A DESCRIPTION OF THE HYDROLOGIC SYSTEM AND THE EFFECTS OF COAL MINING ON WATER QUALITY IN THE EAST FORK LITTLE CHARITON RIVER AND THE ALLUVIAL AQUIFER BETWEEN MACON AND HUNTSVILLE, NORTH-CENTRAL MISSOURI

By Dennis C. Hall

U.S. Geological Survey

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GEOLOGICAL SURVEY

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CONTENTS

	Page
Abstract	1
Introduction	2
Purpose and approach	2
Acknowledgments	8
Climate	8
Hydrologic system	8
Streamflow characteristics	8
Geology and aquifer properties	9
Ground-water movement	13
Effects of coal mining on water quality	16
East Fork Little Chariton River	16
Alluvial aquifer	27
Summary and conclusions	29
References cited	31
Supplemental data	33

ILLUSTRATIONS

Page

Figures 1.-4. Maps showing:

1. Study area and location of strip-mined land..... 3

2. Location of alluvial wells..... 4

3. Location of data-collection sites for gain-loss studies 7

4. Pennsylvanian bedrock in the study area..... 10

Figure 5. Diagram showing generalized stratigraphy in the study area..... 11

6. Diagram showing generalized lithologic section through a hypothetical abandoned strip mine..... 12

7. Map showing potentiometric surface in shallow aquifers in parts of Macon, Randolph, and Chariton Counties, summers of 1981 and 1982..... 14

8. Graph showing hydraulic gradient in spring, summer, and fall at a site 6.5 miles downstream from Macon near the East Fork Little Chariton River..... 15

9. Map showing selected surface-water sites where water-quality data were collected in north-central Missouri and south-central Iowa..... 19

10. Diagram showing major ions in water from eight wells completed in alluvium and in water from the East Fork Little Chariton River at two locations..... 28

TABLES

Page

1. Location of surface- and ground-water sites..... 5

2. Medians of pH, specific conductance, and selected chemical constituents at selected surface- and ground-water sites..... 17

3. Sulfate-to-chloride ratios at selected surface- and ground-water sites..... 18

4. Medians of pH and selected chemical constituents, and sulfate-to-chloride ratios at selected surface-water sites in north-central Missouri and south-central Iowa..... 20

5. Results of the October 1982 gain-loss study of the East Fork Little Chariton River..... 21

6. Results of the July 1983 gain-loss study of the East Fork Little Chariton River..... 23

7. Summary of water-quality data for tributaries to the East Fork Little Chariton River during the October 1982 and July 1983 gain-loss studies..... 25

8. Selected data for wells completed in alluvium..... 34

9. Water-quality data for selected wells completed in alluvium..... 35

10. Water-quality data for the October 1982 gain-loss study of the East Fork Little Chariton River..... 37

11. Water-quality data for the July 1983 gain-loss study of the East Fork Little Chariton River..... 39

12. Streamflow and water-quality data, East Fork Little Chariton River near Macon..... 41

13. Streamflow and water-quality data, East Fork Little Chariton River near Huntsville..... 47

14. Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville..... 59

CONVERSION FACTORS

For readers who prefer to use metric units, conversion factors for terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain SI unit
inch	25.40	millimeter
	0.02540	meter
inch per hour	0.007056	millimeter per second
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
foot squared per day	0.09290	meter squared per day
cubic foot per second	0.02832	liter per second

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows: °F = 9/5 °C + 32

Sea Level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, fomerly called "Mean Sea Level of 1929."

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ABSTRACT

The quality of surface and ground water has been affected by the abandoned strip mines and by abandoned underground mines in a 110-square mile subbasin of the East Fork Little Chariton River. More than 14 percent of the area was strip mined for coal before 1979. This report was prepared to describe the hydrologic system in the area and to analyze the effects of coal mining on quality of water in the river and alluvial aquifer, with major emphasis on defining strip-mining effects.

The ground-water gradient was from glacial drift or coal spoil to alluvium to the East Fork Little Chariton River, and was greatest in spring and least in fall. Seepage from the alluvium to the East Fork Little Chariton River occurs throughout the year, except during drought conditions when the only river flow is water released from Long Branch Lake. In the East Fork Little Chariton River median dissolved-solids concentrations increased from 153 milligrams per liter near Macon to 630 milligrams per liter near Huntsville and median sulfate concentrations increased from 36 milligrams per liter near Macon to 360 milligrams per liter near Huntsville. The median dissolved-solids concentration in water from the alluvium increased from 408 milligrams per liter upstream from the strip mines to 641 milligrams per liter near the mines and median dissolved-sulfate concentration increased from 140 to 350 milligrams per liter. The sulfate-to-chloride ratio, used as the most sensitive indicator of strip-mining effect, increased markedly downstream in the East Fork Little Chariton River and nearby Middle Fork Little Chariton River, which also is affected by strip mining. There were no significant increases in sulfate-to-chloride ratio and dissolved-solids concentrations in comparable nearby subbasins of the Grand, Thompson, and Chariton Rivers where there was no mining.

INTRODUCTION

A recent report (Hall and Davis, 1986) describes effects of coal strip mining on water quality of high-wall lakes and aquifers in the Macon-Huntsville area of north-central Missouri. These effects, especially changes in dissolved constituents in the water, extend beyond the strip mines to adjacent aquifers and to the streams draining the area.

More than 14 percent of the area in the 110-square mile drainage subbasin of the East Fork Little Chariton River between Macon and Huntsville (fig. 1), the area of study for this report, was strip mined before 1979. No strip mines are located upstream of Macon. Most of the mines have been abandoned; although, areas mined during the late 1970's and the 1980's have been reclaimed according to Public Law 95-87 (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 1979). The East Fork Little Chariton River subbasin was selected as an area where effects of strip mining on hydrology, especially water quality, could be studied effectively.

There are some abandoned underground coal mines in the basin. However, the effects on constituent concentrations in the East Fork Little Chariton River from these are not as significant as the effects from strip-mine sources.

Purpose and Approach

The purpose of this report is to: (1) Describe the hydrologic system in a 110-square mile area between Macon and Huntsville in north-central Missouri, and (2) analyze the effects of coal mining in the area on quality of water in the East Fork Little Chariton River and the alluvial aquifer, with major emphasis on defining the effects of strip mining.

Sixteen wells were drilled in the alluvium of the East Fork Little Chariton River, singly, or in groups of two to four for aquifer testing (fig. 2, table 1). Two of these wells were drilled upstream from any coal strip mines. The alluvial wells were used for determination of water-surface altitudes, aquifer testing, and as sources of samples for chemical analyses. Tables in the "Supplemental Data" section at the back of this report contain well-construction information and results of chemical analyses of water from the alluvial wells. Information regarding wells in other aquifers is given in Hall and Davis (1986).

Two gain-loss studies were done on streamflow in the East Fork Little Chariton River between Macon and Huntsville, one in October 1982, and one in July 1983 (fig. 3). A gain-loss study is a series of discharge measurements made during a short time along a reach of a stream, usually during base-flow (sustained or fair-weather flow) conditions, to identify where gains or losses in flow occur. Chemical analyses were obtained on water samples collected at selected sites during these studies to identify stream reaches affected by coal mining. Discharge and water-quality data for sites at each end of the subbasin are available for several years before and during the study ("Supplemental Data" section at the back of this report).

Stream sites in the East Fork Little Chariton River subbasin between Macon (site 1) and Huntsville (site 7) are shown in figure 3. The site near Macon (site 1) was sampled monthly from October 1971 to October 1974, and July 1979 to December 1981. The site near Huntsville (site 7) has been sampled monthly from September 1963 to the present (1985).

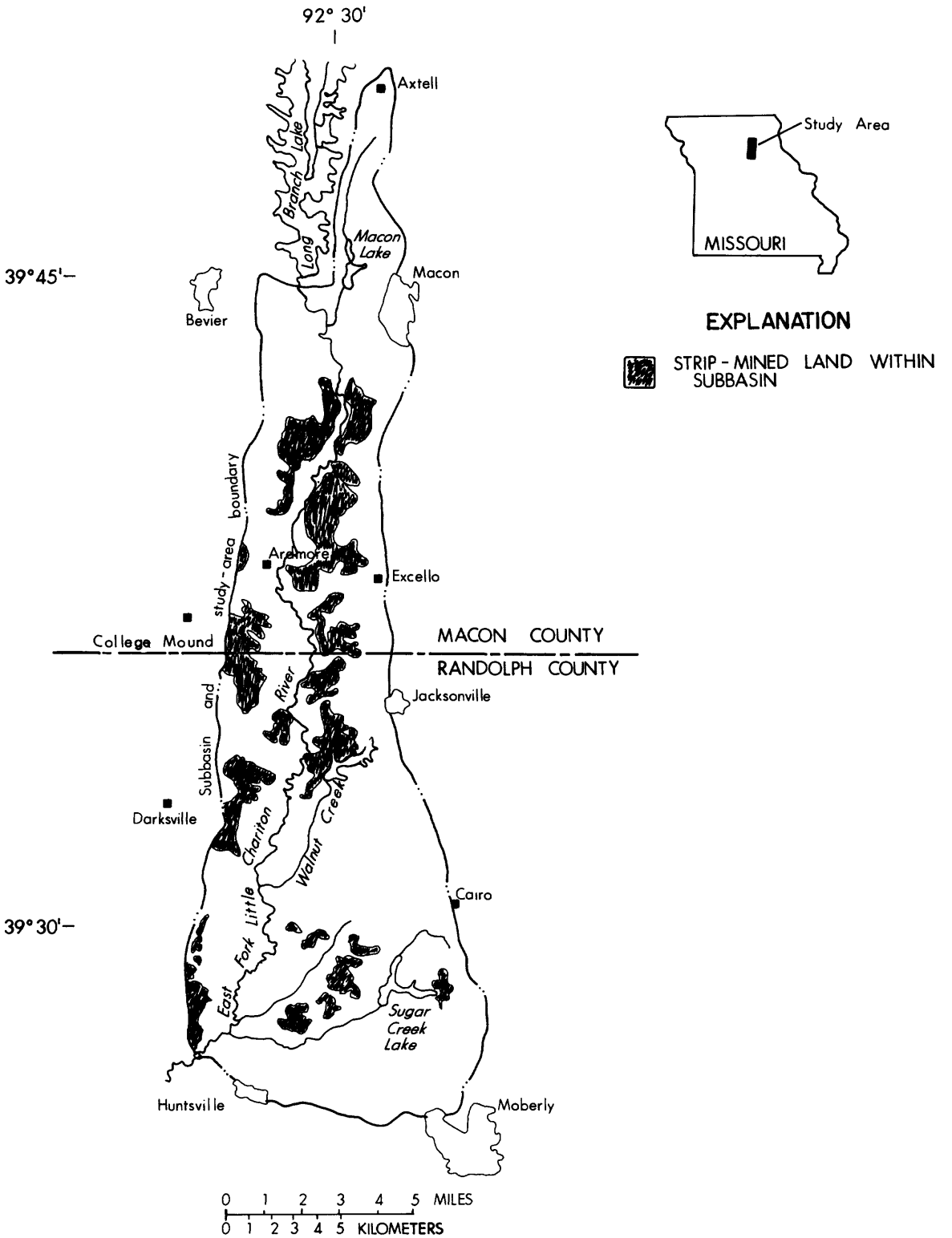


Figure 1.--Study area and location of strip-mined land.

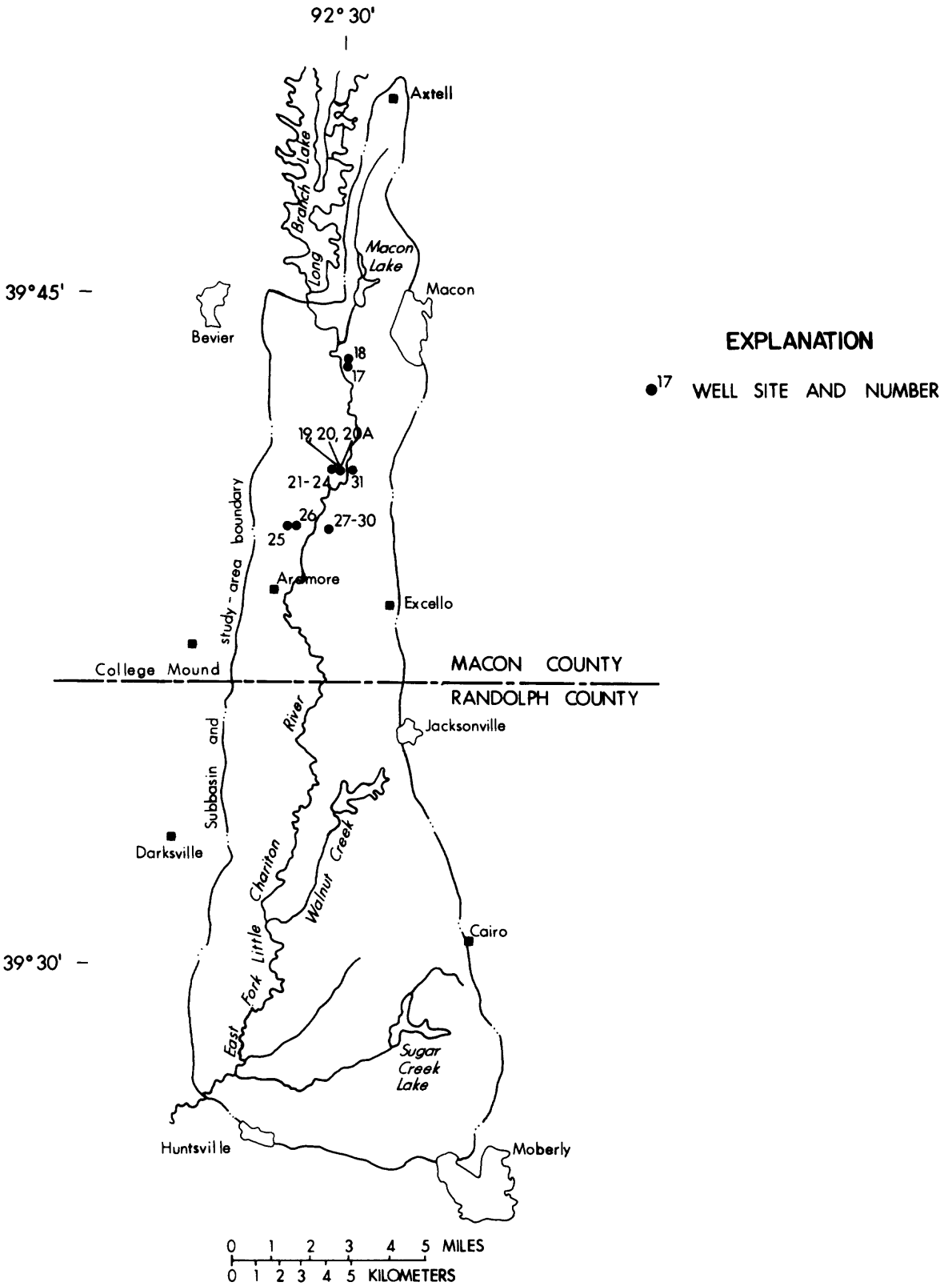


Figure 2.--Location of alluvial wells.

Table 1.--Location of surface- and ground-water sites

Site number (figs. 2 and 3)	Latitude	Longitude	Sequence number	U.S. Geological Survey downstream-order number
1				06906200
1.1	394404	0922922	01	
1.2	394342	0923001	01	
2	394254	0922950	01	
2.1	394254	0922950	02	
2.2	394254	0922950	03	
2.3	394253	0923022	01	
2.4	394234	0922931	01	
2.5	394122	0923018	01	
2.6	394038	0923018	01	
2.7	394030	0923118	01	
2.8	383957	0923057	03	
2.9	393957	0923057	04	
3	393957	0923057	01	
3.1	393957	0923057	02	
3.2	393957	0923057	05	
3.3	393928	0923055	01	
3.4	393933	0923135	01	
3.5	393928	0923055	01	
3.6	393928	0923135	01	
4	393814	0923145	01	
4.1	393814	0923145	02	
4.2	393858	0923127	01	
4.3	393745	0923105	01	
4.4	393720	0923047	01	
4.5	393651	0923124	01	
4.6	393603	0923041	01	
4.7	393642	0923220	01	
4.8	393525	0923058	01	
4.9	393428	0923036	01	
5	393349	0923107	01	
5.1	393404	0923229	01	
6	393138	0923225	01	
6.1	393114	0923134	01	
6.2	393037	0923128	01	
6.3	393001	0923151	01	
6.4	392955	0923137	01	
6.5	392831	0923333	01	
6.6	392807	0923238	01	
6.7	392737	0923237	01	
7				06906300
17	394344	0923003	01	
18	394344	0923001	01	
19	394114	0923011	02	

Table 1.--Location of surface- and ground-water sites--Continued

Site number (figs. 2 and 3)	Latitude	Longitude	Sequence number	U.S. Geological Survey downstream-order number
20	394114	0923011	01	
20A	394114	0923011	03	
21	394114	0923014	04	
22	394114	0923014	03	
23	394114	0923014	02	
24	394114	0923014	01	
25	393959	0923104	01	
26	393958	0923104	01	
27	394002	0923044	01	
28	394002	0923044	02	
29	394002	0923044	03	
30	394002	0923044	04	
31	394113	0923010	01	

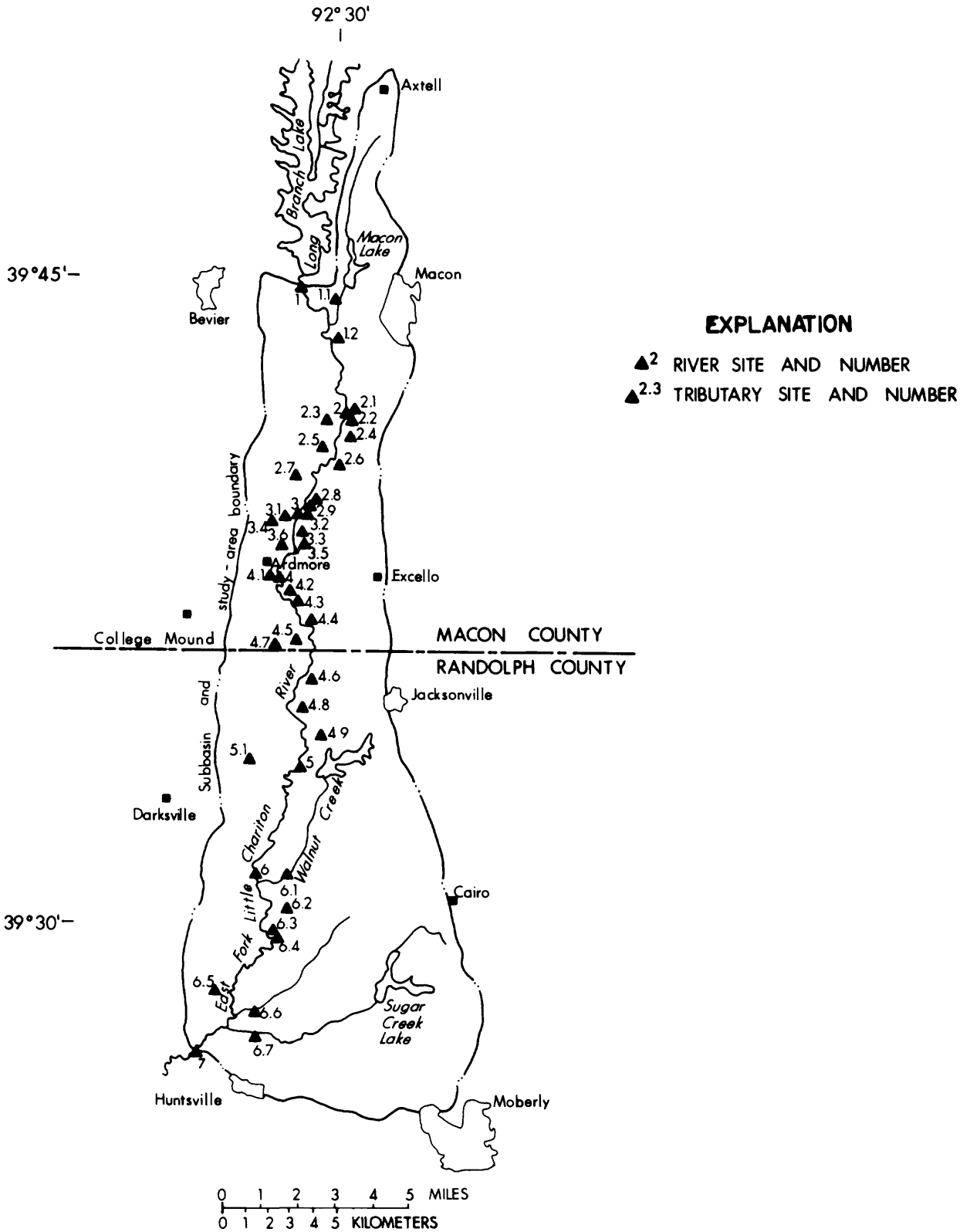


Figure 3.--Location of data-collection sites for gain-loss studies.

