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HYDROLOGY OF THE ARBUCKLE MOUNTAINS AREA, SOUTH-CENTRAL OKLAHOMA

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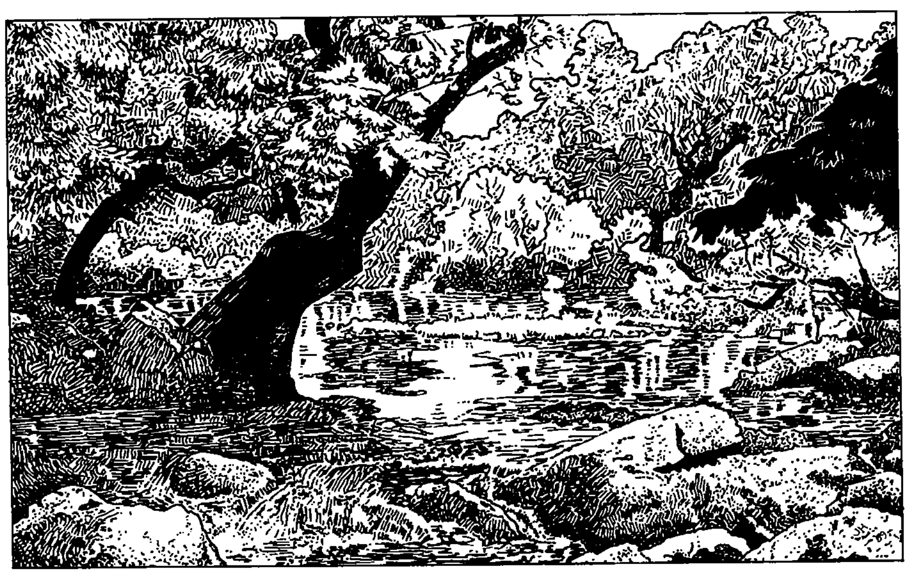

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Title-Page Illustration

Blue Hole Spring on the Chapman Ranch. Pen-and-ink drawing by John Havens, after a slide by Roy Fairchild.

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HYDROLOGY OF THE ARBUCKLE MOUNTAINS AREA, SOUTH-CENTRAL OKLAHOMA

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Abstract.—Rocks that make up the Arbuckle–Simpson aquifer crop out over ~500 mi² in the Arbuckle Mountains province in south-central Oklahoma. The aquifer consists of limestone, dolomite, and sandstone of the Arbuckle and Simpson Groups of Late Cambrian to Middle Ordovician age and is about 5,000–9,000 ft thick. The rocks were subjected to intensive folding and faulting associated with major uplift of the area during Early to Late Pennsylvanian time.

Water in the aquifer is confined in some parts of the area, while in other parts it is unconfined. The average saturated thickness of the aquifer is ~3,500 ft in the outcrop area. Water levels measured in wells fluctuated from 8–53 ft each year, primarily in response to recharge from rainfall.

Recharge to the aquifer is estimated at ~4.7 in./yr.

The average storage coefficient of the aquifer is estimated at 0.008, and the average transmissivity is estimated at 15,000 ft²/day. Based on an average saturated thickness of ~3,500 ft and a storage coefficient of 0.008, the volume of ground water contained in the 500-mi² outcrop area is ~9 million acre-ft. An undetermined amount of fresh water probably exists in the aquifer around the periphery of the aquifer outcrop.

Base flow of streams that drain the aquifer accounts for ~60% of the total annual runoff from the outcrop area and is maintained by numerous springs. The close hydraulic connection between streams in the outcrop area and the aquifer is shown by a close correlation between base flow in Blue River and the fluctuation of ground-water levels in five wells in the Blue River basin. This correlation also exists between the discharge by Byrds Mill Spring and the fluctuation in water level in a nearby observation well; increase and decrease in spring discharge correspond to rise and fall of the water level in the well.

