	199	1,700	415	-0.44	-0.35
Sediment, suspended (mg/L)	17	4,090	14	48,100	11,500	3.94	15.8
Aluminum, total recoverable (µg/L)	24	1,500	200	16,000	3,200	4.45	20.8
Aluminum, dissolved (µg/L)	24	110	0	600	150	1.83	3.74
Arsenic, total (µg/L)	21	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	22	190	40	470	90	1.21	2.86
Cadmium, total recoverable (µg/L)	19	1.6	0	20	5.0	3.34	11.2
Cadmium, dissolved (µg/L)	20	0.00	0	0	0.00	.	.

Chromium, total recoverable (µg/L)	24	0.00	0	0	0.00	.	.
Chromium, dissolved (µg/L)	24	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	24	2.9	0	40	8.6	3.86	16.3
Copper, dissolved (µg/L)	24	1.7	0	10	3.8	1.91	1.79
Iron, total recoverable (µg/L)	24	1,400	210	1,000	2,000	3.45	13.9
Iron, dissolved (µg/L)	24	390	0	2,900	760	2.56	5.82
Lead, total recoverable (µg/L)	17	20	0	160	38	3.50	13.2
Lead, dissolved (µg/L)	17	8.8	0	40	12	1.19	0.82
Manganese, total recoverable (µg/L)	24	9,400	2,000	24,000	5,700	0.91	0.64
Manganese, dissolved (µg/L)	24	9,300	1,600	24,000	5,600	0.88	0.64
Mercury, total recoverable (µg/L)	21	0.05	0.0	1.0	0.22	4.58	21.0
Mercury, dissolved (µg/L)	2	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	24	250	10	640	170	0.59	-0.07
Zinc, dissolved (µg/L)	24	210	0	600	160	0.59	-0.16

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = -.0056 x Sp. cond. +46.7	23	-0.18	15
SO_4 = .6309 x Sp. cond. -129	23	.98	65
Cl = .0075 x Sp. cond. +6.94	23	.54	5.8
F = .0004 x Sp. cond. +.23	23	.83	.12
Ca = .1041 x Sp. cond. -6.66	23	.87	30
Mg = .0643 x Sp. cond. -14.3	23	.98	6.6
Na = .0433 x Sp. cond. -1.18	20	.95	6.6
K = .0026 x Sp. cond. +4.44	21	.14	8.9
SiO_2 = .0028 x Sp. cond. +4.96	23	.36	3.7
DS = .8660 x Sp. cond. -122	21	.98	87

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 37.8 \times Q^{-.0443}$	23	-0.21	0.1956	56.9	36.3
$SO_4 = 800 \times Q^{-.1013}$	23	-.37	.2373	72.7	42.1
$Cl = 18.8 \times Q^{-.0815}$	23	-.49	.1350	36.4	26.7
$F = .82 \times Q^{-.1093}$	23	-.66	.1172	31.0	23.6
$Ca = 148 \times Q^{-.1012}$	23	-.39	.2210	66.3	39.9
$Mg = 81.3 \times Q^{-.1092}$	23	-.40	.2354	71.9	41.8
$Na = 66.7 \times Q^{-.1145}$	20	-.52	.1867	53.7	34.9
$K = 7.02 \times Q^{-.0342}$	21	-.15	.2144	63.8	39.0
$SiO_2 = 6.31 \times Q^{.1487}$	23	.52	.2277	68.9	40.8
$DS = 1,109 \times Q^{-.0884}$	21	-.36	.2234	67.3	40.2
Sp. cond. $= 1,504 \times Q^{-.1493}$	34	-.64	.1936	56.2	36.0

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07186040 COW CREEK NEAR WEIR, KS

LOCATION.--Lat 37°18'35", long 94°40'48", in NE¼NE¼NW¼ sec.33, T.31 S., R.25 E., Cherokee County, Hydrologic Unit 11070207, at downstream side of highway bridge, 1.5 mi (2.4 km) upstream from Brush Creek and 5.0 mi (8.0 km) east of Weir.