The ratio of dissolved-sulfate concentration to dissolved-chloride concentration was calculated and used as the most sensitive indicator of coal strip-mining effect on water quality. Use of sulfate-to-chloride ratio was justified based on the geochemical model describing strip-mining-spoil weathering (Hall and Davis, 1986) and on water-quality information presented later in this report.

Acknowledgments

The cooperation of many persons and organizations was essential to the success of this study. We are grateful for the cooperation of those who permitted the installation of wells or other equipment on their properties. These are Associated Electric Cooperative, Inc., particularly K.C. Vories; J.L. Vories; J.L. Webster; H.S. and C.S. Phillips, owners of Phillips Farms; L.E. White; and C.J. and J.T. Marino.

CLIMATE

The climate in the study area is humid. Annual precipitation at Macon is about 39 inches, average annual snowfall is 22 inches, and the mean annual temperature is 52.7 °F (National Weather Service, 1983). Average annual potential evapotranspiration is 28 inches (Lewis, 1982, p. 23), and average annual runoff is 8 to 9 inches (Skelton, 1971, plate 1).

HYDROLOGIC SYSTEM

Streamflow Characteristics

The East Fork Little Chariton River flows southward through slightly rolling hills in Macon and Randolph Counties toward the Missouri River, eroding through the drift of the glaciated peneplain. The stream has been regulated in the study area since August 1978 by Long Branch Lake, which is used for flood control, water supply, water-quality control, and recreation. A minimum discharge of 7 cubic feet per second normally is released (R.C. Knipp, U.S. Army, Corps of Engineers, oral commun., 1985).

The average discharge at the streamflow-gaging station, East Fork Little Chariton River near Macon (fig. 3, site 1), was 107 cubic feet per second for 1972-83 (U.S. Geological Survey, 1984). Seven-day average low flows were zero during most years before construction of the reservoir. The maximum discharge at the station was 8,700 cubic feet per second in April 1973, also prior to reservoir construction. At the main-stem streamflow-gaging station near Huntsville (site 7), about 35 river miles downstream, flows are affected by reservoir operation and also by operation of industrial pumps 7 miles upstream. The maximum discharge at the station was 30,000 cubic feet per second in April 1973, and there was no flow in the stream at times before the reservoir was constructed.

The flow characteristics of the small, unregulated tributaries of the East Fork Little Chariton River in the area are similar to other northern Missouri streams. Low flows are not well-sustained, and most of these streams are intermittent, responding rapidly to precipitation or a lack of it. Minimum streamflows in Missouri usually occur in late summer and fall (Skelton, 1966). Long-term records indicate more record minimum flows in August than in any other month, followed by September and October.

Geology and Aquifer Properties

Alluvium is present in channels of the larger streams, such as the East Fork Little Chariton River, on glacial drift, or occasionally on bedrock. It is as much as 50 feet thick and is composed of sand, silt, and clay in discontinuous layers of well-sorted to poorly sorted material.

Glacial drift is the major parent material of coal spoil and usually is adjacent to alluvium and spoil in north-central Missouri. The glacial drift is composed largely of sand, silt, and clay, with some gravel and larger rocks. It primarily is poorly sorted till, but contains lenses of well-sorted glacial outwash. Zones of weathering along fractures are evident in cuts made in the glacial drift (Horner and Shifrin, Inc., 1981; and D.K. Potter, U.S. Soil Conservation Service, oral commun., 1984). Thickness of glacial drift ranges from about 20 to 150 feet. Glacial drift overlies bedrock throughout the area, except for the few locations where rivers have removed it. On the higher ridges, where erosion has been limited, glacial drift is capped by 5 to 15 feet of loess.

The Pennsylvanian bedrock includes the Marmaton Group and underlying Cherokee Group, designated Cherokee Shale by the U.S. Geological Survey (figs. 4 and 5), consisting of various rock types, such as limestone, sandstone, shale, coal, and clay. Coal generally is present in the Pennsylvanian bedrock at depths less than 100 feet (fig. 5). Pyrite is associated with the coal. Blocks and smaller fragments of bedrock are a significant component of spoil formed by strip mining for coal.

Spoil in the study area is about 9-percent carbonate. The fine-grained fraction is poorly sorted, averaging 39-percent clay, 39-percent silt, and 22-percent sand (Draney, 1982). Spoil in pre-1972 strip mines was routinely abandoned to natural weathering processes. A diagram of a hypothetical abandoned strip mine is shown in figure 6. The redistribution of soil, glacial drift, blocks, and smaller fragments of bedrock producing spoil substantially alters the hydrology and geochemistry of the shallow ground water (Hall and Davis, 1986). Permeability is increased and weathering of spoil by water is relatively rapid.

The alluvial aquifer is mostly confined with local unconfined areas. Values of transmissivity determined by aquifer tests at 2 sets of wells completed in the alluvium were 1.6 feet squared per day for wells 19, 20, and 20A with saturated thickness of 27 feet, and 16 feet squared per day for wells 21-24 with saturated thickness of 40 feet (see fig. 2). These values are in agreement with reported values that range from 4.1 to 11 feet squared per day (Haliburton Associates, 1981; Horner and Shifrin, Inc., 1981). Storage coefficients determined for wells 21-24 ranged from 0.00034 to 0.00097. Storage coefficients of this small magnitude are indicative of a confined aquifer, in agreement with observations during well drilling. Therefore, recharge to this aquifer primarily would be laterally from glacial drift and spoil.

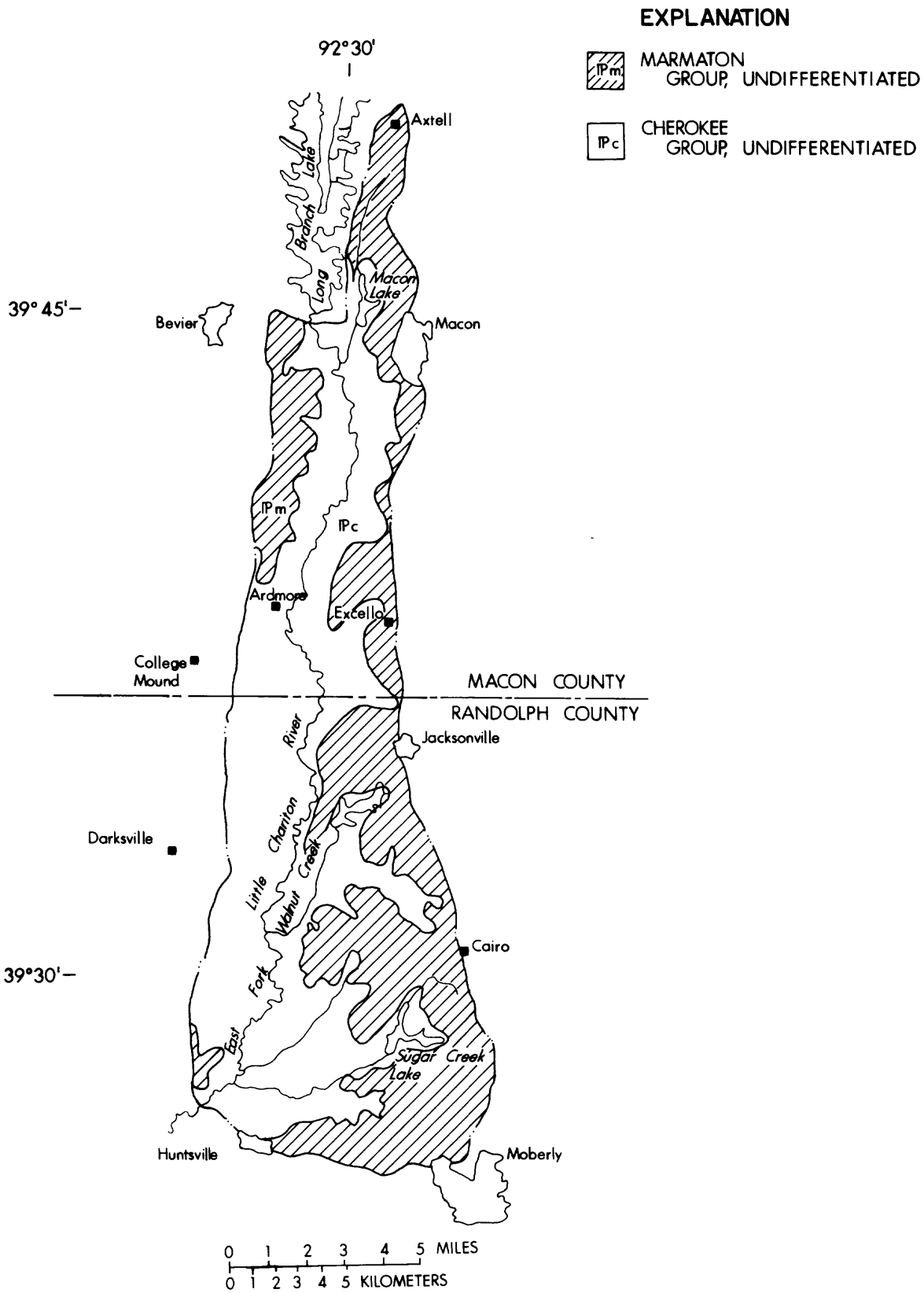


Figure 4.--Pennsylvanian bedrock in the study area (modified from Hall and Davis, 1986.)

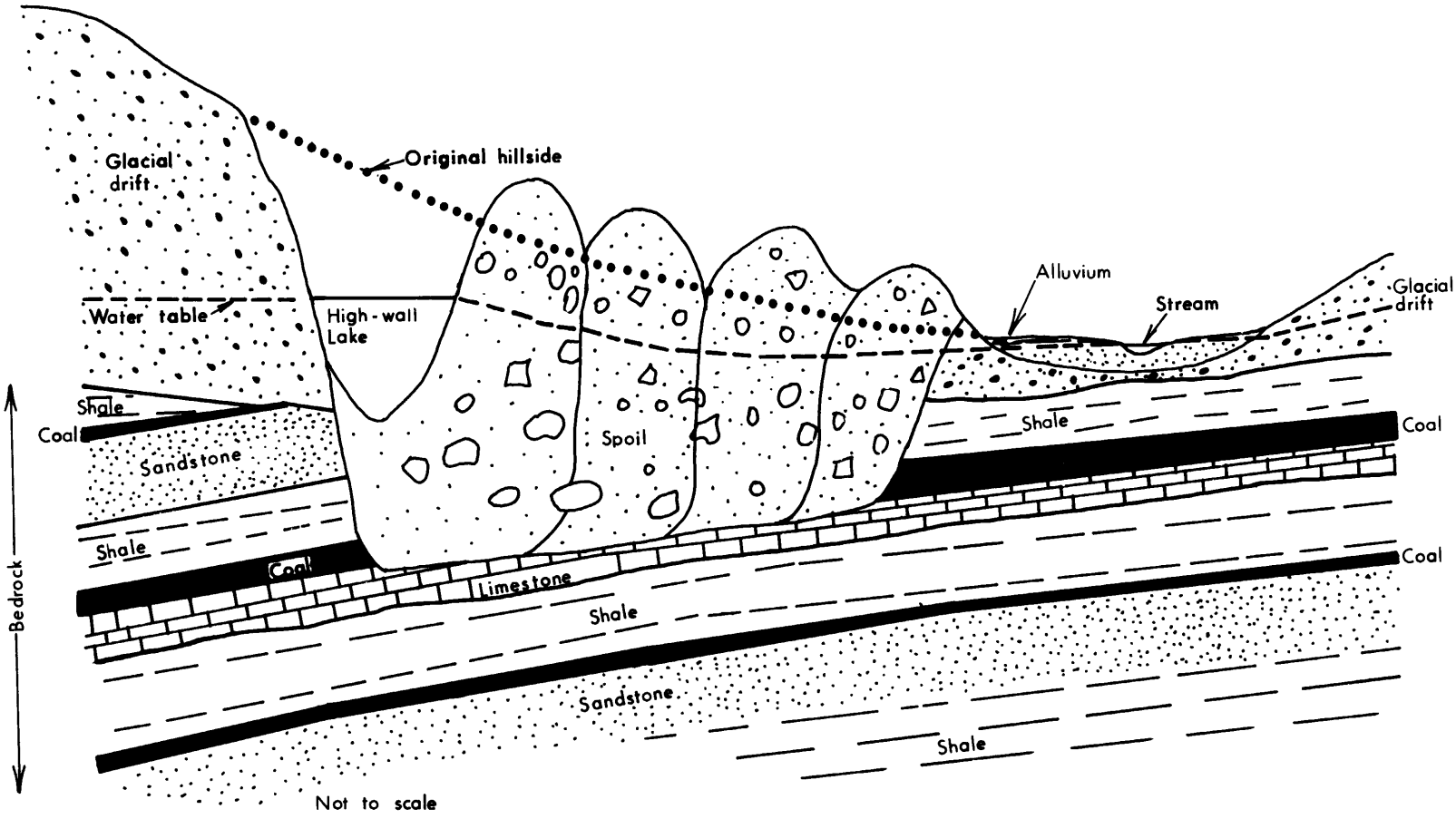
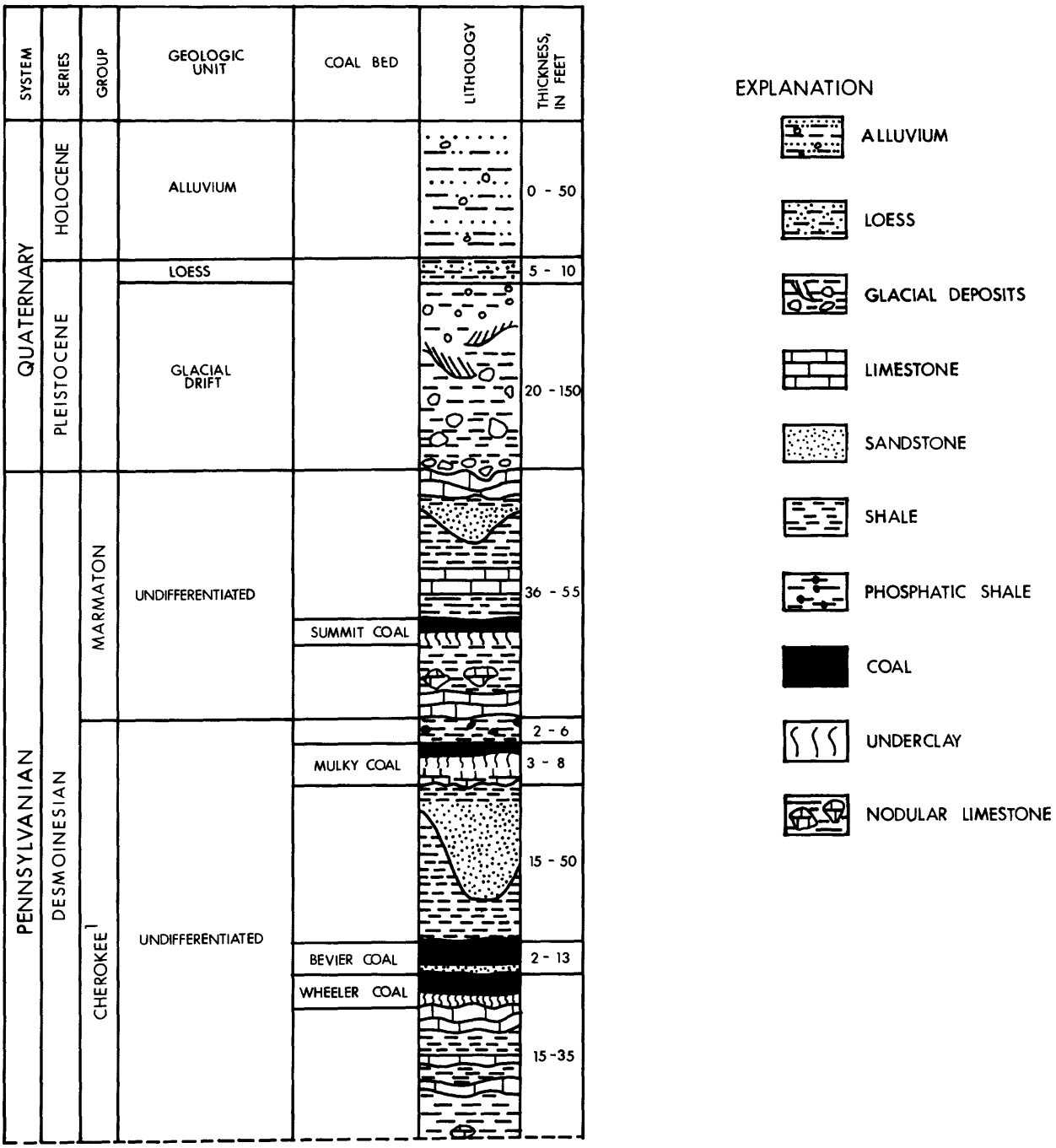


Figure 6.--Generalized lithologic section through a hypothetical abandoned strip mine (from Hall and Davis, 1986).



[1]Designated Cherokee shale by the U.S. Geological Survey

Figure 5.--Generalized stratigraphy in the study area (from Hall and Davis, 1986).

Reported values of transmissivity in glacial drift range from 0.002 to 29 feet squared per day (Horner and Shifrin, Inc., 1981; Haliburton Associates, 1981). Storage coefficients were not determined. The aquifer is unconfined near the land surface, but confined at depth with slow rates of recharge (Haliburton Associates, 1981). Infiltration rates into the glacial drift are about 0.06 inch per hour (D.K. Potter, oral commun., 1984). Historically, hand-dug wells in glacial drift were common and were used for stock and domestic water supplies. Because of small production rates, these wells usually were supplemented with precipitation collected from roofs of buildings. The glacial drift-bedrock contact zone is a zone of increased permeability and water availability.