The chemical quality of water from the Arbuckle–Simpson aquifer is suitable for most industrial and municipal uses. The water is hard and of the bicarbonate type; the average hardness is ~340 mg/L, and the average dissolved-solids concentration is ~360 mg/L. Because springs issue from the aquifer and discharge to streams in the area, the quality of water from springs and base flow in streams is similar to that of ground water. The average dissolved-solids concentration of stream water is slightly less than that of water from wells and springs.

INTRODUCTION

Urbanization, economic growth, and improved standards of living in rural areas of south-central Oklahoma require ever-increasing amounts of water; a potential source of this water is the Arbuckle–Simpson aquifer of Late Cambrian to Middle Ordovician age. Basic information on the availability and potability of water from the aquifer is needed to provide water managers, planners, and consumers with adequate information for orderly development and wise use of this vital resource. Recognizing the need for such information, the Oklahoma Geological Survey requested the U.S. Geological Survey to make an appraisal of the Arbuckle–Simpson aquifer; this report presents the results of that appraisal.

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Purpose and Scope

This report describes the hydrology of the Arbuckle Mountains area (Fig. 1), including the geologic framework and the hydrologic characteristics of the Arbuckle–Simpson aquifer, relationships between ground water and surface water, and the chemical characteristics of ground water and surface water. Data used in preparing this report were obtained from field and laboratory analyses and from published and unpublished records of the U.S. Geological Survey and state and local agencies. Field data include records of wells, springs, streams, ground-water levels, precipitation, and selected chemical parameters of ground and surface waters; these data are presented in Appendixes 2–8. Water samples from wells, streams, and springs were analyzed in the laboratories of the U.S. Geological Survey.

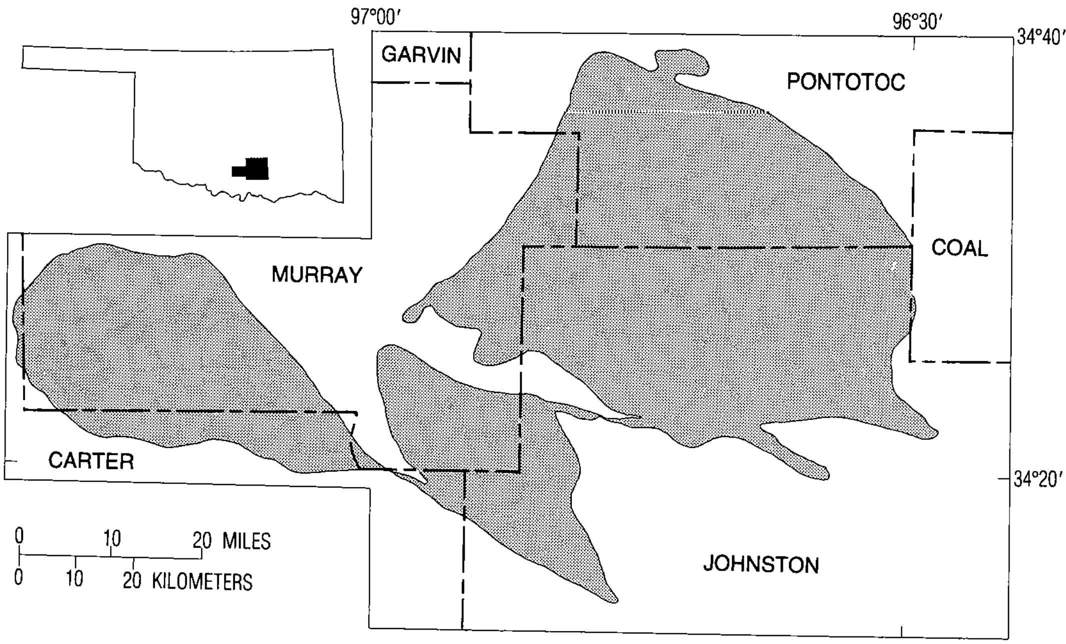

Figure 1. Location of the study area, showing outcrop area of the Arbuckle–Simpson aquifer.

Units of measurement used in this report are in the inch–pound system; measurements can be converted to metric equivalents by use of conversion factors presented in Appendix 1. Hydrologic terms used in this report are defined in Appendix 2.