DRAINAGE AREA.--170 mi^2 (440 km^2), approximately

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	63	625	3.3	6,800	1,200	4.13	19.1
Streamflow, mean daily (ft^3/s)	746	123	3.3	7,020	555	8.35	78.5
Specific conductance (µmhos/cm at 25°C)	57	795	164	1,620	408	0.49	-0.98
Specific conductance, mean daily (µmhos/cm at 25°C)*	277	1,300	329	1,890	329	-0.81	0.46
Temperature (°C)	44	14.4	0.0	28.5	8.3	-0.21	-0.81
pH (units)	36	7.2	6.5	7.7	0.3	-0.39	-0.44
Oxygen, dissolved (mg/L)	31	6.3	1.0	12.8	2.7	0.28	-0.14
Oxygen demand, chemical (low level) (mg/L)	16	26	0.2	43	11	-0.54	0.36
Oxygen demand, chemical (high level) (mg/L)	4	72	50	96	20	0.20	-2.44
Alkalinity (mg/L as $CaCO_3$)	32	81	14	190	43	0.67	0.06
Hardness (mg/L as $CaCO_3$)	31	360	70	730	180	0.36	-0.48
Hardness, noncarbonate (mg/L as $CaCO_3$)	31	280	44	630	170	0.53	-0.55
Acidity, total (mg/L as H)	30	0.3	0.2	0.6	0.1	1.05	0.95
Acidity (mg/L as $CaCO_3$)	30	15	8.0	30	5.2	0.97	0.94
Calcium, dissolved (mg/L)	31	79	18	160	37	0.52	-0.26
Magnesium, dissolved (mg/L)	31	41	6.0	81	22	0.24	-0.86
Sodium, dissolved (mg/L)	29	60	5.8	110	34	-0.19	-1.56
Potassium, dissolved (mg/L)	29	8	3	13	3	0.39	-0.91
Bicarbonate (mg/L)	32	99	17	230	52	0.68	0.13
Carbonate (mg/L)	32	0	0	0	.	.	.
Chloride, dissolved (mg/L)	32	40	5.0	96	26	0.48	-0.91
Sulfate, dissolved (mg/L)	32	380	70	720	190	0.22	-1.08
Fluoride, dissolved (mg/L)	31	0.6	0.2	1.0	0.2	-0.41	-0.48
Nitrogen, nitrate, dissolved (mg/L as N)	32	1.4	0.10	8.4	1.5	3.38	14.2
Nitrogen, ammonia, total (mg/L as N)	28	3.7	0.19	13	4.0	1.12	0.01
Phosphorus, total (mg/L as P)	26	1.2	0.02	7.6	1.9	2.64	6.74
Phosphorus, ortho, dissolved (mg/L as P)	26	0.76	0.00	6.2	1.6	2.67	6.66
Silica, dissolved (mg/L as SiO_2)	32	8.5	1.3	16	3.6	-0.17	-0.57
Solids, sum of constituents, dissolved (mg/L)	29	656	131	1,180	306	-0.03	-1.07
Sediment, suspended (mg/L)	34	2,890	70	38,900	8,330	3.86	14.3
Aluminum, total recoverable (µg/L)	36	3,700	0	27,000	5,800	2.47	6.95
Aluminum, dissolved (µg/L)	35	100	0	1,500	270	4.33	21.4
Arsenic, total (µg/L)	33	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	31	270	40	550	140	0.19	-0.79
Cadmium, total recoverable (µg/L)	34	3.2	0	60	10	4.89	26.1
Cadmium, dissolved (µg/L)	34	0.29	0	10	1.7	5.83	34.0

Chromium, total recoverable (µg/L)	36	0.28	0	10	1.7	6.00	36.0
Chromium, dissolved (µg/L)	36	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	36	3.6	0	40	8.3	2.98	10.2
Copper, dissolved (µg/L)	36	1.4	0	10	3.5	2.18	2.91
Iron, total recoverable (µg/L)	36	3,300	360	16,000	4,100	1.85	2.83
Iron, dissolved (µg/L)	36	110	0	690	140	2.75	9.46
Lead, total recoverable (µg/L)	31	30	0	320	60	3.94	17.9
Lead, dissolved (µg/L)	28	9.3	0	80	16	2.97	11.4
Manganese, total recoverable (µg/L)	36	3,100	370	7,000	1,800	0.42	-0.95
Manganese, dissolved (µg/L)	36	2,900	220	7,000	1,900	0.38	-1.00
Mercury, total recoverable (µg/L)	30	0.04	0.0	0.8	0.17	3.99	15.7
Mercury, dissolved (µg/L)	4	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	36	95	0	370	90	1.30	1.44
Zinc, dissolved (µg/L)	36	37	0	170	40	1.49	2.41

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = .0752 x Sp. cond. +23.9	32	0.61	42
SO_4 = .4214 x Sp. cond. -43.7	32	.91	82
Cl = .0393 x Sp. cond. +.57	32	.64	20
F = .0004 x Sp. cond. +.27	31	.83	.11
Ca = .0727 x Sp. cond. +6.42	31	.84	20
Mg = .0483 x Sp. cond. -6.91	31	.93	8.0
Na = .0673 x Sp. cond. -5.39	29	.83	20
K = .0041 x Sp. cond. +3.55	29	.58	2.5
SiO_2 = .0007 x Sp. cond. +7.89	32	.07	3.7
DS = .7053 x Sp. cond. -27.5	29	.98	64