Values of transmissivity determined in bedrock aquifers near the study area are small, ranging from 0.003 to 1 foot squared per day (Haliburton Associates, 1981; Horner and Shifrin, Inc., 1981). Bedrock aquifers are confined; therefore, recharge predominately is at outcrop areas. These aquifers are not considered significant regionally, except in the case of underground-mine drainage and in strip mines where the bedrock aquifers have been breached.

Because of the inherent heterogeneity of the spoil, there are large local variations in transmissivity, recharge rates, and, therefore, variations in water quality. Reported values of transmissivity range from about 1 to greater than 35 feet squared per day (Seifert, 1982; Shell Engineering Associates, 1981). Infiltration rates into spoil are about 0.2 to 0.6 inch per hour (D.K. Potter, oral commun., 1984). Recharge mainly is from precipitation, although lateral flow from glacial drift probably contributes some recharge (Hall and Davis, 1986). The aquifer is unconfined, but could have local areas that are confined. Discharge is by seepage at the downgradient bases of spoil dumps and laterally into glacial drift and alluvium.

Ground-Water Movement

Ground-water movement during the summer in the shallow aquifers in the East Fork Little Chariton River subbasin and surrounding areas generally is toward the streams (fig. 7). Water levels in wells along a transect in the alluvium at a location 6.5 miles downstream from site 1 on the East Fork Little Chariton River (fig. 2, wells 19-24 and 31) indicated that the hydraulic gradient was from the alluvium toward the stream, regardless of the time of year. The gradient was greatest in the spring when weather conditions were wettest and least in the fall when weather conditions were driest (fig. 8).

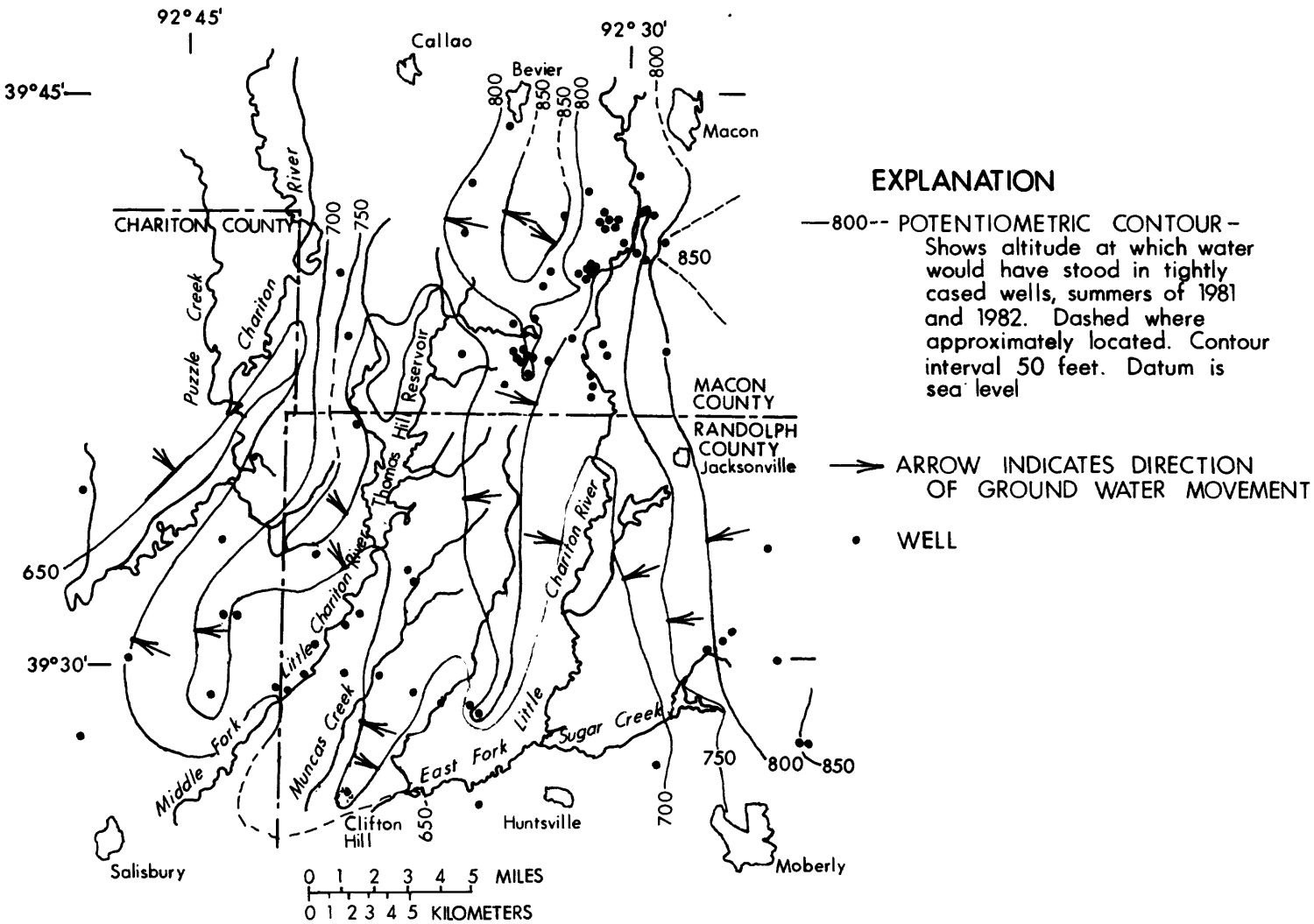


Figure 7.--Potentiometric surface in shallow aquifers in parts of Macon, Randolph, and Chariton Counties, summers of 1981 and 1982 (from Hall and Davis, 1986).

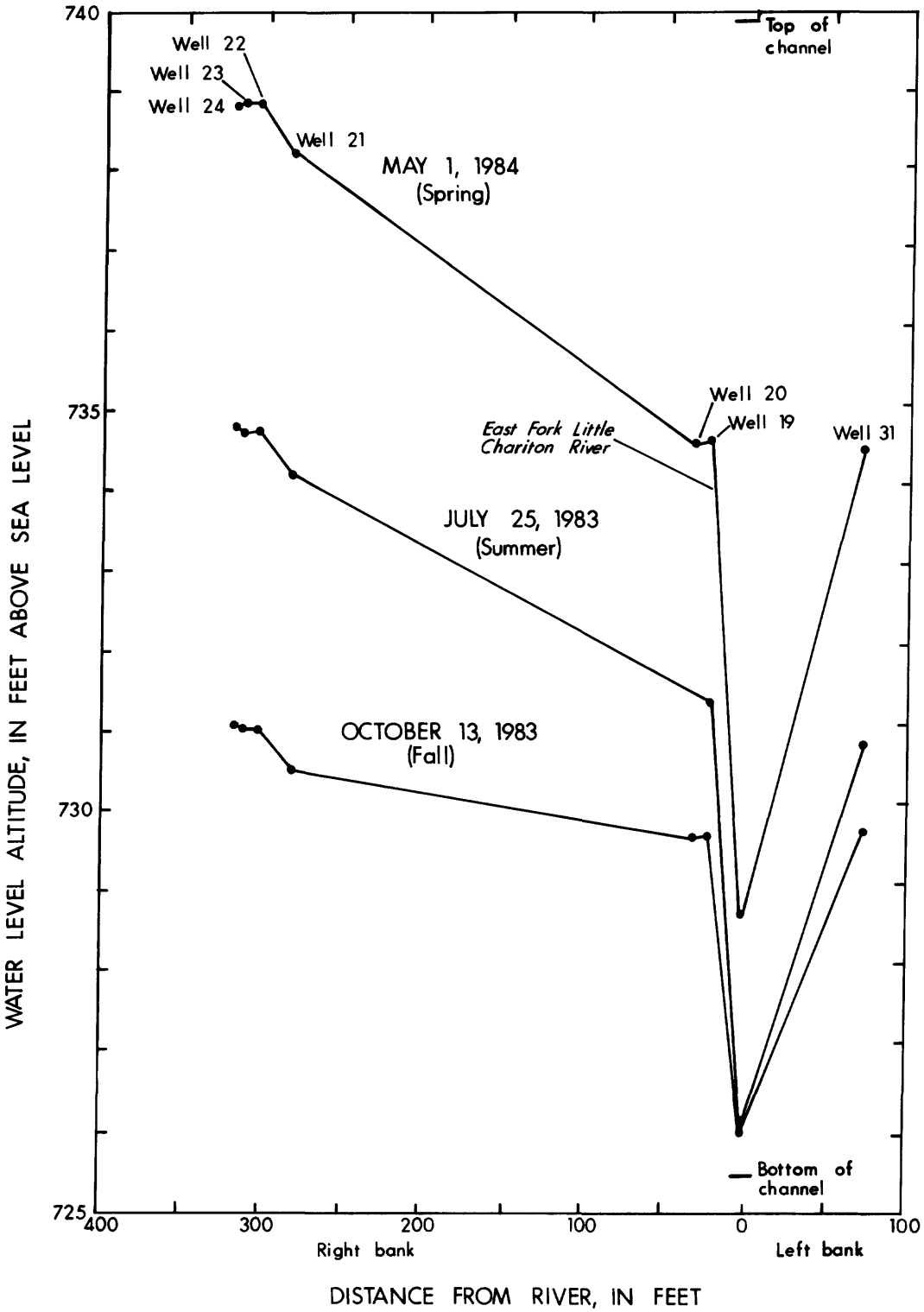


Figure 8.--Hydraulic gradient in spring, summer, and fall, at a site 6.5 miles downstream from Macon near the East Fork Little Chariton River.

EFFECTS OF COAL MINING ON WATER QUALITY

East Fork Little Chariton River

The median concentrations of dissolved solids in the East Fork Little Chariton River were 153 milligrams per liter near Macon (site 1) and 630 milligrams per liter near Huntsville (site 7), a 4.1-fold increase (table 2) in the reach affected by coal mining. Median concentrations of bicarbonate, silica, and iron were greater at the Macon site. Concentrations of dissolved solids were significantly greater at Huntsville than at Macon (Kruskal-Wallis test; 95-percent confidence level; Gibbons, 1976), primarily due to increases in concentrations of sulfate, calcium, and magnesium. Streamflow, specific conductance, calcium, sodium, and sulfate were all significantly greater at the Huntsville site; pH was significantly less at the Huntsville site. Chloride was not significantly different between the two sites.

Sulfate concentrations were increased and chloride concentrations were decreased in ground water in strip-mine spoil as compared to other water sources in north-central Missouri (Hall and Davis, 1986). Therefore, sulfate-to-chloride ratio was used as the most sensitive indicator of strip mining effect on water quality. There was a 9-fold increase (5.5 to 50) in sulfate-to-chloride ratio, calculated from medians, between the East Fork Little Chariton River near Macon and near Huntsville (table 3).

Streams in north-central Missouri that are not in strip-mining areas, such as the Grand, Thompson, and Chariton Rivers, do not have large downstream increases in dissolved-solids concentrations or sulfate-to-chloride ratio (fig. 9 and table 4). The Middle Fork Little Chariton River flows through strip-mined lands similar to the East Fork Little Chariton River. Mean dissolved-solids concentration increased from 230 to 345 milligrams per liter and sulfate-to-chloride ratio increased from 8.8 to 44 from near Callao to near Prairie Hill, Missouri.

Gain-loss studies were made and water-quality sampling was done in the East Fork Little Chariton River basin downstream from Macon on October 26-28, 1982, and July 18-20, 1983 (fig. 3, tables 5 and 6). High base-flow conditions (no overland runoff) existed in the basin during both studies and releases from the Long Branch Lake were constant (less than 2-percent variation). Water removal and return to the river complicated the analysis of the 12-mile reach of the river upstream from Huntsville, so this reach was not included in the study.

Physical-property values and chemical-constituent concentrations in tributaries were variable (table 7): pH ranged from 2.4 to 8.0 units, sulfate ranged from 610 to 3,800 milligrams per liter, chloride ranged from 2.7 to 16 milligrams per liter; dissolved-solids ranged from 962 to 6,050 milligrams per liter; and sulfate-to-chloride ratio ranged from 77 to 630. Tributary inflows with pH values less than 5.0 were considered to contain some diffuse inflow from abandoned underground coal mines or coal-waste deposits. Although such inflows were small, they probably contributed to the decreased pH, but were not the dominant cause of increased constituent concentrations in the East Fork Little Chariton River.

Table 2.--Medians of pH, specific conductance, and selected chemical constituents at selected surface- and ground-water sites

[Concentrations in milligrams per liter unless otherwise indicated; numbers of analyses shown in parentheses; µS/cm, microsiemens per centimeter at 25 °Celsius; ft^3/s, cubic feet per second; µg/L, micrograms per liter; --, not applicable]

Property or constituent[a]	East Fork Little Chariton River near Macon	East Fork Little Chariton River near Huntsville	Alluvium upstream of strip mines (2 wells)	Alluvium near strip mines (7 wells)	Glacial drift (18 wells)	Bed-rock (4 wells)	Coal spoil (15 wells)
pH, in units	7.7 (68)	7.3 (136)	6.6 (3)	6.7 (7)	7.4 (18)	9.0 (4)	6.6 (55)
Specific conductance, in µs/cm	275 (68)	852 (136)	780 (3)	970 (7)	697 (4)	1,140 (2)	3,060 (55)
Discharge or flow, in ft^3/s	18 (68)	36 (136)	--	--	--	--	--
Calcium, dissolved	32 (41)	110 (136)	67 (2)	94 (6)	86 (18)	11 (4)	500 (55)
Magnesium, dissolved	6.6 (41)	42 (100)	16 (2)	22 (6)	28 (18)	8.4 (4)	190 (55)
Sodium, dissolved	10 (41)	22 (99)	24 (2)	48 (6)	48 (18)	190 (4)	75 (55)
Potassium, dissolved	4 (41)	5 (99)	1 (2)	1 (6)	10 (18)	15 (4)	6 (55)
Bicarbonate, as HCO_3	113 (68)	86 (124)	340 (3)	370 (7)	363 (18)	418 (4)	510 (55)
Sulfate, dissolved	36 (68)	360 (128)	140 (3)	350 (7)	77 (18)	110 (4)	1,900 (55)
Chloride, dissolved	6.6 (41)	7.2 (99)	7.4 (2)	3.5 (6)	10 (18)	7.4 (4)	3.6 (55)
Silica, dissolved, as SiO_2	7.9 (41)	7.6 (96)	24 (2)	21 (6)	16 (7)	18 (4)	15 (55)
Iron, dissolved, in µg/L	120 (66)	90 (55)	27,000 (3)	12,000 (7)	260 (7)	20 (4)	5,100 (55)
Manganese, dissolved, in µg/L	200 (66)	1,300 (125)	6,300 (2)	5,800 (6)	300 (15)	100 (4)	4,700 (55)
Dissolved solids, calculated sum[b]	153 (41)	630 (96)	408 (2)	641 (6)	559 (8)	776 (4)	2,860 (55)

[a]Individual analysis from glacial drift, bedrock, and coal spoil are given in Hall and Davis (1986); analysis of water from the river and from the alluvium are given in "Supplemental Data" at the back of this report.

[b]Analysis of water from glacial drift and bedrock are residue at 180 °Celsius.

Table 3.--Sulfate-to-chloride ratios at selected surface- and ground-water sites

[Ratios were calculated from median concentrations given in table 1, except that for tributary 3.4, which was calculated from a single analysis given in table 5]

Source of water	Sulfate-to-chloride ratio
East Fork Little Chariton River near Macon	5.5
East Fork Little Chariton River near Huntsville	50
Alluvium upstream of strip mines	19
Alluvium near strip mines	100
Glacial drift	7.7
Bedrock	15
Coal spoil	530
Tributary 3.4 (affected by underground-mine drainage)	310

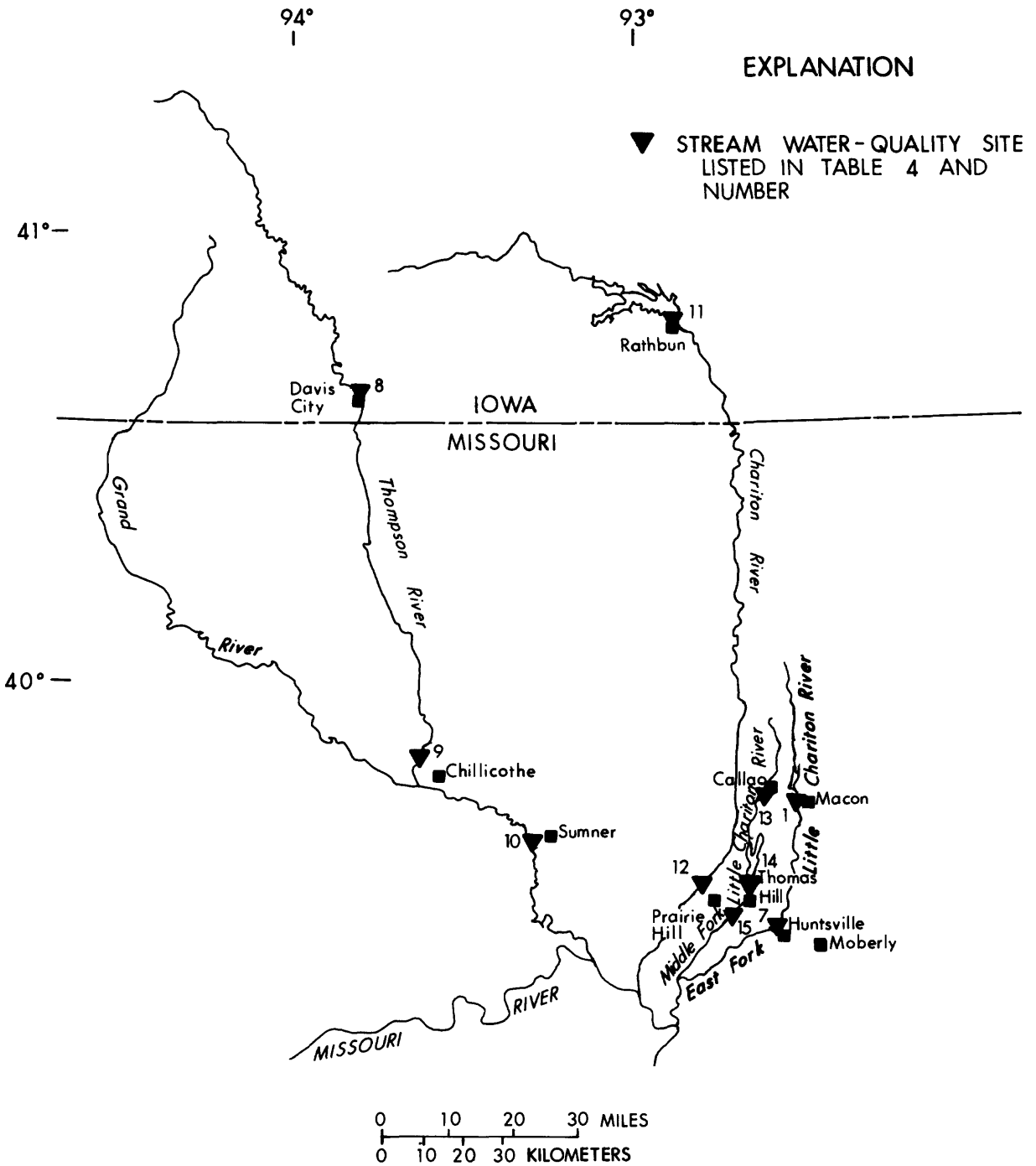


Figure 9.--Selected surface-water sites where water-quality data were collected in north-central Missouri and south-central Iowa. (Modified from Detroy and others, 1983, p. 37)

Table 4.--Medians of pH and selected chemical constituents, and sulfate-to-chloride ratios at selected surface-water sites in north-central Missouri and south-central Iowa

[Numbers of samples are in parentheses. Data except for chloride[1] and sulfate-to-chloride ratios[2] from Detroy and others, 1983, p. 36-47. Units and symbol: mg/L, milligrams per liter; µg/L, micrograms per liter; --, no data]

Site number (fig. 9)	Site name	Median pH, in units	Mean sulfate, dissolved, in mg/L	Mean chloride dissolved, in mg/L	Median iron dissolved, in µg/L	Median manganese, dissolved, in µg/L	Mean dissolved solids, in mg/L	Sulfate-to-chloride ratio
8	Thompson River at Davis City, Iowa	7.9 (34)	42 (10)	6.1 (10)	--	--	260 (12)	6.9
9	Thompson River near Chillicothe, Missouri	7.9 (80)	41 (80)	8.2 (85)	60 (70)	60 (80)	250 (78)	5.0
10	Grand River near Sumner, Missouri	7.8 (166)	40 (66)	7.4 (142)	50 (94)	80 (119)	250 (164)	5.4
11	Chariton River near Rathbun, Iowa	7.6 (92)	90 (26)	--	120 (25)	--	265 (78)	--
12	Chariton River near Thomas Hill, Missouri	7.8 (133)	63 (133)	6.3 (161)	60 (85)	50 (111)	240 (133)	10
1	East Fork Little Chariton River near Macon, Missouri	7.8 (30)	32 (30)	8.0 (3)	70 (28)	170 (28)	160 (30)	4.0
7	East Fork Little Chariton River near Huntsville, Missouri	7.6 (31)	301 (31)	7.9 (3)	80 (28)	570 (28)	570 (28)	38
13	Middle Fork Little Chariton River near Callao, Missouri	7.9 (3)	54 (3)	6.1 (1)	60 (2)	210 (2)	230 (3)	8.8
14	Middle Fork Little Chariton River near Thomas Hill, Missouri	7.9 (14)	117 (14)	4.1 (2)	60 (13)	30 (13)	250 (14)	29
15	Middle Fork Little Chariton River near Prairie Hill, Missouri	7.6 (14)	202 (14)	4.6 (2)	50 (13)	250 (13)	345 (14)	44

[1]Chloride data for the five Little Chariton River sites were from M.G. Detroy, U.S. Geological Survey, written commun., 1984; for the other five sites, chloride data were from available WATSTORE records.