Previous Studies

Ham (1955,1969) and Ham and others (1954) described the geology of the Arbuckle Mountains. Information on the geohydrology of the Arbuckle–Simpson aquifer has been provided by Fay (1968,1969) and Hart (1966,1974).

Site-Numbering System

The method used in this report to assign a number to a data-collection site is based on its location in a particular township, range, and quarter-quarter-quarter section. As shown in Figure 2, the fractional parts of a section are given from larger to smaller areas of the section; the final digit is the sequential number of a site within the smallest fractional subdivision (10 acres).

Acknowledgments

The authors are indebted to many people throughout the study area for their cooperation

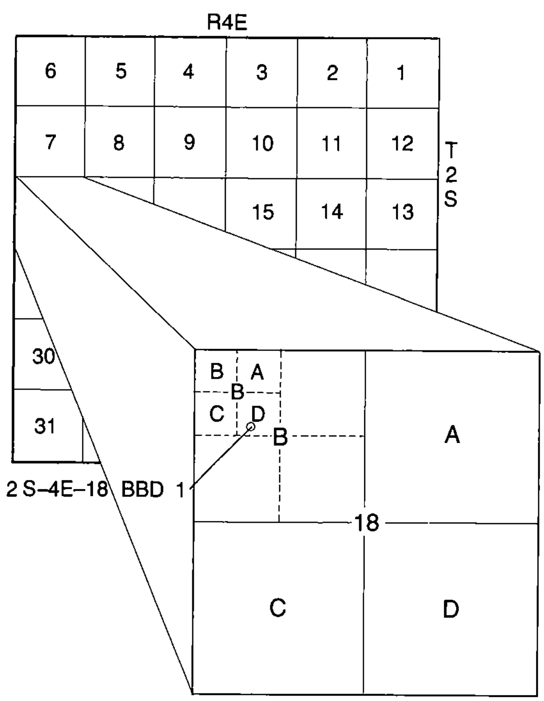

Figure 2. Site-numbering system.

and assistance in supplying information on wells, use of water, and other pertinent data.

Especially appreciated are the cooperation and assistance extended by members of the Oklahoma Geological Survey, who provided sources of literature and many helpful suggestions.

GEOGRAPHIC AND GEOLOGIC SETTING

The Arbuckle–Simpson aquifer underlies an area of ~500 mi^2 in the Arbuckle Mountains physiographic province of south-central Oklahoma (Fig. 1). The term "mountains" is misleading, because the topography of the area consists of gently rolling hills separated from plains by the Washita River. The river follows part of the Washita Valley fault zone. The topography reflects the degree of structural deformation of the underlying rocks. The western part of the mountains, referred to as the Arbuckle Hills, is characterized by a series of northwest-trending ridges formed on resistant rocks that are intensely folded and faulted. The eastern part of the mountains, referred to as the Arbuckle Plains, is characterized by a gently rolling topography formed on relatively flat-lying, intensely faulted limestone beds. Neither the eastern nor the western part of the area has a well-developed karst topography, but a few small karst features have developed in the western part of the area as a result of solution of the underlying carbonate rocks.

Blue River, Pennington Creek, Mill Creek, Rock Creek, Delaware Creek, Oil Creek and Sycamore Creek are the principal streams draining the eastern part of the area and flow generally toward the south–southeast into the Washita River and Red River. Colbert, Hickory, Honey, Falls, Henryhouse, Cool, and Spring Creeks are the principal streams draining the western Arbuckle Mountains (Fig. 3). These streams are sustained throughout the year by springflow. Many of the small tributary streams are intermittent and cease to flow in late summer.

Bedrock geology is portrayed on Plate 1 (adapted from Ham, McKinley, and others, 1954).

CLIMATE

The study area is in a moist, subhumid zone. Most precipitation occurs as rainfall, with some light snow or sleet during the winter.