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value above regression line	Standard error of estimate in percentage of predicted value below regression line
$HCO_3 = 175 \times Q^{-.2080}$	32	-0.71	0.1846	53.0	34.6
$SO_4 = 696 \times Q^{-.2240}$	32	-.73	.1902	55.0	35.5
$Cl = 101 \times Q^{-.3402}$	32	-.89	.1537	42.5	29.8
$F = 1.01 \times Q^{-.1389}$	31	-.77	.1022	26.5	21.0
$Ca = 130 \times Q^{-.1776}$	31	-.69	.1688	47.5	32.2
$Mg = 83.6 \times Q^{-.2549}$	31	-.76	.1973	57.5	36.5
$Na = 171 \times Q^{-.3622}$	29	-.92	.1461	40.0	28.6
$K = 12.8 \times Q^{-.1699}$	29	-.85	.0954	24.6	19.7
$SiO_2 = 8.03 \times Q^{-.0182}$	32	-.06	.2517	78.5	44.0
$DS = 1,314 \times Q^{-.2321}$	29	-.82	.1492	41.0	29.1
Sp. cond. $= 1,953 \times Q^{-.2193}$	57	-.86	.1244	33.2	24.9

* Data through September 1978

Table 3.--Descriptive statistics of water-quality parameters and chemical constituents and results of regression analyses relating concentrations of selected dissolved chemical constituents to specific conductance and instantaneous streamflow--Continued

07186050 BRUSH CREEK NEAR WEIR, KS

LOCATION.--Lat 37°18'32", long 94°42'19", in NE¼NE¼NE¼ sec.31, T.31 S., R.25 E., Cherokee County, at upstream site of U.S. 69 highway bridge, 4.0 mi (6.4 km) east of Weir.

DRAINAGE AREA.--30.0 mi^2 (77.7 km^2).

Constituent or parameter	N	Mean	Minimum value	Maximum value	Standard deviation	Skewness	Kurtosis
Streamflow, instantaneous (ft^3/s)	32	16	0.12	153	34	3.03	9.62
Streamflow, mean daily (ft^3/s)*	621	21	.05	1,100	85	8.41	82.4
Specific conductance (µmhos/cm at 25°C)	32	1,100	525	1,650	297	-0.08	-1.01
Specific conductance, mean daily (µmhos/cm at 25°C)**	345	982	180	1,720	304	-0.61	-0.06
Temperature (°C)	32	13.8	0.0	26.5	8.7	-0.19	-1.23
pH (units)	30	4.4	3.1	6.9	1.4	0.96	-0.83
Oxygen, dissolved (mg/L)	27	8.3	5.0	12.8	2.2	0.29	-0.87
Oxygen demand, chemical (low level) (mg/L)	16	17	7	47	12	1.70	2.08
Oxygen demand, chemical (high level) (mg/L)	2	52	50	54	3	.	.
Alkalinity (mg/L as $CaCO_3$)	29	5	0	38	11	1.87	2.19
Hardness (mg/L as $CaCO_3$)	28	450	220	700	120	0.01	-0.68
Hardness, noncarbonate (mg/L as $CaCO_3$)	28	450	190	700	130	-0.11	-0.69
Acidity, total (mg/L as H)	27	1.2	0.1	12	2.2	4.85	24.6
Acidity (mg/L as $CaCO_3$)	27	39	5.0	80	23	0.23	-1.13
Calcium, dissolved (mg/L)	28	100	52	170	28	-0.03	0.03
Magnesium, dissolved (mg/L)	28	46	20	68	13	-0.12	-0.77
Sodium, dissolved (mg/L)	26	48	16	67	15	-0.75	-0.27
Potassium, dissolved (mg/L)	26	6	4	9	1	0.12	-0.75
Bicarbonate (mg/L)	29	7	0	46	14	1.87	2.19
Carbonate (mg/L)	29	0	0	0	0	.	.
Chloride, dissolved (mg/L)	29	11	0.1	16	3.0	-1.86	6.20
Sulfate, dissolved (mg/L)	29	570	200	840	160	-0.41	-0.39
Fluoride, dissolved (mg/L)	28	0.6	0.2	0.9	0.2	-0.74	0.65
Nitrogen, nitrate, dissolved (mg/L as N)	29	0.15	0.00	0.80	0.20	2.25	4.95
Nitrogen, ammonia, total (mg/L as N)	26	0.80	0.18	1.4	0.36	-0.04	-0.95
Phosphorus, total (mg/L as P)	23	0.04	0.00	0.13	0.05	1.06	-0.52
Phosphorus, ortho, dissolved (mg/L as P)	23	0.01	0.00	0.04	0.01	1.86	5.91
Silica, dissolved (mg/L as SiO_2)	29	23	4.3	39	9.8	-0.34	-0.78
Solids, sum of constituents, dissolved (mg/L)	26	807	331	1,180	218	-0.42	-0.68
Sediment, suspended (mg/L)	5	128	56	318	108	2.07	4.44
Aluminum, total recoverable (µg/L)	30	1,900	0	4,000	1,100	-0.13	-0.41
Aluminum, dissolved (µg/L)	29	1,400	0	4,000	1,200	0.31	-0.77
Arsenic, total (µg/L)	27	0.00	0	0	0.00	.	.
Boron, dissolved (µg/L)	28	220	90	350	70	-0.11	-0.88
Cadmium, total recoverable (µg/L)	26	1.5	0	20	4.6	3.22	10.5
Cadmium, dissolved (µg/L)	27	0.81	0	12	3.0	3.50	11.2