[2]Sulfate-to-chloride ratios were calculated from means given in this table.

Table 5.--Results of the October 1982 gain-loss study of the East Fork Little Chariton River

[--, no data; <, less than; DWSC, discharge-weighted specific conductance; E, estimated]

Site number (fig. 3)	River miles	Discharge (cubic feet per second) River	Discharge (cubic feet per second) Tributary	Discharge (cubic feet per second) Gain (+) or loss (-) in main stem	Specific conductance (microsiemens per centimeter at 25 °Celsius)	pH (units)
1	0	10.2	--	--	176	8.0
1.1	--	--	0.19	--	668	7.5
1.2	--	--	<.01	--	--	--
2	4.1	12.8	--	+2.6	203	7.8
2.1	--	--	<.01	--	810	7.9
2.2	--	--	<.01	--	--	--
2.3	--	--	.07	--	900	7.8
2.4	--	--	<.01	--	--	--
2.5	--	--	.14	--	3,500	7.8
2.6	--	--	.18	--	4,050	7.8
2.7	--	--	--	--	--	--
2.8	--	--	.14	--	2,440	7.7
2.9	--	--	<.01	--	--	--
3	8.1	14.0	--	+1.2	690	7.6
3.1	--	--	.09	--	2,550	4.0
3.2	--	--	0.10	--	3,940	7.4
3.3	--	--	.61	--	5,000	8.0
3.4	--	--	.05	--	4,150	3.4
3.5	--	--	.16	--	5,000	8.2
3.6	--	--	.05	--	1,130	7.6
4	10.8	14.9	--	+.9	1,080	7.7
4.1	--	--	.18	--	2,700	3.4
4.2	--	--	<.01	--	--	--
4.3	--	--	<.1	--	--	--
4.4	--	--	.54	--	2,770	7.9
4.5	--	--	<.01	--	--	--
4.6	--	--	.39	--	2,180	7.4
4.7	--	--	.14	--	2,300	7.9
4.8	--	--	<.01	--	--	--
4.9	--	--	<.01	--	--	--
5	18.6	18.4	--	+3.5	1,250	7.9
5.1	--	--	<.01	--	--	--
6	24.3	18.3	--	-.1	1,300	7.8
			Net <+3.2	Net +8.1		

Table 5.--Results of the October 1982 gain-loss study of the East Fork Little Chariton River--Continued

Site number (fig. 3)	DWSC (cubic feet per second x microsiemens per centimeter at 25 °Celsius)	Gain(+) or loss(-) of DWSC in main stem	Sulfate concentration (milligrams per liter)	Sulfate load (milligrams-per liter x cubic feet per second)	Gain(+) or loss(-) of sulfate load in main stem	Chloride concentration (milligrams per liter)	Sulfate-to-chloride ratio
1	1,800	--	21	210	--	5.0	4.2
1.1	130	--	250E	48	--	--	--
1.2	--	--	--	--	--	--	--
2	2,600	+800	25	320	+110	4.9	5.1
2.1	<8	--	340E	<3	--	--	--
2.2	--	--	--	--	--	--	--
2.3	60	--	400E	30	--	--	--
2.4	--	--	--	--	--	--	--
2.5	490	--	2,100E	290	--	--	--
2.6	730	--	2,500E	450	--	--	--
2.7	--	--	--	--	--	--	--
2.8	340	--	1,400E	200	--	--	--
2.9	--	--	--	--	--	--	--
3	9,660	+7,060	230	3,200	+2,900	5.3	43
3.1	200	--	1,700	200	--	2.7	630
3.2	390	--	2,400E	240	--	--	--
3.3	3,000	--	3,800	2,300	--	14	--
3.4	200	--	2,600E	100	--	--	--
3.5	800	--	3,100E	500	--	--	--
3.6	60	--	560E	30	--	--	--
4	16,100	+6,440	450	6,700	+3,500	6.0	75
4.1	490	--	1,600	290	--	9.5	170
4.2	--	--	--	--	--	--	--
4.3	--	--	--	--	--	--	--
4.4	1,500	--	1,700E	920	--	--	--
4.5	--	--	--	--	--	--	--
4.6	850	--	1,300E	510	--	--	--
4.7	320	--	1,300E	180	--	--	--
4.8	--	--	--	--	--	--	--
4.9	--	--	--	--	--	--	--
5	23,000	+6,900	560	10,000	+3,300	5.9	95
5.1	--	--	--	--	--	--	--
6	23,800	+800	570	10,000	0	6.1	93
		Net +22,000			Net +9,800		

Table 6.--Results of the July 1983 gain-loss study of the East Fork Little Chariton River

[--, no data; <, less than; E, estimated; DWSC, discharge-weighted specific conductance]

Site number (fig. 3)	River miles	Discharge (cubic feet per second) River	Discharge (cubic feet per second) Tributary	Discharge (cubic feet per second) Gain (+) or loss (-) in main stem	Specific conductance (microsiemens per centimeter at 25 °Celsius)	pH (units)
1	0	14.5	--	--	183	8.2
1.1	--	--	[a]0.05E	--	557	7.3
1.2	--	--	0	--	--	--
2	4.1	15.0	--	+0.5	197	7.6
2.1	--	--	0	--	--	--
2.2	--	--	0	--	--	--
2.3	--	--	0	--	--	--
2.4	--	--	0	--	--	--
2.5	--	--	[b].06	--	3,910	7.9
2.6	--	--	[b].05E	--	4,150	7.9
2.7	--	--	[b].05E	--	4,900	7.1
2.8	--	--	[b].01E	--	4,050	4.6
2.9	--	--	[b]<.05	--	4,800	8.1
3	8.1	16.8	--	+1.8	430	8.4
3.1	--	--	[b]<.05	--	4,100	2.9
3.2	--	--	0.05E	--	--	--
3.3	--	--	.96	--	6,700	7.7
3.4	--	--	.15E	--	4,450	2.6
3.5	--	--	0	--	--	--
3.6	--	--	.05E	--	2,170	4.1
4	10.8	16.6	--	-.2	775	7.7
4.1	--	--	0	--	--	--
4.2	--	--	0	--	--	--
4.3	--	--	0	--	--	--
4.4	--	--	.42	--	3,620	8.0
4.5	--	--	0	--	--	--
4.6	--	--	[a]0	--	--	--
4.7	--	--	[a]0	--	--	--
4.8	--	--	[a]0	--	--	--
4.9	--	--	0	--	--	--
5	18.6	16.1	--	-.5	850	8.0
5.1	--	--	[a]0	--	--	--
6	24.3	16.0	--	-.1	745	8.0
			Net <+2.0	Net +1.5		

Table 6.--Results of the July 1983 gain-loss study of the East Fork Little Chariton River--Continued

Site number (fig. 3)	DWSC (cubic feet per second x microsiemens per centimeter at 25 °Celsius)	Gain(+) or loss(-) of DWSC in main stem	Sulfate concentration (milligrams per liter)	Sulfate load (milligrams per liter x cubic feet per second)	Gain(+) or loss(-) of sulfate load in main stem	Chloride concentration (milligrams per liter)	Sulfate-to-chloride ratio
1	2,650	--	24	350	--	4.4	5.5
1.1	30	--	180E	9	--	--	--
1.2	0	--	--	0	--	--	--
2	2,960	+310	25	380	+30	4.7	5.3
2.1	0	--	--	0	--	--	--
2.2	0	--	--	0	--	--	--
2.3	0	--	--	0	--	--	--
2.4	0	--	--	0	--	--	--
2.5	200	--	2,500E	200	--	--	--
2.6	200	--	2,700E	100	--	--	--
2.7	200	--	3,200E	200	--	--	--
2.8	40	--	2,600E	30	--	--	--
2.9	<200	--	3,100E	<200	--	--	--
3	7,220	+4,260	120	2,000	+1,600	4.8	25
3.1	<200	--	2,600E	<100	--	--	--
3.2	--	--	--	--	--	--	--
3.3	6,400	--	3,800	3,600	--	16	240
3.4	670	--	3,400	510	--	11	310
3.5	0	--	--	0	--	--	--
3.6	100	--	1,300E	60	--	--	--
4	12,900	+5,700	380	6,300	+4,300	5.1	75
4.1	--	--	--	0	--	--	--
4.2	--	--	--	0	--	--	--
4.3	--	--	--	0	--	--	--
4.4	1,500	--	2,300E	970	--	--	--
4.5	--	--	--	0	--	--	--
4.6	--	--	--	0	--	--	--
4.7	--	--	--	0	--	--	--
4.8	--	--	--	0	--	--	--
4.9	--	--	--	0	--	--	--
5	13,700	+800	330	5,300	-1,000	5.2	63
5.1	--	--	--	0	--	--	--
6	11,900	-1,800	300	4,800	-500	5.3	57
		Net +9,300			Net +4,400		

[a]Measured 8-26-83.

[b]Measured 8-25-83.

Table 7.--Summary of water-quality data for tributaries to the East Fork Little Chariton River during the October 1982 and July 1983 gain-loss studies

[Concentrations in milligrams per liter unless otherwise indicated; µS/cm, microsiemens per centimeter at 25 °Celsius; ft^3/s, cubic feet per second; µg/L, micrograms per liter]

Property or constituent	Number of samples	Median	Minimum	Maximum
pH, in units	8	7.7	2.4	8.0
Specific conductance, in µS/cm	8	2,620	1,400	6,700
Discharge, in ft^3/s	8	0.8	0.09	1.5
Calcium, dissolved	8	370	130	490
Magnesium, dissolved	8	150	56	310
Sodium, dissolved	8	62	27	1,000
Potassium, dissolved	8	10	6.1	21
Bicarbonate, as HCO_3	8	73	0.0	520
Sulfate, dissolved	8	1,650	610	3,800
Chloride, dissolved	8	8.7	2.7	16
Aluminum, dissolved, in µg/L	8	130	10	21,000
Iron, dissolved, in µg/L	7	70	8	28,000
Manganese, dissolved, in µg/L	8	2,900	420	17,000
Dissolved solids, calculated sum	8	2,270	962	6,050
Sulfate-to-chloride ratio	8	210	77	630

In October 1982, there was an increase in flow of 8.1 cubic feet per second (79 percent) in the 24-mile reach of the East Fork Little Chariton River downstream from Macon (table 5). Tributary inflow accounted for about 3.2 cubic feet per second and the remaining 4.9 cubic feet per second was diffuse inflow from the alluvium along the main stem. In contrast, in July 1983 (table 6) there was an increase in flow of 1.5 cubic feet per second (10 percent), which was slightly less than the tributary inflow and indicated little or no contribution from the alluvium. Estimated error per flow measurement is plus or minus 5 to 8 percent on the main stem and 8 percent or more on the tributaries.

Discharge-weighted specific conductance, obtained as the product of specific conductance times discharge at a site is proportional to dissolved-solids load and can be summed to determine specific conductance (or dissolved solids) gain or loss along a stream. During the October 1982 study, there was a 22,000-unit gain of discharge weighted specific conductance in the main stem (table 4). Of this increase, 9,600 units were from tributary inflow. About 25 percent of the 7,060-unit gain in the 4-mile reach between sites 2 and 3 was from tributary inflow, whereas about 75 percent was from diffuse ground-water inflow to the the main stem. The specific conductance of the diffuse ground-water inflow (0.65 cubic foot per second) to the main stem between sites 2 and 3 would have had to have been about 8,400 microsiemens per centimeter at 25 °Celsius, indicating a possible substantial effect from the more mineralized underground-mine water in this reach. Most of the remaining increase in discharge-weighted specific conductance in the main stem can be explained by inflow from alluvium near strip mines (median specific conductance, 970 microsiemens per centimeter at 25 °Celsius; table 2). The sulfate-to-chloride ratio in the 24-mile reach increased from 4.2 to 93; sulfate-to-chloride ratios of tributary inflow were as much as 630. The pH decreased from 8.0 to 7.8 in the 24-mile reach.

During the July 1983 study, discharge-weighted specific conductance increased throughout the first four reaches of the main stem and decreased in the remaining reach. The net increase in discharge-weighted specific conductance was 9,300 units (table 6), approximately equivalent to the contribution by tributary inflow (9,700 units). Chloride concentration increased 20 percent, and sulfate-to-chloride ratio increased from 5.5 to 57. The pH decreased from 8.2 to 8.0.

Sulfate analyses were obtained only at the East Fork Little Chariton River and selected inflow sites. However, in most cases where sulfate was not analyzed, it was estimated (in milligrams per liter) from specific conductance (in microsiemens per centimeter at 25 °Celsius), using the linear regression equation obtained from combined data from the two gain-loss studies:

Sulfate = 0.690 x specific conductance - 202
(standard error of regression = 238).

Sulfate load during the October 1982 study increased in all reaches (table 5). Tributary inflow contributed 6,300 units. The remaining increase (3,500 units) could be accounted for by seepage of water from alluvium with some direct contribution from spoil and underground mines. Sulfate load during the 1983 study (table 6) increased throughout each of the first three reaches and decreased throughout each of the last two reaches. The net increase in sulfate load for the 24-mile reach was 4,400 units, all of which could be accounted for by tributary inflow (6,000 units).

Sulfate-to-chloride ratios increased downstream in the main stem for both gain-loss studies (4.2 to 93 in October 1982 and 5.5 to 57 in July 1983). The increase are during October 1982 study is attributed to ground-water seepage into tributaries and the main stem and to underground-mine drainage into tributaries. The sulfate-to-chloride ratio of tributary inflow was as much as 630. The increase during the July 1983 study is attributed to underground-mine drainage into tributaries; ground-water seepage was not appreciable at that time. The sulfate-to-chloride ratio of tributary inflows was as much as 310. The increase was larger during the 1982 study when ground-water seepage made a larger contribution to flow, than during the 1983 study when seepage was less.

Alluvial Aquifer

Median dissolved-solids concentration in water from alluvium upstream of the strip mines was 408 milligrams per liter. This is a larger concentration than that in water from the East Fork Little Chariton River near Macon, but smaller than that in water from the East Fork Little Chariton River near Huntsville, alluvium near strip mines, glacial drift, bedrock, or coal spoil (table 2). Sulfate-to-chloride ratios in water from alluvium upstream of the strip mines were larger than those in water from the East Fork Little Chariton River near Macon, glacial drift, and bedrock, but smaller than those in water from alluvium near the strip mines or coal spoil. Based on aquifer positions, water quality, and the fact that the hydraulic gradient is toward the East Fork Little Chariton River, recharge to alluvium principally comes from glacial drift, with locally varying quantities coming from coal spoil.

The quality of water from the alluvium near the strip mines is considerably different from that of water from the alluvium upstream from the strip mines (tables 2 and 3). Near the strip mines, the median dissolved-solids concentration was 641 milligrams per liter, the median sulfate concentration was 350 milligrams per liter, and the median sulfate-to-chloride ratio was 100; upstream from the strip mines, the median dissolved-solids concentration was 408 milligrams per liter, the median sulfate concentration was 140 milligrams per liter, and the median sulfate-to-chloride ratio was 19. Predominant ions in the upstream alluvial wells were calcium and bicarbonate, generally changing toward calcium and magnesium and sulfate in water from the alluvial wells near the strip mines (fig. 10). There is a similar trend in water from the East Fork Little Chariton River between Macon and Huntsville.