Long-term precipitation data from National Weather Service stations in and adjacent to the

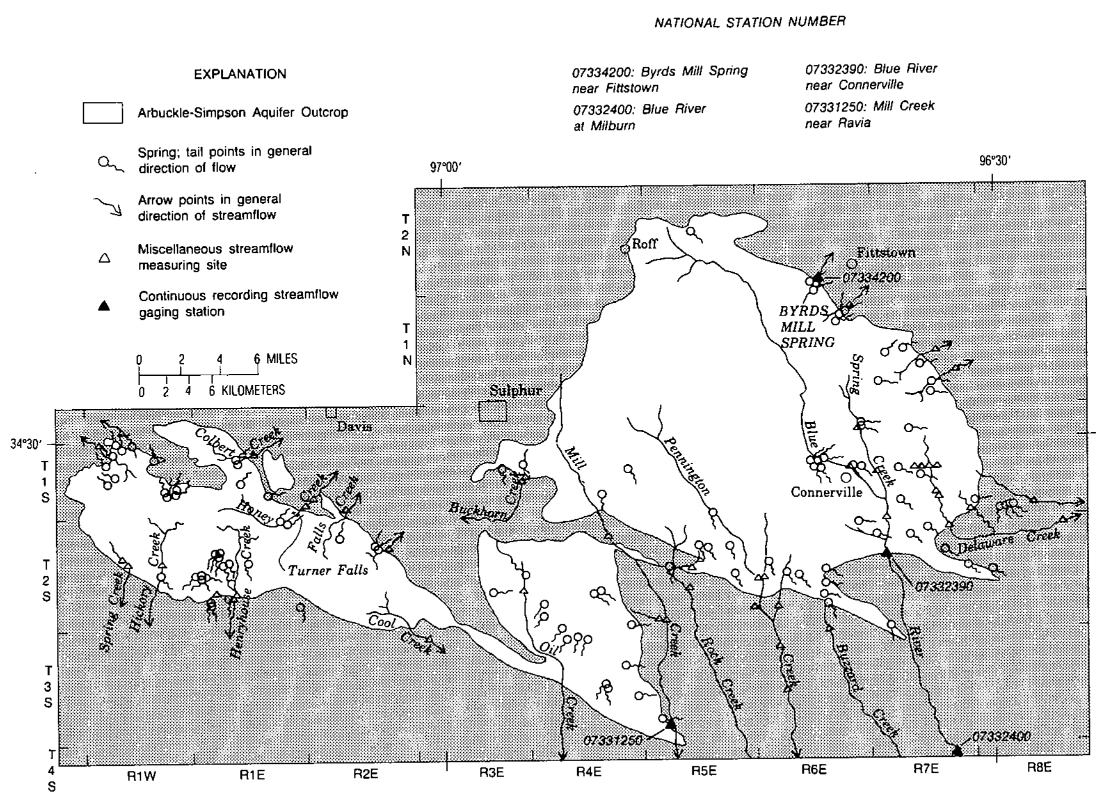

Figure 3. Principal streams, streamflow gaging sites and springs in the study area.

study area (Table 1, Pl. 2) give a time-weighted average precipitation of 38.2 in./yr. Precipitation records at these stations during the 3-yr study period (October 1976–September 1979) indicate that the precipitation for the 1978 water year was ~84% of both the 6-yr and long-term average precipitation (Table 2).

Three additional recording rain gages were operated during the study period to determine the variation in precipitation within the area. These short-term records were used in conjunction with the long-term records at Ada (10 mi north of the study area), Sulphur, and Pontotoc to aid in evaluating rates of aquifer recharge and an areal hydrologic budget. Monthly precipitation at the three short-term stations is listed in Table 3; the total precipitation varies greatly in any given month in different parts of the study area.

Seasonal variations in the climate of the study area are indicated in Figure 4 by the average monthly temperature and precipitation at Sulphur (near the central part of the study area) for the 30-yr period 1941–70. Maximum temperatures commonly occur in July and August, while minimum temperatures occur in December and January. Maximum rainfall generally occurs during the spring months, April through June, with a less intense wet period in September and October; the seasonal dry period occurs from November through February. Figure 5 shows the annual precipitation at Pontotoc, in the northeast part of the study area, for the 48-yr period 1931–78. As indicated by Figure 5, precipitation was below the annual average during the period 1976–78, which overlapped the study period. However, during 1967–75, the 9-yr period preceding the study period (except in 1972), precipitation was near or above the annual average in the northeast part of the study area.