Chromium, total recoverable (µg/L)	30	1.0	0	10	3.0	2.81	6.31
Chromium, dissolved (µg/L)	30	0.00	0	0	0.00	.	.
Copper, total recoverable (µg/L)	30	4.7	0	80	15	4.86	25.2
Copper, dissolved (µg/L)	30	4.5	0	100	18	5.24	28.1
Iron, total recoverable (µg/L)	29	4,200	900	14,000	3,100	1.72	3.50
Iron, dissolved (µg/L)	30	3,400	0	14,000	3,400	1.56	2.68
Lead, total recoverable (µg/L)	24	18	0	120	30	2.43	5.47
Lead, dissolved (µg/L)	23	14	0	98	24	2.54	7.27
Manganese, total recoverable (µg/L)	30	4,100	910	7,200	1,700	-0.38	-0.30
Manganese, dissolved (µg/L)	30	4,000	900	7,300	1,700	-0.36	-0.23
Mercury, total recoverable (µg/L)	24	0.05	0.0	1.0	0.20	4.82	23.5
Mercury, dissolved (µg/L)	3	0.00	0.0	0.0	0.00	.	.
Zinc, total recoverable (µg/L)	30	270	60	800	130	2.27	9.34
Zinc, dissolved (µg/L)	29	270	30	820	140	1.95	7.88

Regression equation	N	Correlation coefficient	Standard error of estimate (mg/L)
HCO_3 = -.0339 x Sp. cond. +45.3	29	-0.70	10
SO_4 = .5403 x Sp. cond. -46.6	29	.96	45
Cl = .0061 x Sp. cond. +4.42	29	.58	2.5
F = .0004 x Sp. cond. +.15	28	.79	.10
Ca = .0774 x Sp. cond. +16.3	28	.79	18
Mg = .0414 x Sp. cond. -.69	28	.94	4.4
Na = .0458 x Sp. cond. -2.87	26	.87	7.4
K = .0021 x Sp. cond. +3.72	26	.40	1.4
SiO_2 = .0228 x Sp. cond. -2.72	29	.66	7.5
DS = .7458 x Sp. cond. -21.6	26	.96	58

Regression equation	N	Correlation coefficient	Standard error of estimate in log_{10} units	Standard error of estimate in percentage of predicted value: above regression line	Standard error of estimate in percentage of predicted value: below regression line
$HCO_3 = 2.14 \times Q^{-.6828}$	7	0.80	0.3798	140	58.3
$SO_4 = 581 \times Q^{-.1298}$	29	-.74	.0992	25.7	20.4
$Cl = 11.1 \times Q^{-.2304}$	29	-.48	.3491	123	55.5
$F = .68 \times Q^{-.1258}$	28	-.74	.0936	24.0	19.4
$Ca = 106 \times Q^{-.0894}$	28	-.57	.1088	28.5	22.2
$Mg = 47.7 \times Q^{-.1141}$	28	-.71	.0937	24.1	19.4
$Na = 51.3 \times Q^{-.1769}$	26	-.86	.0875	22.3	18.2
$K = 6.35 \times Q^{-.1121}$	26	-.85	.0583	14.4	12.6
$SiO_2 = 22.4 \times Q^{-.1713}$	29	-.56	.2091	61.8	38.2
$DS = 845 \times Q^{-.1201}$	26	-.74	.0922	23.6	19.1
Sp. cond. = $1,157 \times Q^{-.1106}$	32	-.76	.0831	21.1	17.4

* High streamflow gage
** Data through September 1978

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