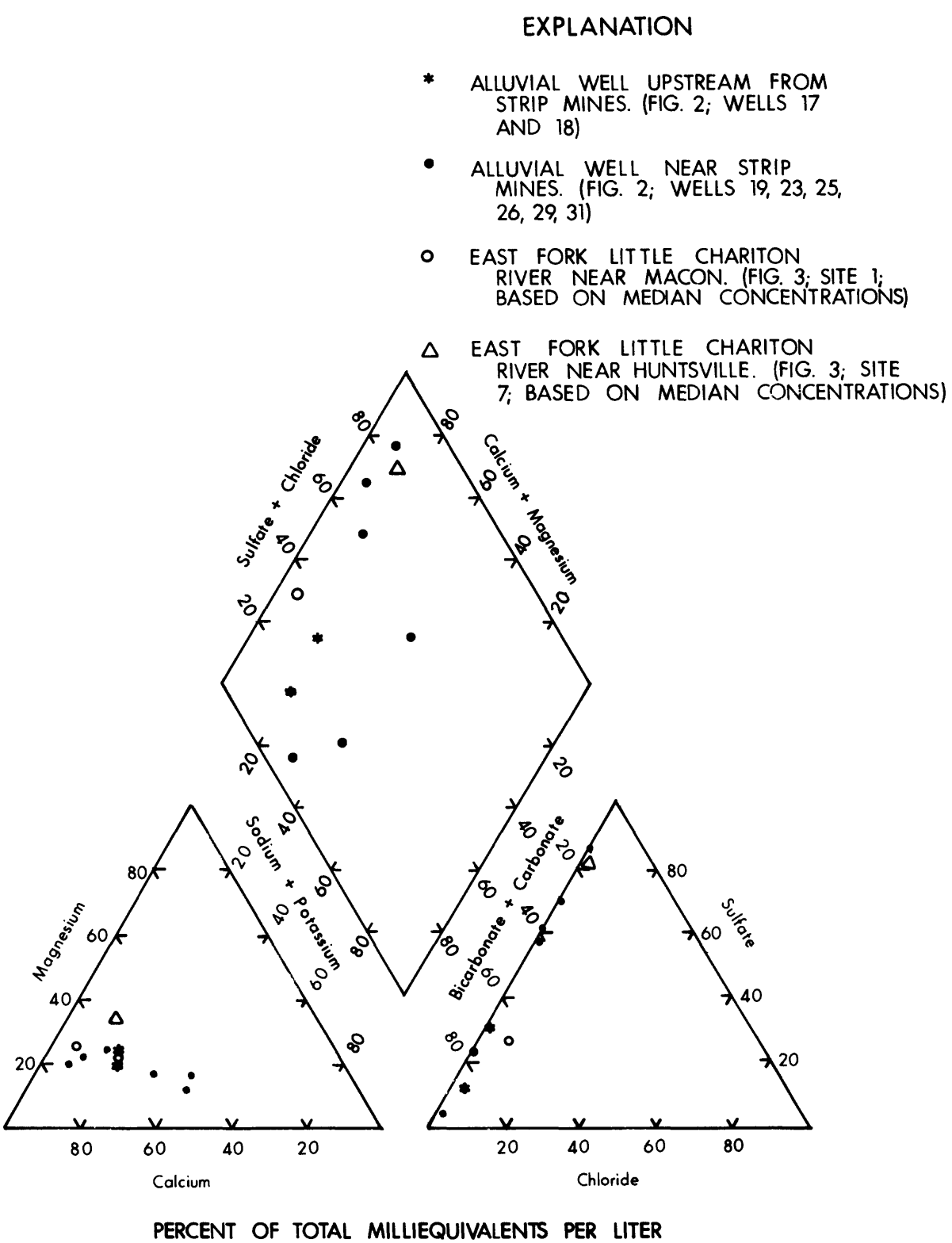


Figure 10.--Major ions in water from eight wells completed in alluvium and in water from the East Fork Little Chariton River at two location.

SUMMARY AND CONCLUSIONS

North-central Missouri contains many coal strip mines abandoned before the beginning of reclamation practices designated by Public Law 95-87 in 1979. The quality of surface water and ground water in alluvium has been affected by abandoned strip mines and by abandoned underground mines. More than 14 percent of the land in the 110-square-mile subbasin of the East Fork Little Chariton River from Macon downstream to Huntsville had been strip mined before 1979.

Alluvium has been deposited on flood plains of larger streams in the area, such as the East Fork Little Chariton River. It consists of layers of poorly-sorted silt and sand confined by layers of clay. The alluvium has small values of transmissivity (1.6 to 16 feet squared per day) and storage coefficients (0.0003 to 0.001). The storage coefficients are indicative of a confined aquifer, which is in agreement with observations during well drilling. Recharge primarily is lateral from glacial drift and spoil. The hydraulic gradient is toward the stream throughout the year.

Values of transmissivity in glacial drift range from 0.002 to 29 feet squared per day. Storage coefficients were not determined. The aquifer is unconfined near the land surface, but confined at depth with slow rates of recharge. Infiltration rates are about 0.06 inch per hour.

Values of transmissivity in bedrock aquifers are small, ranging from 0.003 to 1 foot squared per day. The aquifers are confined, therefore recharge predominately is at outcrop areas. The aquifers are significant in the case of underground-mine drainage or in strip mines where bedrock aquifers have been breached.

In the strip-mine spoil, there are large local variations in values of transmissivity, recharge rates, and, therefore, in water quality. Values of transmissivity range from about 1 to more than 35 feet squared per day. Infiltration rates are about 0.2 to 0.6 inch per hour. The aquifer is unconfined, but could have local areas that are confined. Recharge is from precipitation and lateral flow from glacial drift.

Ground-water movement in the shallow aquifers generally is toward the streams. Ground-water seepage to the streams decreases to zero at times in the driest years.

The median dissolved-solids concentration in the East Fork Little Chariton River was 153 milligrams per liter near Macon and 630 milligrams per liter near Huntsville. Calcium, magnesium, and sulfate accounted for most of the increase. The sulfate-to-chloride ratio, used as the most sensitive indicator of coal-strip mining effect, was 5.5 near Macon and 50 near Huntsville, a 9-fold increase.

The Middle Fork Little Chariton River basin contains abandoned strip-mined areas and also has a downstream increase in dissolved-solids concentration and sulfate-to-chloride ratio. The Grand, Thompson, and Chariton Rivers in north-central Missouri without nearby strip mining do not have a downstream increase in dissolved solids and sulfate-to-chloride ratio.

The East Fork Little Chariton River is a gaining stream, except during drought conditions when net ground-water flow to the river approaches zero. During the two gain-loss studies, tributary inflow accounted for 40 and 100 percent of the gain in flow. The specific conductance increased from 176 to 1,300 and from 183 to 745 microsiemens per centimeter at 25 °Celsius downstream during the two studies. The sulfate-to-chloride ratio increased from 4.2 to 93 and from 5.5 to 57. The pH decreased 0.2 unit during both studies.

Median dissolved-solids concentration, in milligrams per liter, was 408 in water from alluvium upstream from the strip mines, 641 in water from alluvium near the strip mines, 559 in glacial drift, 776 in bedrock, and 2,860 in coal strip-mine spoil. The sulfate-to-chloride ratio calculated from median values was 19 in alluvial water upstream from the strip mines, was slightly greater for glacial drift and bedrock water, was 5.3 times greater in alluvial water near the strip mines, and 28 times greater in water from coal strip-mine spoil. Water from the alluvium near abandoned spoil is affected by recharge of water from the spoil. Water in the East Fork Chariton River increases in dissolved-solids concentration and sulfate-to-chloride ratio where seepage from the affected alluvium enters the river.

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SUPPLEMENTAL DATA

Table 8.--Selected data for wells completed in alluvium

[Wells were drilled with 5.5- to 6.5-inch augers, cased with polyvinyl chloride, perforated through the sandy intervals. Perforations were made by hacksaw at a density of 12 cuts per linear foot, perpendicular to the axis of the casing. The annulus surrounding the casing was filled with washed, pea-sized quartz gravel to within 3 to 12 feet of the land surface and sealed with bentonite. Well-production development was by pumping until water cleared and recovery improved]

Well number (fig. 2)	Altitude at land surface above sea level (feet)	Depth of well (feet)	Depth of perforated interval (feet)	Diameter of well casing (inches)	Date completed
17	749.13	42.8	32.8-42.8	2	1-25-83
18	750.75	36.5	21.5-36.5	2	1-25-83
19	739.99	45.6	25.6-45.6	2	1-25-83
20	740.10	35.2	12.8-35.2	4	2-07-83
20A	739.76	45.0	35.0-45.0	4	5-18-83
21	740.86	29.3	19.3-29.3	2	1-26-83
22	740.99	30.0	19.0-29.0	2	1-27-83
23	741.00	28.8	18.8-28.8	2	1-27-83
24	740.74	28.1	18.1-28.1	4	2-08-83
25	732.93	25.6	15.6-25.6	2	1-27-83
26	732.69	28.4	18.4-28.4	2	1-28-83
27	731.84	18.0	3.7-18.0	4	2-04-83
28	731.98	21.5	11.5-21.5	2	2-03-83
29	732.19	21.1	11.1-21.1	2	2-03-83
30	732.22	20.6	10.6-20.6	2	2-04-83
31	739.21	45.0	35.0-45.0	2	5-18-83

Table 9.--Water-quality data for selected wells completed in alluvium

[µs/cm, microsiemens per centimeter at 25 °Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; fet-fld, field endpoint titration-field; µg/L, micrograms per liter;--, no data; <, less than]

Well number (fig. 2)	Date of sample	Specific conductance (µs/cm)	pH (units)	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)
17	7-27-83	470	6.4	15.0	0.0	170	71	50	11	18	1.0
18	7-27-83	760	6.6	15.0	.0	290	0	84	20	29	.90
	9-28-83	730	6.7	16.0	.0	--	--	--	--	--	--
19	7-25-83	760	6.9	15.0	--	220	0	68	12	75	.80
21	9-29-83	1240	6.6	13.0	.7	--	--	--	--	--	--
23	7-24-83	810	6.8	17.5	.0	240	58	69	16	76	.70
25	7-28-83	2750	6.6	15.0	.0	1,700	1,300	500	100	59	2.6
26	7-26-83	970	6.7	15.0	.0	420	190	120	28	33	.90
29	7-27-83	2470	6.3	17.0	.0	1,400	860	430	68	37	2.3
31	7-27-83	560	6.7	16.0	.5	190	0	57	11	38	1.8

Well number (fig. 2)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Carbon dioxide, dissolved (mg/L as CO2)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Residue at 180 deg C, dissolved (mg/L)	Sum of constituents, dissolved (mg/L)
17	270	0	100	171	33	7.2	0.20	26	252	300
18	360	0	--	144	140	7.6	.40	21	438	520
	340	0	--	108	140	--	--	--	--	--
19	410	0	--	82	100	2.4	.40	19	452	500
21	230	0	--	92	510	--	--	--	--	--
23	220	0	--	55	250	3.5	.40	23	557	560
25	420	0	--	168	1,700	3.5	.40	16	2,700	2,700
26	270	0	--	86	350	1.4	.50	23	719	720
29	610	0	--	486	1,200	12	.20	16	2,100	2,200
31	370	0	--	117	11	4.2	.30	24	303	350

Table 9.--Water-quality data for selected wells completed in alluvium--Continued

Well number (fig. 2)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)	Nickel, dissolved (µg/L as NI)	Strontium, dissolved (µg/L as SR)	Zinc, dissolved (µg/L as ZN)
17	20	15,000	3,600	2	200	11
18	<10	28,000	9,000	<1	370	14
	--	27,000	--	--	--	--
19	<10	13,000	3,700	1	260	15
21	--	8,000	--	--	--	--
23	<10	10,000	4,900	<1	300	14
25	20	65,000	32,000	29	1,600	60
26	140	24,000	6,300	6	470	8
29	20	150,000	21,000	30	1,100	30
31	10	11,000	5,200	13	220	7

Table 10.--Water-quality data for the October 1982 gain-loss study of the East Fork Little Chariton River

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter at 25 °Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; fet-fld, field endpoint titration-field; µg/L, micrograms per liter;--, no data; <, less than]

Location number (fig. 3)	Date of sample	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)	Temperature (deg C)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Acidity (mg/L as CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)
1	10-26-82	1315	10	176	8.0	14.0	74	17	--	22	4.5
2	10-26-82	1540	13	203	7.9	11.0	84	10	--	25	5.2
3	10-27-82	0825	14	690	7.6	9.0	260	140	--	62	25
3.1	10-27-82	0905	.09	2,550	4.0	8.5	1,700	1,700	30	360	190
3.3	10-27-82	1310	.61	5,000	8.0	11.5	2,500	1,800	--	490	300
4	10-27-82	1345	15	1,080	7.7	10.0	400	280	--	90	42
4.1	10-27-82	1410	.18	2,700	3.4	10.0	1,400	1,400	119	380	110
5	10-27-82	1620	18	1250	7.9	10.0	520	390	--	120	53
6	10-27-82	1705	18	1300	7.8	10.0	540	410	--	120	58
6.2	10-28-82	0920	1.5	1580	7.9	10.5	570	470	--	130	59
7	10-27-82	1740	18	1330	7.8	10.5	750	630	--	210	54

Date of sample	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Carbon dioxide, dissolved (mg/L as CO2)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Solids, residue at 180 deg C dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)
10-26-82	4.9	4.0	70	0.00	57	1.1	21	5.0	0.20	0.9	115	97
10-26-82	5.7	4.2	90	.00	74	2.0	25	4.9	.20	1.1	118	120
10-27-82	39	4.9	140	.00	115	5.6	230	5.3	.20	1.8	462	440
10-27-82	27	7.9	0	.00	0	.0	1,700	2.7	.60	9.0	2,400	2,300
10-27-82	1,000	17	850	.00	697	14	3,800	14	.50	9.0	6,280	6,100
10-27-82	78	5.6	150	.00	123	4.8	450	6.0	.30	2.2	795	750
10-27-82	49	6.4	0	.00	0	.0	1,600	9.5	.20	21	2,300	2,200
10-27-82	71	5.8	160	.00	131	3.2	560	5.9	.30	2.7	941	900
10-27-82	74	6.0	160	.00	131	4.0	570	6.1	.30	2.6	983	920
10-28-82	75	6.1	120	.00	98	2.4	610	7.9	.30	2.7	1,020	950
10-27-82	58	9.7	150	.00	123	3.8	780	6.5	.40	3.1	1,270	1,200

Table 10.--Water-quality data for the October 1982 gain-loss study of the East Fork Little Chariton River--Continued

Date of sample	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)	Nickel, dissolved (µg/L as NI)	Strontium, dissolved (µg/L as SR)	Zinc, dissolved (µg/L as ZN)
10-26-82	40	35	15	1	87	7
10-26-82	20	81	110	2	86	5
10-27-82	20	46	410	5	500	<3
10-27-82	1,900	2,600	7,100	180	700	260
10-27-82	30	70	4,000	40	6,200	60
10-27-82	30	23	580	8	800	<3
10-27-82	8,900	28,000	8,400	79	800	180
10-27-82	30	26	540	7	820	3
10-27-82	70	5	710	10	840	4
10-28-82	90	8	1,100	14	780	20
10-27-82	20	4	620	8	960	17

Table 11.--Water-quality data for the July 1983 gain-loss study of the East Fork Little Chariton River

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter at 25 °Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; fet-fld, field endpoint titration-field; µg/L, micrograms per liter; (E), estimated; --, No data; <, less than]

Location number (fig. 3)	Date of sample	Time	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)	Temperature (deg C)	Oxygen, dissolved (mg/L)	Oxygen, dissolved (percent saturation)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Acidity (mg/L as CACO3)
1	7-18-83	1215	14	183	8.2	27.0	--	--	74	8	--
2	7-18-83	1345	15	197	7.6	27.5	--	--	77	16	--
3	7-18-83	1505	17	430	8.4	30.5	--	--	160	77	5.0
3.3	7-19-83	0820	.96	6,700	7.7	23.0	--	--	2,400	1,700	35
3.4	7-20-83	1130	.15(E)	4,450	2.6	25.5	--	--	2,300	2,300	894
4	7-19-83	0920	17	775	7.7	26.5	--	--	270	180	--
5	7-19-83	1250	16	850	8.0	34.5	--	--	300	160	5.0
6	7-19-83	1400	16	745	8.0	30.5	--	--	300	200	--
6.1	7-20-83	--	1.1	1,400	7.8	30.0	--	--	710	610	15
6.6	7-19-83	1615	1.3	1,640	7.7	27.0	--	--	790	690	5.0
7	7-19-83	1500	17	895	8.1	31.0	--	--	330	230	--
	7-19-83	1815	17	900	8.5	32.0	7.2	98	320	220	--

Date of sample	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Carbon dioxide, dissolved (mg/L as CO2)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)
7-18-83	22	4.6	5.9	3.3	80	0.00	--	0.8	24	4.4	0.20	2.4
7-18-83	23	4.7	6.2	3.6	74	.00	--	3.0	25	4.7	.20	2.2
7-18-83	39	14	24	3.9	92	2	--	.6	120	4.8	.20	2.5
7-19-83	440	310	980	21	780	.00	--	25	3,800	16	.30	9.9
7-20-83	480	270	56	20	0	.00	--	.0	3,400	11	1.6	49
7-19-83	60	30	66	4.5	110	.00	--	3.5	380	5.1	.20	2.9
7-19-83	66	32	64	4.7	170	.00	--	2.7	330	5.2	.20	2.5
7-19-83	66	32	63	4.8	120	.00	--	1.9	300	5.3	.20	2.4
7-20-83	190	56	43	11	120	.00	--	3.0	730	4.1	.50	3.3
7-19-83	170	89	69	9.6	120	.00	--	3.8	790	6.5	.90	3.4
7-19-83	74	35	64	5.0	120	.00	--	1.5	350	7.2	.30	2.2
7-19-83	72	34	52	4.6	--	--	105	.6	320	9.0	.20	--

Table 11.--Water-quality data for the July 1983 gain-loss study of the East Fork Little Chariton River--Continued

Date of sample	Solids, residue at 180 deg C, dis-solved (mg/L)	Solids, sum of consti-tuents, dis-solved (mg/L)	Alum-inum, dis-solved (µg/L as AL)	Cadmium, dis-solved (µg/L as CD)	Copper, dis-solved (µg/L as CU)	Iron, dis-solved (µg/L as FE)	Lead, dis-solved (µg/L as PB)	Manga-nese, dis-solved (µg/L as MN)	Mercury dis-solved (µg/L as HG)	Nickel, dis-solved (µg/L as NI)	Stron-tium, dis-solved (µg/L as SR)	Zinc, dis-solved (µg/L as ZN)
7-18-83	108	110	480	--	--	110	--	16	--	4	80	92
7-18-83	110	110	100	--	--	62	--	58	--	<1	82	16
7-18-83	258	260	40	--	--	23	--	66	--	1	280	12
7-19-83	6,100	6,000	10	--	--	40	--	1,800	--	20	5,400	30
7-20-83	4,600	4,600	21,000	--	--	240,000	--	17,000	--	240	690	330
7-19-83	627	600	40	--	--	25	--	150	--	4	550	6
7-19-83	582	590	30	--	--	12	--	100	--	2	560	35
7-19-83	558	530	30	--	--	7	--	210	--	2	550	29
7-20-83	1,140	1,100	30	--	--	270	--	420	--	7	1,200	6
7-19-83	1,300	1,200	170	--	--	11	--	540	--	15	920	13
7-19-83	600	600	40	--	--	8	--	430	--	2	550	15
7-19-83	607	--	--	2	<5	<20	<5	420	<0.5	--	--	16

Table 12.--Streamflow and water-quality data, the East Fork Little Chariton River near Macon

[Ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter at 25 °Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; fet-fld, field endpoint titration-field; µg/L, micrograms per liter; --, no data; <, less than]