TABLE 1.—AVERAGE CALENDAR-YEAR PRECIPITATION AT STATIONS IN AND ADJACENT TO THE STUDY AREA

Station	Period of record	Average precipitation (in.)
Ada	1941–70	39.45
Pontotoc	1931–78	38.21
Sulphur	1931–78	37.53
Time-weighted average		38.25

SURFACE WATER

Principal Streams in the Study Area

Several perennial streams in the study area are fed by springs that issue from the limestones and sandstones that make up the Arbuckle–Simpson aquifer. The major streams include Pennington, Mill, Falls, Honey, Oil, and Delaware Creeks, and the Blue River and its tributaries.

A gaging station was established on Blue River, near Connerville, at the contact between the Arbuckle Group and the Tishomingo Granite of Precambrian age (Pl. 1) to be used in conjunction with a long-term station (Blue River at Milburn) already in operation 15.2 mi downstream. The two stations were used to estimate evapotranspiration rates in the area. In addition, base-flow data were collected at miscellaneous sites on all major streams that drain the outcrop area (Fig. 3) to determine seepage rates and winter and summer ground-water discharge from the aquifer.

Figure 3 shows the four streams that drain 85% of the eastern part of the study area: the four streams and their drainage areas are Blue River (162 mi^2), Pennington Creek (65.7 mi^2),

TABLE 2.—ANNUAL PRECIPITATION FOR SIX WATER YEARS AT STATIONS IN AND NEAR THE STUDY AREA

Station	Precipitation (in.), Water years					
	1969	1970	1971	1977	1978	1979
Ada	43.43	44.05	41.51	38.31	32.92	36.31
Pontotoc	34.33	41.87	33.39	37.00	31.90	50.41
Sulphur	36.70	44.18	41.69	34.69	31.86	35.97
Average	38.15	43.37	38.86	36.67	32.23	40.90
6-yr average = 38.36						

TABLE 3.—PRECIPITATION AT THREE SITES IN THE STUDY AREA (in.)

	1977			1978			1979		
Month	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
Jan.	NR	NR	NR	1.00	1.05	0.70	2.23	1.70	1.87
Feb.	NR	NR	NR	1.8*	2.12	1.57	1.68	1.46	1.19
Mar.	NR	NR	NR	2.6*	3.70	1.81	4.07	5.99	4.49
Apr.	NR	NR	NR	2.7*	2.70	2.82	2.33	2.45	2.43
May	4.72	5.91	3.36	6.43	6.30	8.80	4.76	5.64	3.37
June	2.70	4.94	3.70	2.60	3.88	4.17	3.33	4.90	6.17
July	NR	2.78	0.9	2.24	0.47	0.60	0.24	1.0*	2.62
Aug.	3.3	4.48	2.13	1.18	0.73	0.71	2.20	3.33	4.01
Sept.	2.45	4.00	1.30	2.99	1.17	3.18	3.36	0.57	0.59
Oct.	2.50	1.4*	1.66	0.94	0.90	0.91	NR	NR	NR
Nov.	0.78	0.8*	0.68	4.00	5.06	4.57	NR	NR	NR
Dec.	0.2*	0.06	0.13	0.51	0.32	0.41	NR	NR	NR

Locations of sites: site 1, 02S-04E-23 CAB (originally at 02S-04E-26 CCB; moved to new site August 1, 1978); site 2, 01N-06E-08 BBA; site 3, 01S-01E-36 AAC.
NR = no record.
*Estimated.

Mill Creek (46.4 mi^2), and Oil Creek (28.6 mi^2). Continuous records of flow have been collected at Blue River at Milburn (Fig. 3, station 07332400) since October 1965, and 15.2 mi upstream at Blue River near Connerville (station 07332390) since October 1977. The mean annual discharge of Blue River at Milburn for the 14-yr period of record (1966–79) was 140 ft^3/sec. Mean annual discharge at this station for the 3-yr study period (1977–79) was 89.2 ft^3/sec. Runoff of Blue River during the study period was 64% of the long-term average. Three years of continuous records of flow were also recorded at Mill Creek near Ravia (Fig. 3, station 07331250) from October 1968 through September 1971. In addition, a 19-yr continuous record (since 1958) has been collected at Byrds Mill Spring near Fittstown (Fig. 3, station 07334200). Miscellaneous streamflow measurements have been collected periodically at several sites in and near the study area since 1949.

Because the Tishomingo Granite acts as a barrier to ground-water flow from the Arbuckle–Simpson aquifer, streamflow at the Blue River near Connerville approximates the total surface and subsurface water discharging from the outcrop area.

Figure 6 shows a fairly close relation (correlation coefficient 0.95) of monthly mean flows at the Milburn and Connerville stations for the common period of record (1977–79 water years) and indicates that the Milburn gaging station can be used to approximate the characteristics of flow from the study area.

The flows at the two sites are about equal in the range 30–40 ft^3/sec, but the river is a gaining stream between the two sites when flow at Connerville is >40 ft^3/sec. Probably there is some inflow to Blue River between the two sites when flow is great enough to exceed 40 ft^3/sec at the Connerville station. The scatter of points in Figure 6 reflects both year-to-year variation in antecedent moisture and seasonal differences in evapotranspiration. Monthly average flows at both sites did not fall below ~32 ft^3/sec during the 3-yr study period.

Seasonal Fluctuations in Streamflow

Seasonal trends in streamflow in the study area are shown by the hydrograph for Blue River near Connerville (Fig. 7). The flow responds rapidly to significant rainfall events and is typically high during the early spring, when frontal storms commonly move into Oklahoma. The flow then declines during June and July, reaching base-flow levels by July or August. Base flow will continue to decline in response to declining ground-water levels and high evapotranspiration. Not until January or February does streamflow begin to increase again in response to winter rainfall.

Figure 8 shows the duration curve of mean daily flow for Blue River at Milburn and indi-

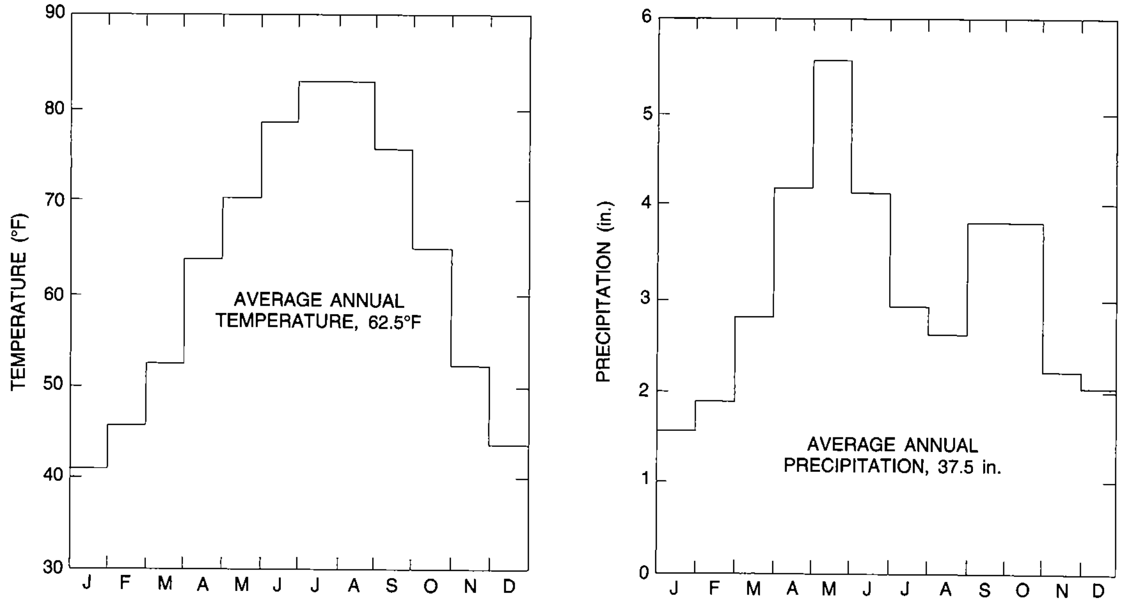

Figure 4. Average monthly temperature and precipitation at Sulphur, 1941–70.