Site number (fig. 3)	Date of sample	Discharge (ft^3/s)	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)
1	10-14-71	0.50	--	290	7.4
	11-10-71	2.1	--	355	7.6
	12-15-71	1,010	--	120	7.4
	1-12-72	19	--	420	7.5
	2-09-72	4.0	--	585	7.4
	3-15-72	263	--	220	7.3
	4-12-72	13	--	405	7.7
	5-10-72	16	--	390	7.8
	6-14-72	1.6	--	380	8.0
	7-19-72	3.3	--	330	7.7
	8-16-72	.58	--	220	7.7
	9-20-72	2.0	--	210	7.6
	10-11-72	.00	--	300	8.0
	11-15-72	240	--	207	7.7
	12-13-72	2.7	--	670	7.6
	1-17-73	60	--	338	7.3
	2-14-73	340	--	258	7.4
	3-14-73	1,250	--	162	7.3
	4-11-73	319	--	222	7.2
	5-16-73	17	--	342	7.8
	6-13-73	6.2	--	295	7.4
	7-17-73	.85	--	250	7.7
	8-15-73	13	--	223	7.5
	9-11-73	48	--	165	7.1
	10-10-73	70	--	288	7.6
	11-14-73	12	--	520	7.8
	12-11-73	42	--	348	7.4
	1-21-74	740	--	195	7.2
	2-13-74	22	--	455	7.8
	3-12-74	520	--	185	7.4
	4-09-74	16	--	508	8.1
	5-14-74	414	--	252	7.5
	6-18-74	25	--	230	7.6
	7-23-74	.06	--	295	7.6
	8-21-74	10	--	228	7.9
	9-17-74	.00	--	282	7.7
	7-12-79	--	45	224	7.4
	8-09-79	--	43	242	7.5
	9-05-79	--	24	275	8.1
	10-11-79	--	18	306	7.5

Table 12.--Streamflow and water-quality data, the East Fork Little Chariton River near Macon--Continued

Site number (fig. 3)	Date of sample	Discharge (ft^3/s)	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)
1	11-08-79	--	23	247	8.0
	12-11-79	--	3.6	275	7.5
	1-16-80	--	4.0	287	8.1
	2-20-80	--	10	308	7.6
	3-19-80	--	7.0	282	8.2
	4-02-80	--	63	285	8.2
	5-06-80	--	62	268	8.3
	6-03-80	--	57	250	7.8
	7-08-80	--	42	272	7.9
	8-12-80	--	3.2	268	7.9
	8-20-80	--	2.5	275	7.9
	9-16-80	--	22	276	7.6
	10-07-80	--	.40	277	8.0
	11-05-80	--	10	299	7.0
	12-17-80	--	40	287	7.1
	1-28-81	--	3.0	276	8.0
	2-11-81	--	3.0	321	7.8
	3-10-81	--	43	278	7.9
	4-07-81	--	30	259	8.2
	5-13-81	--	391	234	7.8
	6-04-81	--	334	194	7.3
	7-21-81	--	150	150	8.2
	8-05-81	--	471	131	7.5
	9-17-81	--	475	147	7.6
	10-27-81	--	4.0	163	7.8
	11-18-81	--	5.0	176	8.1
	10-26-82	--	10	176	8.0
	7-18-83	--	14	183	8.2

Table 12.--Streamflow and water-quality data, the East Fork Little Chariton River near Macon--Continued

Site number (fig. 3)	Date of sample	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Sulfate, dissolved (mg/L as SO4)
1	10-14-71	14.5	7.0	97	23	28	6.5	10	8.2	90	0.00	74	40
	11-10-71	5.5	10.3	130	21	38	9.1	18	7.1	140	.00	112	49
	12-15-71	4.0	6.8	45	19	13	3.1	4.5	4.0	32	.00	26	23
	1-12-72	.5	10.7	170	55	48	12	17	3.8	140	.00	115	78
	2-09-72	.0	10.2	230	55	65	16	30	4.6	210	.00	174	100
	3-15-72	7.0	10.0	83	37	24	5.6	8.7	4.2	56	.00	46	47
	4-12-72	13.0	9.0	180	57	36	23	21	3.5	160	.00	128	86
	5-10-72	13.5	8.8	170	34	49	11	18	3.7	160	.00	134	68
	6-14-72	23.0	5.8	170	22	48	11	17	4.9	170	.00	143	55
	7-19-72	23.0	5.2	140	41	42	9.5	15	7.4	130	.00	103	69
	8-16-72	24.5	5.4	85	11	25	5.6	9.0	6.3	92	.00	75	30
	9-20-72	22.5	3.8	81	14	24	5.0	8.0	7.5	82	.00	67	24
	10-11-72	19.5	9.0	110	32	34	7.1	11	6.6	100	.00	82	50
	11-15-72	3.5	7.4	77	25	23	4.8	7.9	6.8	64	.00	52	38
	12-13-72	.0	10.2	240	74	75	14	31	6.4	210	.00	171	120
	1-17-73	1.0	7.3	120	34	37	7.5	12	6.4	110	.00	89	54
	2-14-73	.0	8.7	92	26	27	6.0	11	3.8	80	.00	66	41
	3-14-73	10.0	7.6	50	11	15	3.0	4.7	3.3	48	.00	39	19
	4-11-73	3.0	8.8	91	29	27	5.7	9.5	2.3	76	.00	62	38
	5-16-73	14.5	9.0	140	29	42	8.8	12	3.2	140	.00	112	49
	6-13-73	24.0	5.0	120	20	35	7.8	12	3.0	120	.00	100	39
	7-17-73	25.0	6.1	96	11	28	6.3	8.7	4.1	100	.00	85	28
	8-15-73	22.5	6.5	84	9	25	5.2	6.4	3.8	92	.00	75	25
	9-11-73	21.5	5.4	65	13	19	4.2	6.1	4.6	64	.00	52	20
	10-10-73	21.0	6.1	130	18	37	8.1	11	4.1	130	.00	108	39
	11-14-73	10.5	8.8	220	38	62	15	20	4.4	220	.00	179	72
	12-11-73	1.0	10.8	150	47	45	9.6	12	3.8	130	.00	105	55
	1-21-74	.0	9.3	72	36	21	4.8	5.8	3.1	44	.00	36	29
	2-13-74	2.0	10.5	200	62	59	13	19	2.4	170	.00	139	83
	3-12-74	8.5	7.3	78	24	23	4.9	7.4	3.0	66	.00	54	29
	4-09-74	13.5	8.7	220	50	62	15	26	2.6	200	.00	167	91
	5-14-74	15.5	8.1	100	27	30	6.6	9.4	2.1	92	.00	75	41
	6-18-74	20.0	7.2	85	13	25	5.4	9.1	3.0	88	.00	72	28
	7-23-74	29.5	6.2	130	31	38	8.1	11	4.3	120	.00	97	43
	8-21-74	27.0	2.9	93	14	28	5.5	6.0	3.8	96	.00	79	29
	9-17-74	21.5	7.6	110	19	33	7.0	11	4.1	110	.00	92	34
	7-12-79	24.0	7.2	100	29	32	5.8	7.4	1.8	92	.00	75	48
	8-09-79	27.5	7.3	--	--	--	--	--	--	120	.00	95	26
	9-05-79	26.5	7.4	--	--	--	--	--	--	110	.00	90	28
	10-11-79	18.0	9.0	--	--	--	--	--	--	120	.00	95	35

Table 12.--Streamflow and water-quality data, the East Fork Little Chariton River near Macon--Continued

Site number (fig. 3)	Date of sample	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Sulfate, dissolved (mg/L as SO4)
1	11-08-79	9.0	10.4	--	--	--	--	--	--	120	0.00	98	27
	12-11-79	5.5	12.8	--	--	--	--	--	--	120	.00	95	41
	1-16-80	3.0	13.4	--	--	--	--	--	--	120	.00	100	36
	2-20-80	1.5	13.0	--	--	--	--	--	--	140	.00	110	50
	3-19-80	7.5	12.8	--	--	--	--	--	--	120	.00	98	28
	4-02-80	8.0	12.0	--	--	--	--	--	--	110	.00	94	48
	5-06-80	18.0	8.8	--	--	--	--	--	--	120	.00	98	29
	6-03-80	23.0	9.0	--	--	--	--	--	--	100	.00	82	41
	7-08-80	27.0	7.5	--	--	--	--	--	--	110	.00	90	27
	8-12-80	30.5	7.8	--	--	--	--	--	--	120	.00	98	29
	8-20-80	26.0	--	110	15	34	7.1	8.7	4.7	130	.00	99	29
	9-16-80	23.0	7.2	--	--	--	--	--	--	120	.00	95	33
	10-07-80	21.0	9.4	--	--	--	--	--	--	150	.00	121	28
	11-05-80	8.5	10.8	--	--	--	--	--	--	120	.00	95	62
	12-17-80	4.0	--	--	--	--	--	--	--	120	.00	98	54
	1-28-81	2.5	--	--	--	--	--	--	--	120	.00	98	36
	2-11-81	2.0	--	--	--	--	--	--	--	120	.00	98	36
	3-10-81	7.0	--	--	--	--	--	--	--	120	.00	98	35
	4-07-81	14.0	--	--	--	--	--	--	--	110	.00	90	46
	5-13-81	16.0	--	--	--	--	--	--	--	94	.00	77	35
	6-04-81	18.0	--	--	--	--	--	--	--	64	.00	52	39
	7-21-81	28.5	--	--	--	--	--	--	--	60	.00	49	5.6
	8-05-81	24.0	--	--	--	--	--	--	--	60	.00	49	3.0
	9-17-81	21.5	--	--	--	--	--	--	--	72	.00	59	<5.0
	10-27-81	10.0	--	68	12	20	4.4	4.4	4.3	68	.00	56	7.0
	11-18-81	13.0	--	--	--	--	--	--	--	64	.00	52	8.1
	10-26-82	14.0	--	74	17	22	4.5	4.9	4.0	70	.00	57	21
	7-18-83	27.0	--	74	8	22	4.6	5.9	3.3	80	.00	--	24

Table 12.--Streamflow and water-quality data, the East Fork Little Chariton River near Macon--Continued

Site number (fig. 3)	Date of sample	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Solids, residue at 180 deg C, dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)
1	10-14-71	9.0	0.00	6.5	163	150	--	0.000	--	140	360
	11-10-71	14	.10	7.2	218	210	--	.010	--	310	110
	12-15-71	2.2	.10	4.6	76	71	--	.070	--	220	220
	1-12-72	7.2	.10	9.1	261	240	--	.097	--	30	600
	2-09-72	13	.00	10	380	340	--	.041	--	30	800
	3-15-72	10	.10	6.6	143	130	--	.068	--	220	160
	4-12-72	13	.00	4.6	270	260	--	.000	--	40	360
	5-10-72	9.1	.00	8.7	259	250	--	.000	--	80	300
	6-14-72	6.6	.30	8.4	262	240	--	.022	--	10	200
	7-19-72	7.9	.30	4.6	214	220	--	.100	--	50	40
	8-16-72	6.0	.30	6.2	151	130	--	.000	--	110	200
	9-20-72	6.6	.30	7.1	135	120	--	.013	--	140	360
	10-11-72	10	.10	8.0	169	180	--	.026	--	150	240
	11-15-72	6.8	.10	8.3	142	130	--	.095	--	260	290
	12-13-72	21	.20	12	401	380	--	.029	--	70	270
	1-17-73	8.7	.20	7.3	196	190	--	.060	--	180	400
	2-14-73	7.2	.20	8.7	158	140	--	.042	--	240	220
	3-14-73	2.0	.30	6.6	85	78	--	.042	--	340	110
	4-11-73	3.3	<.10	7.0	140	130	--	.015	--	210	130
	5-16-73	4.8	.30	11	199	200	--	.012	--	160	160
	6-13-73	5.5	.30	10	202	170	<0.010	.020	--	420	280
	7-17-73	6.4	.20	8.6	160	140	--	.040	--	160	130
	8-15-73	3.8	.20	11	139	130	--	.030	--	220	170
	9-11-73	2.9	.10	8.6	118	97	--	.030	--	130	60
	10-10-73	4.2	.30	14	199	180	--	<.010	--	170	190
	11-14-73	6.9	.20	13	314	300	--	.040	--	950	270
	12-11-73	8.0	.20	12	217	210	--	.020	--	130	480
	1-21-74	6.8	1.0	7.7	124	100	--	.020	--	370	180
	2-13-74	8.8	.20	12	287	280	--	.010	--	90	620
	3-12-74	5.4	.20	7.9	137	110	--	.030	--	290	50
	4-09-74	6.4	.40	8.3	318	310	--	.020	--	50	210
	5-14-74	2.8	.30	8.2	163	150	--	.060	--	<10	210
	6-18-74	5.0	.30	7.5	141	130	--	--	--	40	30
	7-23-74	5.3	.20	9.6	185	180	--	.030	--	30	150
	8-21-74	3.6	.20	6.3	137	130	--	.020	--	60	60
	9-17-74	7.7	.30	4.6	173	160	--	.030	--	50	160
	7-12-79	6.0	.20	3.4	167	150	--	--	--	--	--
	8-09-79	--	--	--	151	--	--	--	--	100	250
	9-05-79	--	--	--	150	--	--	--	--	20	140
	10-11-79	--	--	--	177	--	--	--	--	120	970

Table 12.--Streamflow and water-quality data, the East Fork Little Chariton River near Macon--Continued

Site number (fig. 3)	Date of sample	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L at SIO2)	Solids, residue at 180 deg C, dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)
1	11-08-79	--	--	--	164	--	--	--	--	40	670
	12-11-79	--	--	--	184	--	--	--	--	60	1,000
	1-16-80	--	--	--	173	--	--	--	--	60	290
	2-20-80	--	--	--	182	--	--	--	--	270	100
	3-19-80	--	--	--	164	--	--	--	--	70	90
	4-02-80	--	--	--	191	--	--	--	--	10	70
	5-06-80	--	--	--	148	--	--	--	--	290	70
	6-03-80	--	--	--	248	--	--	--	--	400	250
	7-08-80	--	--	--	168	--	--	--	--	40	140
	8-12-80	--	--	--	169	--	--	--	--	40	240
	8-20-80	7.0	0.20	2.0	160	160	--	--	--	--	--
	9-16-80	--	--	--	102	--	--	--	--	120	210
	10-07-80	--	--	--	165	--	--	--	--	150	240
	11-05-80	--	--	--	212	--	--	--	--	20	200
	12-17-80	--	--	--	180	--	--	--	--	20	100
	1-28-81	--	--	--	161	--	--	--	--	40	20
	2-11-81	--	--	--	176	--	--	--	--	60	20
	3-10-81	--	--	--	158	--	--	--	--	60	70
	4-07-81	--	--	--	172	--	--	--	--	30	80
	5-13-81	--	--	--	157	--	--	--	--	50	30
	6-04-81	--	--	--	146	--	--	--	--	290	30
	7-21-81	--	--	--	113	--	--	--	--	190	50
	8-05-81	--	--	--	104	--	--	--	--	210	310
	9-17-81	--	--	--	96	--	--	--	--	120	360
	10-27-81	11	0.20	1.4	105	87	--	--	--	170	580
	11-18-81	--	--	--	111	--	--	--	--	130	240
	10-26-82	5.0	.20	.9	115	97	--	--	40	35	15
	7-18-83	4.4	.20	2.4	108	110	--	--	480	110	16

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville

[Ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter at 25 °Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; fet-fld, field enpoint titration-field; µg/L, micrograms per liter; --, no data; <, less than]

Site number (fig. 3)	Date of sample	Discharge (ft^3/s)	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)
7	9-01-63	0.60	--	1,280	4.3
	9-17-63	.60	--	1,200	3.5
	10-09-63	.20	--	1,400	4.2
	11-13-63	.20	--	1,490	2.6
	12-03-63	.80	--	1,800	2.9
	2-10-64	.50	--	2,180	3.8
	3-10-64	50	--	1,150	6.3
	3-31-64	110	--	630	7.4
	4-21-64	1,060	--	380	7.3
	5-13-64	16	--	1,340	7.2
	6-09-64	12	--	1,250	6.3
	7-07-64	1.4	--	850	7.1
	9-09-64	198	--	90	7.0
	10-07-64	.70	--	875	4.8
	11-04-64	.00	--	1,440	5.7
	12-01-64	2.5	--	1,120	4.9
	1-26-65	1,430	--	195	6.7
	2-18-65	44	--	855	6.8
	3-17-65	1,260	--	350	7.0
	4-13-65	315	--	465	7.2
	5-12-65	8.0	--	1,360	7.1
	6-15-65	15	--	925	7.3
	7-13-65	6.2	--	870	7.3
	8-10-65	1.6	--	1,110	6.8
	9-08-65	178	--	345	7.8
	10-06-65	6.4	--	975	7.5
	11-04-65	4.7	--	1,540	7.3
	12-07-65	4.8	--	1,960	7.1
	1-11-66	15	--	760	7.3
	2-16-66	18	--	881	7.5
	3-31-66	26	--	980	7.4
	4-18-66	21	--	1,180	7.0
	5-24-66	455	--	410	7.3
	6-28-66	54	--	900	7.1
	7-25-66	3.3	--	1,280	7.0
	8-23-66	26	--	1,500	6.7

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Discharge (ft^3/s)	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)
7	9-27-66	2.1	--	1,010	6.8
	10-18-66	80	--	450	7.3
	11-14-66	3.3	--	1,450	5.8
	12-12-66	50	--	550	7.3
	1-10-67	14	--	1,520	7.1
	2-10-67	90	--	630	7.9
	3-06-67	33	--	1,050	7.1
	4-04-67	2,540	--	211	7.2
	5-09-67	1,090	--	304	6.9
	6-06-67	80	--	716	7.0
	7-05-67	40	--	957	7.0
	8-21-67	57	--	265	7.0
	9-18-67	2.5	--	1,080	6.9
	10-23-67	11	--	666	7.0
	11-06-67	318	--	464	7.2
	12-11-67	170	--	772	7.2
	1-10-68	15	--	1,240	7.4
	2-05-68	292	--	512	7.0
	3-05-68	21	--	1,470	7.4
	4-12-68	31	--	896	7.6
	5-10-68	17	--	1,100	7.8
	6-20-68	17	--	499	7.1
	7-11-68	.45	--	1,280	6.7
	8-08-68	100	--	387	6.9
	9-16-68	1.5	--	1,560	7.0
	10-14-68	51	--	798	6.6
	11-18-68	304	--	413	6.9
	12-09-68	36	--	794	7.3
	1-20-69	852	--	210	6.6
	2-17-69	95	--	746	7.4
	3-10-69	100	--	855	7.7
	4-07-69	1,590	--	249	7.1
	5-05-69	62	--	1,030	7.3
	6-16-69	122	--	1,100	7.0
	10-11-73	126	--	690	7.4
	11-15-73	21	--	1,730	7.2
	12-12-73	73	--	900	7.2
	1-21-74	1,070	--	350	7.3
	2-13-74	63	--	1,300	7.3
	3-13-74	576	--	360	7.4
	4-10-74	55	--	1,400	7.6