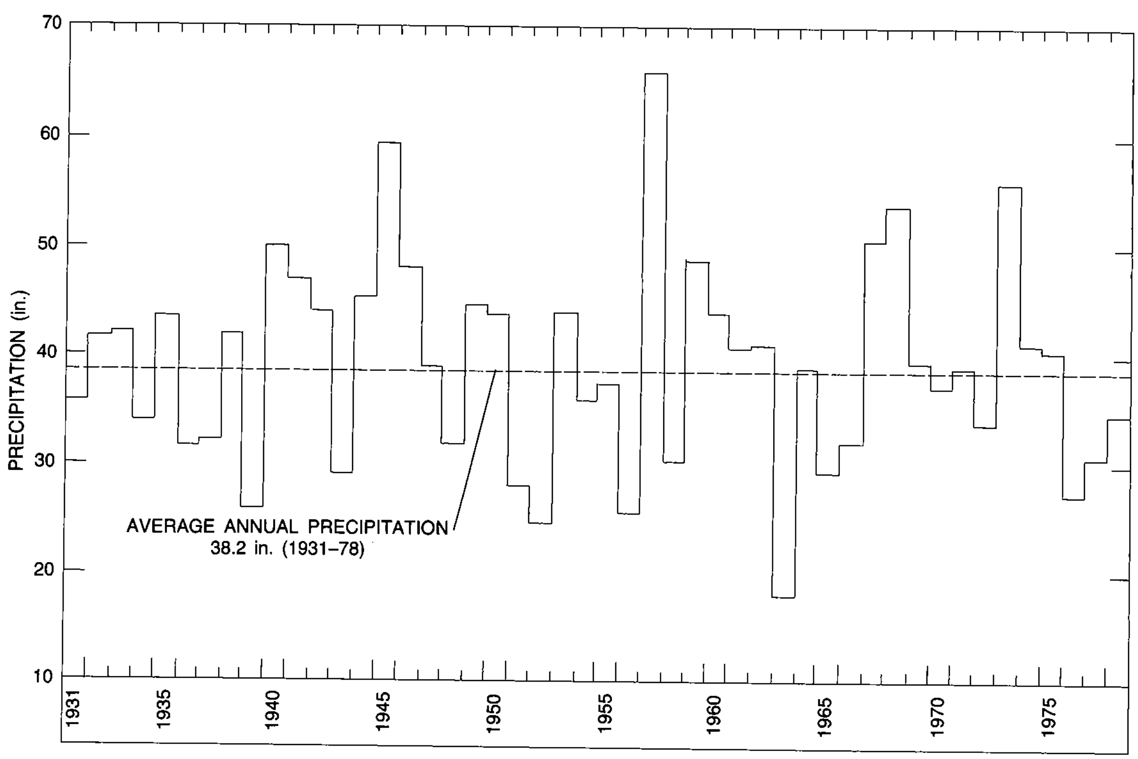

Figure 5. Annual precipitation at Pontotoc, 1931–78.

cates the percent of time a given daily flow can be expected to be equaled or exceeded during the year. The duration curve—which was defined from a 14-yr record of mean daily flow (1966–79)—shows that 10% of the time flow equaled or exceeded 220 ft^3/sec, 50% of the time flow equaled or exceeded 66 ft^3/sec, and 90% of the time flow equaled or exceeded 30 ft^3/sec. The flat slope of the duration curve at the lower end indicates that base flow—which primarily represents ground-water discharge from the Arbuckle–Simpson aquifer—approaches a minimum mean daily flow of ~20 ft^3/sec at the Milburn station. However, an instantaneous low flow of 13.6 ft^3/sec was observed at the Milburn station on 28 August 1956 (Huntzinger, 1978). Even though this low-flow value occurred during a year with the second-lowest annual precipitation during the 48-yr period of record, it was a single instantaneous measurement and may have been affected by upstream diversion. Therefore, the low-flow value of 13.6 ft^3/sec is not considered to be representative of the minimum mean daily discharge at Milburn. If the relation of monthly mean discharges in Figure 6 approximates the relation of mean daily flow between Connerville and Milburn, then the flow at the upstream Connerville station would have been ~18 ft^3/sec when the flow at Milburn was 13.6 ft^3/sec.