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Discharge (ft^3/s)	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)
7	5-22-74	3,250	--	177	7.0
	6-19-74	61	--	645	7.4
	7-24-74	6.0	--	890	7.3
	8-22-74	200	--	560	5.6
	9-18-74	4.8	--	1,070	7.2
	10-17-74	24	--	1,050	7.0
	11-20-74	24	--	1,050	7.3
	12-18-74	159	--	595	7.3
	1-15-75	45	--	865	7.3
	2-27-75	330	--	640	7.1
	3-25-75	159	--	850	7.4
	4-24-75	2,300	--	300	7.1
	5-28-75	250	--	1,140	7.5
	6-25-75	30	--	1,550	7.7
	7-30-75	2.8	--	1,780	7.4
	7-11-79	--	47	725	7.5
	8-09-79	--	36	385	7.6
	9-05-79	--	34	525	7.5
	10-11-79	--	18	596	7.5
	11-07-79	--	25	675	7.8
	12-11-79	--	6.2	1,010	7.2
	1-16-80	--	12	1,310	7.7
	2-20-80	--	15	1,600	7.1
	3-19-80	--	32	1,000	7.6
	4-02-80	--	124	650	7.6
	5-06-80	--	60	580	8.0
	6-03-80	--	173	732	7.6
	7-08-80	--	28	455	8.1
	8-12-80	--	2.0	678	7.7
	8-19-80	--	3.6	1,110	7.9
	9-16-80	--	38	486	7.1
	10-07-80	--	.50	442	8.1
	11-04-80	--	1.9	1,190	7.2
	12-17-80	--	18	628	7.4
	1-27-81	--	12	625	7.6
	2-10-81	--	4.2	1,230	7.6
	3-10-81	--	47	612	7.9
	4-07-81	--	36	416	8.3
	5-13-81	--	397	343	7.7
	5-14-81	--	1,740	319	6.9
	6-03-81	--	378	430	7.8

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Discharge (ft^3/s)	Streamflow, instantaneous (ft^3/s)	Specific conductance (µs/cm)	pH (units)
7	7-21-81	--	284	423	7.7
	8-04-81	--	602	350	7.5
	9-16-81	--	406	234	7.6
	10-26-81	--	15	1,820	7.8
	11-18-81	--	22	1,600	7.6
	10-20-82	--	13	1,100	7.2
	10-27-82	--	18	1,330	7.8
	11-03-82	--	98	1,360	8.0
	12-14-82	--	148	398	7.2
	1-05-83	--	74	474	7.7
	2-08-83	--	55	975	7.3
	3-08-83	--	120	677	7.5
	4-12-83	--	500	445	7.7
	5-11-83	--	210	481	7.5
	6-07-83	--	65	480	7.2
	7-19-83	--	17	895	8.1
	7-19-83	--	5.0	900	8.5
	8-16-83	--	3.0	1,280	7.9
	9-28-83	--	1.0	722	8.0
	10-13-83	--	21	1,450	7.7
	11-21-83	--	60	930	7.5
	12-13-83	--	340	502	7.2

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Sulfate, dissolved (mg/L as SO4)
7	9-01-63	--	--	760	760	170	82	--	--	--	--	--	810
	9-17-63	23.5	--	750	760	170	79	16	6.6	0	0.00	--	870
	10-09-63	20.5	8.4	900	900	170	110	25	7.4	0	.00	--	1,100
	11-13-63	4.0	9.5	1,000	1,000	220	110	44	9.7	0	.00	--	1,300
	12-03-63	3.5	--	1,100	1,100	250	120	34	9.0	0	.00	--	1,200
	2-10-64	2.0	--	1,300	1,300	300	140	46	6.5	0	.00	--	1,400
	3-10-64	6.5	--	580	550	140	55	20	4.5	36	.00	--	590
	3-31-64	3.5	--	310	260	78	28	15	4.2	66	.00	--	260
	4-21-64	16.0	--	170	130	46	14	7.0	4.1	52	.00	--	140
	5-13-64	15.5	--	820	730	190	85	29	5.6	110	.00	--	760
	6-09-64	25.5	--	720	680	170	74	24	4.6	52	.00	--	700
	7-07-64	29.0	--	430	370	97	45	23	6.1	66	.00	--	390
	9-09-64	22.0	--	32	10	9.2	2.2	2.3	5.0	27	.00	--	16
	10-07-64	11.5	--	430	420	110	37	12	7.0	4	.00	--	450
	11-04-64	15.0	--	870	860	190	98	25	12	12	.00	--	920
	12-01-64	.0	--	510	510	120	53	18	7.9	2	.00	--	530
	1-26-65	1.0	--	82	59	22	6.5	4.5	3.4	28	.00	--	58
	2-18-65	2.0	--	420	370	100	42	18	3.8	68	.00	--	390
	3-17-65	5.5	--	130	92	37	9.5	5.4	3.1	48	.00	--	100
	4-13-65	12.0	--	200	160	52	18	9.2	3.2	52	.00	--	170
	5-12-65	27.0	--	800	700	170	92	33	5.8	120	.00	--	730
	6-15-65	23.5	--	450	390	110	45	22	4.4	78	.00	--	410
	7-13-65	29.0	--	440	370	110	42	20	4.5	85	.00	--	390
	8-10-65	25.0	--	620	520	140	68	34	6.1	120	.00	--	560
	9-08-65	21.5	--	170	130	42	16	5.6	1.4	50	.00	--	130
	10-06-65	14.0	--	530	440	130	52	23	5.1	110	.00	--	460
	11-04-65	13.5	--	910	830	200	100	39	7.0	100	.00	--	890
	12-07-65	3.5	--	1,200	1,100	250	140	49	6.0	39	.00	--	1,200
	1-11-66	1.0	--	370	340	89	36	24	4.7	40	.00	--	370
	2-16-66	.0	--	430	330	110	38	22	4.3	130	.00	--	360
	3-31-66	9.0	--	510	400	130	47	25	4.3	130	.00	--	420
	4-18-66	13.0	--	670	590	160	68	24	3.7	100	.00	--	580
	5-24-66	17.0	--	190	130	54	14	7.4	3.1	77	.00	--	140
	6-28-66	24.5	--	460	410	110	45	17	4.4	56	.00	--	420
	7-25-66	27.0	--	700	610	150	76	38	6.4	100	.00	--	640
	8-23-66	20.0	--	820	800	180	91	24	5.7	25	.00	--	820
	9-27-66	15.0	--	520	500	110	63	19	6.0	31	.00	--	520
	10-18-66	10.0	--	200	150	46	20	8.0	6.8	59	.00	48	160
	11-14-66	7.0	--	800	790	170	90	30	8.6	11	.00	9	830
	12-12-66	.5	--	240	180	61	22	12	5.7	76	.00	62	200
	1-10-67	.0	--	870	780	190	99	30	4.8	120	.00	95	800
	2-10-67	.5	--	270	210	62	28	15	3.8	70	.00	57	290
	3-06-67	2.0	--	510	440	120	50	22	3.3	90	.00	74	490

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Sulfate, dissolved (mg/L as SO4)
7	4-04-67	16.5	--	83	51	22	6.8	4.5	5.0	39	0.00	32	58
	5-09-67	14.0	--	130	83	34	11	6.8	3.6	57	.00	47	90
	6-06-67	19.0	--	340	280	81	33	16	4.8	66	.00	54	300
	7-05-67	20.0	--	490	410	120	46	20	8.0	100	.00	82	420
	8-21-67	20.5	--	120	67	28	11	5.7	4.7	58	.00	48	77
	9-18-67	23.0	--	550	510	100	72	27	6.5	56	.00	46	510
	10-23-67	15.0	--	280	240	63	31	15	8.8	54	.00	44	260
	11-06-67	5.0	--	200	150	50	19	8.7	4.7	64	.00	52	150
	12-11-67	4.0	--	370	290	94	34	17	6.3	100	.00	82	320
	1-10-68	1.0	--	660	520	150	67	29	4.4	170	.00	138	530
	2-05-68	4.0	--	230	180	59	21	10	3.9	62	.00	51	190
	3-05-68	3.0	--	820	720	180	91	32	4.2	130	.00	103	740
	4-12-68	15.0	--	450	350	110	43	22	4.1	120	.00	98	370
	5-10-68	15.0	--	530	420	130	53	26	5.8	140	.00	118	480
	6-20-68	25.0	--	220	150	58	19	14	4.0	85	.00	70	170
	7-11-68	26.0	--	660	610	150	68	35	7.1	64	.00	52	540
	8-08-68	25.0	--	170	130	44	15	7.4	4.5	51	.00	42	130
	9-16-68	19.0	--	880	830	190	97	34	5.6	57	.00	47	850
	10-14-68	17.0	--	430	380	91	49	20	6.0	58	.00	48	410
	11-18-68	6.0	--	180	140	45	16	8.2	6.8	52	.00	43	140
	12-09-68	2.0	--	390	300	96	36	18	4.7	110	.00	86	330
	1-20-69	1.0	10.8	83	53	22	6.9	5.8	6.2	37	.00	30	56
	2-17-69	2.0	12.4	370	310	86	37	17	3.6	72	.00	59	330
	3-10-69	1.0	12.4	390	320	90	40	20	3.4	84	.00	69	350
	4-07-69	15.0	7.2	110	71	29	9.1	4.9	4.5	48	.00	39	76
	5-05-69	21.0	7.8	530	450	120	57	22	3.8	110	.00	86	450
	6-16-69	16.0	8.2	600	530	130	67	22	3.7	91	.00	75	560
	10-11-73	20.5	5.4	330	230	80	31	19	4.4	120	.00	102	250
	11-15-73	12.0	5.3	870	720	190	96	69	6.8	180	.00	148	800
	12-12-73	1.5	11.4	420	320	99	41	21	4.5	120	.00	95	340
	1-21-74	1.0	9.4	140	95	35	12	7.8	3.3	51	.00	42	93
	2-13-74	4.0	9.8	680	570	150	75	32	4.1	140	.00	112	620
	3-13-74	8.5	8.7	150	80	39	12	12	3.1	82	.00	67	80
	4-10-74	11.0	8.2	660	520	150	69	58	4.0	170	.00	143	640
	5-22-74	22.0	5.0	78	43	24	4.5	4.2	3.0	44	.00	36	39
	6-19-74	22.0	5.9	290	200	69	28	20	3.4	110	.00	89	220
	7-24-74	27.0	6.1	370	280	95	33	42	5.8	110	.00	92	330
	8-22-74	22.0	5.8	250	240	57	25	8.1	4.6	6	.00	5	240
	9-18-74	18.5	7.3	520	440	110	59	38	5.7	100	.00	82	500
	10-17-74	11.0	8.0	480	400	110	49	24	5.7	90	.00	74	440
	11-20-74	6.0	9.8	510	430	120	52	24	4.9	100	.00	82	450
	12-18-74	.5	11.0	230	170	61	20	18	3.6	84	.00	69	180

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Sulfate, dissolved (mg/L as SO4)
7	1-15-75	.0	12.2	380	260	93	35	28	3.7	140	0.00	118	300
	2-27-75	.5	10.8	260	200	62	25	13	3.0	72	.00	59	210
	3-25-75	5.0	10.1	390	300	93	39	28	3.7	110	.00	94	320
	4-24-75	13.5	7.9	120	86	33	9.3	7.0	3.7	43	.00	35	94
	5-28-75	20.0	6.4	630	510	140	67	50	4.5	150	.00	121	560
	6-25-75	26.5	7.3	700	570	160	72	65	5.5	160	.00	128	710
	7-30-75	27.5	6.9	800	680	180	85	93	7.4	150	.00	125	800
	7-11-79	26.0	6.6	270	170	70	24	54	5.9	130	.00	107	270
	8-09-79	27.5	5.6	--	--	--	--	--	--	120	.00	98	84
	9-05-79	24.0	5.4	--	--	--	--	--	--	120	.00	98	430
	10-11-79	15.5	8.8	--	--	--	--	--	--	140	.00	110	130
	11-07-79	6.0	10.2	--	--	--	--	--	--	130	.00	106	260
	12-11-79	9.0	11.2	--	--	--	--	--	--	120	.00	100	560
	1-16-80	4.5	10.6	--	--	--	--	--	--	130	.00	110	610
	2-20-80	.5	11.4	--	--	--	--	--	--	150	.00	120	760
	3-19-80	10.0	10.6	--	--	--	--	--	--	120	.00	98	420
	4-02-80	10.0	10.2	--	--	--	--	--	--	96	.00	79	310
	5-06-80	21.0	6.8	--	--	--	--	--	--	120	.00	100	180
	6-03-80	24.5	4.6	--	--	--	--	--	--	100	.00	82	240
	7-08-80	32.0	6.8	--	--	--	--	--	--	130	.00	110	110
	8-12-80	33.0	9.2	--	--	--	--	--	--	100	.00	85	230
	8-19-80	29.5	--	490	420	130	41	46	6.9	94	.00	75	490
	9-16-80	23.0	7.2	--	--	--	--	--	--	76	.00	62	160
	10-07-80	25.0	9.0	--	--	--	--	--	--	120	.00	98	110
	11-04-80	12.0	9.8	--	--	--	--	--	--	88	.00	72	510
	12-17-80	6.0	--	--	--	--	--	--	--	120	.00	98	130
	1-27-81	1.5	--	--	--	--	--	--	--	92	.00	75	240
	2-10-81	0.5	--	--	--	--	--	--	--	190	.00	156	450
	3-10-81	7.5	--	--	--	--	--	--	--	120	.00	98	210
	4-07-81	15.0	--	--	--	--	--	--	--	130	.00	107	100
	5-13-81	15.5	--	--	--	--	--	--	--	98	.00	80	85
	5-14-81	12.0	--	--	--	--	--	--	--	46	.00	38	110
	6-03-81	18.0	--	--	--	--	--	--	--	84	.00	69	140
	7-21-81	26.5	--	--	--	--	--	--	--	76	.00	62	160
	8-04-81	26.0	--	--	--	--	--	--	--	76	.00	62	100
	9-16-81	21.5	--	--	--	--	--	--	--	80	.00	66	31
	10-26-81	10.5	--	820	680	180	93	130	8.0	180	.00	148	880
	11-18-81	7.5	--	--	--	--	--	--	--	160	.00	131	840
	10-20-82	11.0	9.4	540	470	120	55	56	5.8	--	--	62	510
	10-27-82	10.5	--	750	630	210	54	58	9.7	150	.00	123	780
	11-03-82	12.5	10.2	--	--	--	--	--	--	--	--	118	--
	12-14-82	5.0	--	--	--	--	--	--	--	--	--	194	--

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Temperature (deg C)	Oxygen, dissolved (mg/L)	Hardness (mg/L as CACO3)	Hardness, noncarbonate (mg/L CACO3)	Calcium, dissolved (mg/L as CA)	Magnesium, dissolved (mg/L as MG)	Sodium, dissolved (mg/L as NA)	Potassium, dissolved (mg/L as K)	Bicarbonate, fet-fld (mg/L as HCO3)	Carbonate, fet-fld (mg/L as CO3)	Alkalinity, field (mg/L as CACO3)	Sulfate, dissolved (mg/L as SO4)
7	1-05-83	2.0	12.4	200	170	50	19	15	4.4	--	--	29	150
	2-08-83	1.5	13.2	--	--	--	--	--	--	--	--	82	--
	3-08-83	5.5	10.8	--	--	--	--	--	--	--	--	79	--
	4-12-83	9.0	10.0	210	140	52	19	11	3.9	--	--	71	140
	5-11-83	15.5	8.4	--	--	--	--	--	--	--	--	66	--
	6-07-83	19.5	7.6	--	--	--	--	--	--	--	--	66	--
	7-19-83	31.0	--	330	230	74	35	64	5.0	120	0.00	--	350
	7-19-83	32.0	7.2	320	220	72	34	52	4.6	--	--	105	320
	8-16-83	27.5	5.2	--	--	--	--	--	--	--	--	115	--
	9-28-83	26.0	8.4	--	--	--	--	--	--	--	--	98	--
	10-13-83	12.0	8.8	520	390	110	59	130	7.2	--	--	127	670
	11-21-83	10.5	10.2	--	--	--	--	--	--	--	--	81	--
	12-13-83	3.5	13.0	--	--	--	--	--	--	--	--	69	--

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Solids, residue at 180 deg C, dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)
7	9-01-63	--	--	--	--	--	--	--	--	--	19,000
	9-17-63	04.0	.70	5.7	1,300	1,200	--	--	--	--	18,000
	10-09-63	18	1.8	12	1,620	1,400	--	--	--	--	23,000
	11-13-63	11	1.8	18	1,790	1,700	--	--	--	--	14,000
	12-03-63	11	.80	10	1,800	1,700	--	--	--	--	6,200
	2-10-64	16	.90	10	2,150	1,900	--	--	--	--	15,000
	3-10-64	5.5	.40	7.7	890	850	--	--	--	--	3,300
	3-31-64	7.0	.20	8.1	494	440	--	--	--	--	1,300
	4-21-64	2.0	.30	9.4	217	250	--	--	--	--	400
	5-13-64	12	.50	6.2	1,220	1,100	--	--	--	--	4,800
	6-09-64	8.0	.50	6.8	1,120	1,000	--	--	--	--	2,700
	7-07-64	19	.60	7.7	668	620	--	--	--	--	400
	9-09-64	1.5	0.40	6.8	63	57	--	--	--	--	0
	10-07-64	10	.60	9.6	662	640	--	--	--	--	6,600
	11-04-64	11	1.1	7.4	1,410	1,300	--	--	--	--	16,000
	12-01-64	8.6	.70	8.9	820	750	--	--	--	--	6,900
	1-26-65	3.2	.00	6.5	157	120	--	--	--	--	0
	2-18-65	7.3	.40	9.0	667	600	--	--	--	--	2,600
	3-17-65	2.5	.10	6.7	220	190	--	--	--	--	0
	4-13-65	3.0	.40	10	336	300	--	--	--	--	0
	5-12-65	19	.50	6.0	1,240	1,100	--	--	--	--	0
	6-15-65	9.2	.40	8.8	686	650	--	--	--	--	2,900
	7-13-65	11	.50	7.1	636	630	--	--	--	--	2,500
	8-10-65	24	.60	7.7	921	900	--	--	--	--	5,300
	9-08-65	1.9	.20	6.3	260	230	--	--	--	--	10
	10-06-65	12	.50	11	759	740	--	--	--	--	0
	11-04-65	18	.60	9.3	1,320	1,300	--	--	--	--	3,800
	12-07-65	15	.50	11	1,710	1,600	--	--	--	--	5,100
	1-11-66	8.8	.50	9.6	580	560	--	--	--	--	2,400
	2-16-66	9.2	.30	8.4	667	620	--	--	--	--	1,400
	3-31-66	12	.40	7.8	768	710	--	--	--	--	3,200
	4-18-66	12	.50	5.8	995	910	--	--	--	--	13,000
	5-24-66	2.4	.30	7.8	277	270	--	--	--	--	600
	6-28-66	7.3	.60	7.6	697	640	--	--	--	--	3,300
	7-25-66	5.6	.70	6.0	1,170	990	--	--	--	--	6,600
	8-23-66	2.0	.40	5.8	1,290	1,100	--	--	--	--	2,600
	9-27-66	7.0	.50	5.4	770	740	--	--	--	--	4,200
	10-18-66	3.2	.30	5.9	304	280	--	--	300	--	1,200
	11-14-66	8.4	.60	10	1,220	1,200	--	--	600	--	6,100
	12-12-66	3.6	.30	7.3	384	360	--	--	1,300	--	1,400
	1-10-67	6.8	1.0	8.5	1,310	1,200	--	--	100	--	5,100
	2-10-67	4.8	.70	9.1	510	450	--	--	0	--	2,100

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Solids, residue at 180 deg C, dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)
7	3-06-67	5.7	0.60	7.4	818	750	--	--	1,400	--	3,000
	4-04-67	1.9	.30	8.9	145	130	--	--	2,700	--	200
	5-09-67	2.8	.10	7.4	196	190	--	--	1,100	--	360
	6-06-67	7.8	.50	8.2	501	480	--	--	200	--	2,300
	7-05-67	8.0	.40	9.1	731	680	--	--	100	--	2,000
	8-21-67	3.2	.10	8.0	171	170	--	--	700	--	440
	9-18-67	51	1.1	6.4	845	810	--	--	100	--	5,900
	10-23-67	7.6	.40	9.4	459	420	--	--	400	--	1,700
	11-06-67	3.9	.40	9.1	251	280	--	--	0	--	20
	12-11-67	5.7	.40	10	586	540	--	--	0	--	860
	1-10-68	14	.50	10	983	900	--	--	0	--	3,600
	2-05-68	5.4	.30	7.3	347	330	--	--	100	--	900
	3-05-68	12	.50	6.8	1,200	1,100	--	--	2,500	--	4,500
	4-12-68	9.5	.30	6.7	640	630	--	--	1,400	--	1,700
	5-10-68	11	.40	2.3	876	780	--	--	2,200	--	1,700
	6-20-68	6.4	.40	4.5	345	320	--	--	200	--	670
	7-11-68	31	.70	7.1	1,070	880	--	--	50	--	7,000
	8-08-68	3.6	.40	6.9	250	240	--	--	200	--	790
	9-16-68	20	.70	4.7	1,390	1,200	--	--	500	--	5,000
	10-14-68	12	.50	5.7	650	630	--	--	100	--	1,500
	11-18-68	4.6	.30	7.0	275	260	--	--	500	--	1,000
	12-09-68	8.9	.30	8.8	593	550	--	--	300	--	1,400
	1-20-69	4.2	.30	5.0	147	130	--	--	100	--	360
	2-17-69	5.2	.30	6.6	541	520	--	--	1,600	--	2,300
	3-10-69	7.0	.20	7.6	583	560	--	--	100	--	2,100
	4-07-69	2.3	.40	9.4	170	160	--	--	600	--	180
	5-05-69	8.1	.30	7.9	761	720	--	--	200	--	2,000
	6-16-69	5.0	.60	7.0	845	840	--	--	600	--	720
	10-11-73	4.0	.30	13	498	460	--	<0.010	--	80	1,100
	11-15-73	11	.40	8.9	1,410	1,300	--	.030	--	310	2,000
	12-12-73	9.0	.20	9.5	616	580	--	.020	--	110	1,900
	1-21-74	4.7	.50	7.1	213	190	--	.090	--	440	430
	2-13-74	9.0	.40	9.4	1,030	970	--	.050	--	2,500	3,500
	3-13-74	6.4	.40	8.7	236	200	--	.020	--	280	210
	4-10-74	9.0	.60	6.6	1,080	1,000	--	.020	--	50	1,700
	5-22-74	2.8	.40	7.6	129	110	--	.040	--	110	<10
	6-19-74	7.8	.40	8.5	439	410	--	.010	--	20	820
	7-24-74	15	.30	9.5	636	590	--	.020	--	30	1,900
	8-22-74	3.2	.50	5.3	389	350	--	.010	--	1,900	2,200
	9-18-74	10	.50	5.8	--	780	--	.040	--	80	2,500
	10-17-74	5.2	.30	8.3	766	690	--	0.010	--	50	2,100

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Solids, residue at 180 deg C, dissolved (mg/L)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)
7	11-20-74	7.5	0.30	8.5	801	720	--	.020	--	980	2,300
	12-18-74	6.5	.20	8.1	389	340	--	.010	--	190	750
	1-15-75	9.1	.20	9.7	589	550	--	.030	--	490	1,300
	2-27-75	5.3	.20	6.8	395	360	--	.010	--	300	1,100
	3-25-75	7.2	.30	6.6	613	560	--	.010	--	100	1,200
	4-24-75	4.4	.20	4.5	188	180	--	.050	--	300	360
	5-28-75	4.5	.40	7.2	--	910	--	--	--	40	820
	6-25-75	8.8	.50	6.1	1,220	1,100	--	.010	--	90	2,000
	7-30-75	20	.60	4.5	1,580	1,300	--	.030	--	30	3,700
	7-11-79	7.0	.30	3.2	529	500	--	--	--	--	--
	8-09-79	--	--	--	228	--	--	--	--	80	190
	9-05-79	--	--	--	714	--	--	--	--	<10	830
	10-11-79	--	--	--	324	--	--	--	--	60	740
	11-07-79	--	--	--	503	--	--	--	--	80	430
	12-11-79	--	--	--	974	--	--	--	--	--	--
	1-16-80	--	--	--	1,040	--	--	--	--	200	1,800
	2-20-80	--	--	--	1,220	--	--	--	--	5,200	2,700
	3-19-80	--	--	--	736	--	--	--	--	100	130
	4-02-80	--	--	--	552	--	--	--	--	20	950
	5-06-80	--	--	--	381	--	--	--	--	30	560
	6-03-80	--	--	--	538	--	--	--	--	360	570
	7-08-80	--	--	--	290	--	--	--	--	270	140
	8-12-80	--	--	--	461	--	--	--	--	20	1,100
	8-19-80	5.8	0.40	3.2	840	770	--	--	--	--	--
	9-16-80	--	--	--	317	--	--	--	--	90	660
	10-07-80	--	--	--	282	--	--	--	--	80	150
	11-04-80	--	--	--	867	--	--	--	--	80	1,300
	12-17-80	--	--	--	302	--	--	--	--	70	440
	1-27-81	--	--	--	417	--	--	--	--	80	1,100
	2-10-81	--	--	--	852	--	--	--	--	150	1,000
	3-10-81	--	--	--	392	--	--	--	--	50	540
	4-07-81	--	--	--	270	--	--	--	--	20	290
	5-13-81	--	--	--	236	--	--	--	--	50	270
	5-14-81	--	--	--	270	--	--	--	--	290	610
	6-03-81	--	--	--	289	--	--	--	--	140	480
	7-21-81	--	--	--	303	--	--	--	--	50	210
	8-04-81	--	--	--	225	--	--	--	--	200	280
	9-16-81	--	--	--	153	--	--	--	--	40	90
	10-26-81	11	0.20	4.1	1,600	1,400	--	--	--	69	1,500
	11-18-81	--	--	--	1,510	--	--	--	--	210	2,700
	10-20-81	7.0	0.20	--	930	--	--	--	--	2,600	2,400

Table 13.--Streamflow and water-quality data, the East Fork Little Chariton River near Huntsville--Continued

Site number (fig. 3)	Date of sample	Chloride, dissolved (mg/L as CL)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SIO2)	Solids, residue at 180 deg C, dissolved (MG/L)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Phosphorus, dissolved (mg/L as P)	Aluminum, dissolved (µg/L as AL)	Iron, dissolved (µg/L as FE)	Manganese, dissolved (µg/L as MN)
7	10-27-82	6.5	0.40	3.1	1,270	1,200	--	--	20	4	620
	11-03-82	--	--	--	--	--	--	--	--	--	--
	12-14-82	--	--	--	--	--	--	--	--	--	--
	1-05-83	6.0	.10	--	342	--	--	--	--	330	570
	2-08-83	--	--	--	--	--	--	--	--	--	--
	3-08-83	--	--	--	--	--	--	--	--	--	--
	4-12-83	<2.0	.10	--	290	--	--	--	--	200	470
	5-11-83	--	--	--	--	--	--	--	--	--	--
	6-07-83	--	--	--	--	--	--	--	--	--	--
	7-19-83	7.2	.30	2.2	600	600	--	--	40	8	430
	7-19-83	9.0	.20	--	607	--	--	--	--	<20	420
	8-16-83	--	--	--	--	--	--	--	--	--	--
	9-28-83	--	--	--	--	--	--	--	--	--	--
	10-13-83	9.0	.40	--	1,200	--	--	--	--	<20	420
	11-21-83	--	--	--	--	--	--	--	--	--	--
	12-13-83	--	--	--	--	--	--	--	--	--	--

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville

[ft^3/s, cubic feet per second; µs/cm, microsiemens per centimeter at 25° Celsius; mg/L, milligrams per liter; µs/L, micrograms per liter; --, no data]

Property or constituent	Number of samples	Median	Minimum	Maximum
	East Fork Little Chariton River near Macon (fig. 3, site 1)			
	Before reservoir filling			
Instantaneous flow or daily discharge, in ft^3/s	36	16	0.0	1,250
Specific conductance, in µs/cm	36	289	120	670
pH, in units	36	7.6	7.1	8.1
Water temperature, in degrees Celsius	36	13.5	0.0	29.5
Hardness, as in mg/L $CaCO_3$	36	113	45	245
Noncarbonate hardness, as mg/L $CaCO_3$	36	0	0	0
Dissolved calcium, in mg/L	36	34	13	75
Dissolved magnesium, in mg/L	36	7.0	3.0	23
Dissolved sodium, in mg/L	36	11	4.5	31
Dissolved potassium, in mg/L	36	4.0	2.1	8.2
Bicarbonate, as mg/L HCO_3	36	106	32	218
Alkalinity, as mg/L $CaCO_3$	36	87	26	179
Dissolved sulfate, in mg/L	36	41	19	120
Dissolved chloride, in mg/L	36	6.7	2.0	21
Dissolved fluoride, in mg/L	36	.2	.0	1.0
Dissolved silica, as in mg/L SiO_2	36	8.2	4.6	14
Dissolved-solids residue, in mg/L at 180° Celsius	36	171	76	401
Dissolved solids, calculated sum in mg/L	36	165	71	382
Dissolved iron, in µg/L	36	140	0	950
Dissolved manganese, in µg/L	36	205	30	800

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
	East Fork Little Chariton River near Macon (fig. 3, site 1) During reservoir filling			
Instantaneous flow or daily discharge, in ft^3/s	24	22	0.4	391
Specific conductance, in µs/cm	24	276	224	321
pH, in units	24	7.9	7.0	8.3
Water temperature, in degrees Celsius	24	15.0	1.5	30.5
Hardness, as mg/L $CaCO_3$	5	0	0	114
Noncarbonate hardness, as mg/L $CaCO_3$	24	0	0	0
Dissolved calcium, in mg/L	2	33	32	34
Dissolved magnesium, in mg/L	2	6.4	5.8	7.1
Dissolved sodium, in mg/L	2	8.0	7.4	8.7
Dissolved potassium, in mg/L	2	3.2	1.8	4.7
Bicarbonate, as mg/L HCO_3	24	118	92	148
Alkalinity, as mg/L $CaCO_3$	24	96	75	121
Dissolved sulfate, in mg/L	24	35	26	62
Dissolved chloride, in mg/L	2	6.5	6.0	7.0
Dissolved fluoride, in mg/L	2	.2	.2	.2
Dissolved silica, as mg/L SiO_2	2	2.7	2.0	3.4
Dissolved-solids residue, in mg/L at 180° Celsius	24	168	102	248
Dissolved solids, calculated sum in mg/L	2	153	150	156
Dissolved iron, in µg/L	22	60	10	400
Dissolved manganese, in µg/L	22	140	20	1,000

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
	East Fork Little Chariton River near Macon (fig. 3, site 1) After reservoir filling			
Instantaneous flow or daily discharge, in ft^3/s	8	82	4.0	475
Specific conductance, in µs/cm	8	170	131	194
pH, in units	8	7.9	7.3	8.2
Water temperature, in degrees Celsius	8	19.8	10.0	28.5
Hardness, as mg/L $CaCO_3$	3	74	68	74
Noncarbonate hardness, as mg/L $CaCO_3$	8	0	0	0
Dissolved calcium, in mg/L	3	22	20	22
Dissolved magnesium, in mg/L	3	4.5	4.4	4.6
Dissolved sodium, mg/L	3	4.9	4.4	5.9
Dissolved potassium, in mg/L	3	4.0	3.3	4.3
Bicarbonate, as mg/L HCO_3	8	66	60	80
Alkalinity, as mg/L $CaCO_3$	7	52	49	59
Dissolved sulfate, in mg/L	8	7.6	.0	39
Dissolved chloride, in mg/L	3	5.0	4.4	11
Dissolved fluoride, in mg/L	3	.2	.2	.2
Dissolved silica, as mg/L SiO_2	3	1.4	.9	2.4
Dissolved-solids residue, in mg/L at 180° Celsius	8	110	96	146
Dissolved solids, calculated sum in mg/L	3	97	87	107
Dissolved iron, in µg/L	8	150	35	290
Dissolved manganese, in µg/L	8	145	15	580

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
		Combined data		
Instantaneous flow or daily discharge, in ft^3/s	68	18	0.0	1,250
Specific Conductance, in µs/cm	68	275	120	670
pH, in units	68	7.7	7.0	8.3
Water temperature, in degrees Celsius	68	14.2	.0	30.5
Hardness as mg/L $CaCO_3$	44	99	0	240
Noncarbonate Hardness, as mg/L $CaCO_3$	68	0	0	0
Dissolved calcium, in mg/L	41	32	13	75
Dissolved magnesium, in mg/L	41	6.6	3.0	23
Dissolved sodium, in mg/L	41	10	4.4	31
Dissolved potassium, in mg/L	41	4.0	1.8	8.2
Bicarbonate, as mg/L HCO_3	68	113	32	220
Alkalinity, as mg/L $CaCO_3$	67	94	26	180
Dissolved sulfate, in mg/L	68	36	0.0	120
Dissolved chloride, in mg/L	41	6.6	2.0	21
Dissolved fluoride, in mg/L	41	.2	.0	1.0
Dissolved silica, as mg/L SiO_2	41	7.9	.9	14
Dissolved solids residue, in mg/L at 180° Celsius	68	164	76	401
Dissolved solids, calculated sum in mg/L	41	153	71	382
Dissolved iron, in µg/L	66	115	0	950
Dissolved manganese, in µg/L	66	200	15	1,000

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
	East Fork Little Chariton River near Huntsville (fig. 3, site 7)			
	Before reservoir filling			
Instantaneous flow or daily discharge, in ft^3/s	92	38	0.0	3,250
Specific conductance, in µs/cm	92	893	90	2,180
pH, in units	92	7.1	2.6	7.9
Water temperature, in degrees Celsius	91	13.5	.0	28.9
Hardness, as mg/L $CaCO_3$	92	437	32	1,310
Noncarbonate hardness, as mg/L $CaCO_3$	92	0	0	760
Dissolved calcium, in mg/L	92	106	9.2	300
Dissolved magnesium, in mg/L	92	44	2.2	140
Dissolved sodium in mg/L	91	20	2.3	93
Dissolved potassium, in mg/L	91	4.7	1.4	12
Bicarbonate, as mg/L HCO_3	91	70	0	180
Alkalinity, as mg/L $CaCO_3$	55	69	5	150
Dissolved sulfate, in mg/L	92	401	16	1,410
Dissolved chloride, in mg/L	91	7.5	1.5	51
Dissolved fluoride, in mg/L	91	.4	.0	1.8
Dissolved silica, as mg/L SiO_2	91	7.7	2.3	18
Dissolved-solids residue, in mg/L at 180° Celsius	89	662	63	2,150
Dissolved solids, calculated sum in mg/L	91	629	57	1,940
Dissolved iron, in µg/L	22	110	20	2,500
Dissolved manganese, in µg/L	92	2,000	0	24,000

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
	East Fork Little Chariton River near Huntsville (fig. 3, site 7) During reservoir filling			
Instantaneous flow or daily discharge, in ft^3/s	25	28	0.5	1,740
Specific conductance, in µs/cm	25	628	319	1,600
pH, in units	25	7.6	6.9	8.3
Water temperature, in degrees Celsius	25	15.0	.5	33.0
Hardness, as mg/L $CaCO_3$	5	0	0	490
Noncarbonate hardness, as mg/L $CaCO_3$	25	0	0	0
Dissolved calcium, in mg/L	2	100	70	130
Dissolved magnesium, in mg/L	2	32	24	41
Dissolved sodium, in mg/L	2	50	46	54
Dissolved potassium, in mg/L	2	6.4	5.9	6.9
Bicarbonate, as mg/L HCO_3	25	120	46	190
Alkalinity, as mg/L $CaCO_3$	25	98	38	160
Dissolved sulfate, in mg/L	25	240	84	760
Dissolved chloride, in mg/L	2	6.4	5.8	7.0
Dissolved fluoride, in mg/L	2	.4	.3	.4
Dissolved silica, as mg/L SiO_2	2	3.2	3.2	3.2
Dissolved-solids residue, in mg/L at 180° Celsius	25	461	228	1,220
Dissolved solids, calculated sum in mg/L	2	634	498	770
Dissolved iron, in µg/L	22	80	0	5,200
Dissolved manganese, in µg/L	22	590	130	2,700

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
	East Fork Little Chariton River near Huntsville (fig. 3, site 7) After reservoir filling			
Instantaneous flow or daily discharge, in ft^3/s	19	74	1.0	602
Specific conductance, in µs/cm	19	677	234	1,820
pH, in units	19	7.7	7.2	8.1
Water temperature, in degrees Celsius	19	12.5	1.5	31.0
Hardness, as mg/L $CaCO_3$	6	432	203	825
Noncarbonate hardness, as mg/L $CaCO_3$	8	0	0	0
Dissolved calcium, in mg/L	6	99	50	210
Dissolved magnesium, in mg/L	6	44	19	93
Dissolved sodium, in mg/L	6	57	11	130
Dissolved potassium, in mg/L	6	5.4	3.9	9.7
Bicarbonate, as mg/L HCO_3	8	102	76	180
Alkalinity, as mg/L $CaCO_3$	18	75	29	194
Dissolved sulfate, in mg/L	11	160	31	880
Dissolved chloride, in mg/L	6	6.8	.0	11
Dissolved fluoride, in mg/L	6	.2	.1	.4
Dissolved silica, as mg/L SiO_2	3	3.1	2.2	4.1
Dissolved-solids residue, in mg/L at 180° Celsius	11	342	153	1,600
Dissolved solids, calculated sum in mg/L	3	1,200	598	1,393
Dissolved iron, in µg/L	11	140	4	2,600
Dissolved manganese, in µg/L	11	480	90	2,700

Table 14.--Summary of water-quality data, the East Fork Little Chariton River near Macon and near Huntsville--Continued

Property or constituent	Number of samples	Median	Minimum	Maximum
		Combined data		
Instantaneous flow or daily discharge, in ft^3/s	136	36	0.0	3,250
Specific conductance, in µs/cm	136	852	90	2,180
pH, in units	136	7.3	2.6	8.3
Water temperature, in degrees Celsius	135	13.5	.0	33.0
Hardness, as mg/L $CaCO_3$	103	429	0	1,310
Noncarbonate hardness, as mg/L $CaCO_3$	125	0	0	760
Dissolved calcium, in mg/L	100	106	9.2	300
Dissolved magnesium, in mg/L	100	42	2.2	140
Dissolved sodium, in mg/L	99	22	2.3	130
Dissolved potassium, in mg/L	99	4.7	1.4	12
Bicarbonate, as mg/L HCO_3	124	86	0	190
Alkalinity, as mg/L $CaCO_3$	98	81	5	190
Dissolved sulfate, in mg/L	128	355	16	1,410
Dissolved chloride, in mg/L	99	7.2	.0	51
Dissolved fluoride, in mg/L	99	.4	.0	1.8
Dissolved silica, as mg/L SiO_2	96	7.6	2.2	18
Dissolved-solids residue, in mg/L at 180° Celsius	125	613	63	2,150
Dissolved solids, calculated sum in mg/L	96	630	57	1,940
Dissolved iron, in µg/L	55	90	0	5,200
Dissolved manganese, in µg/L	125	1,300	0	23,000