Average Surface-Water Discharge from the Study Area

The mean annual runoff from the eastern part of the Arbuckle–Simpson outcrop area of 398 mi^2 was determined using estimates of runoff from three streams that drain nearly 70% of this area: Blue River near Connerville (162 mi^2), Mill Creek near Mill Creek (46.4 mi^2), and Pennington Creek near Reagan (65.7 mi^2).

Data used to obtain these estimates include continuous records of discharge at Mill Creek near Ravia (1969–71 water years) and Blue River near Connerville (1977–79 water years), and periodic miscellaneous discharge measurements at Mill Creek near Mill Creek (1955–79 water years) and Pennington Creek near Reagan (1955–79 water years).

The periodic miscellaneous data collected prior to 1967 are published in Huntzinger (1978). All other discharge data are published in the U.S. Geological Survey Annual Water Resources Data Reports for Oklahoma.

Average annual runoff was estimated at each gaging site for the six water years 1969–71 and 1977–79. The annual runoff for each site is listed in Table 4; the methods used to obtain these values for each gaging site are described below.

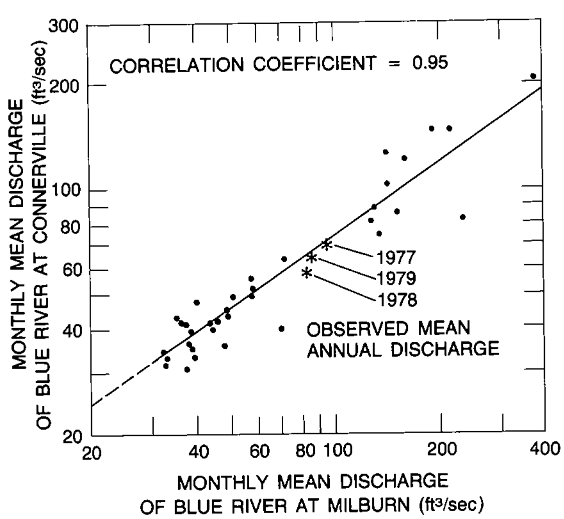

Figure 6. Relation between monthly mean discharge in Blue River at Milburn and Blue River near Connerville, 1977–79 water years.

Blue River near Connerville

Annual runoff for Blue River near Connerville for water years 1969–71 was estimated from Figure 6, using the monthly observed values at Milburn to estimate monthly values at the Connerville site.

Annual runoff for water years 1977–79 was obtained directly from the continuous daily record at the Connerville site.

Mill Creek near Mill Creek

Only periodic miscellaneous discharges were available at the site on Mill Creek near Mill Creek. However, continuous records of discharge were available at a downstream gaging station, Mill Creek near Ravia, for the period 1969–71. Therefore, a relation of monthly mean discharge between Mill Creek near Ravia and Blue River at Milburn was first defined using observed monthly discharges for the common period of continuous record at these two sites (1969–71) (Fig. 9). Monthly discharges for Milburn were then entered into this relation to obtain estimates of monthly discharge and corresponding annual discharges for Mill Creek near Ravia for the period 1977–79. A relation was then defined between periodic discharge measurements at Mill Creek near Mill Creek and corresponding daily mean discharge at the Ravia gaging station, using periodic discharge measurements at Mill Creek near Mill Creek and observed or estimated daily mean discharges at Mill Creek near Ravia for the periods 1969–71 and 1977–79 (Fig. 10). Finally, the annual observed and estimated annual discharges at the Ravia site for the

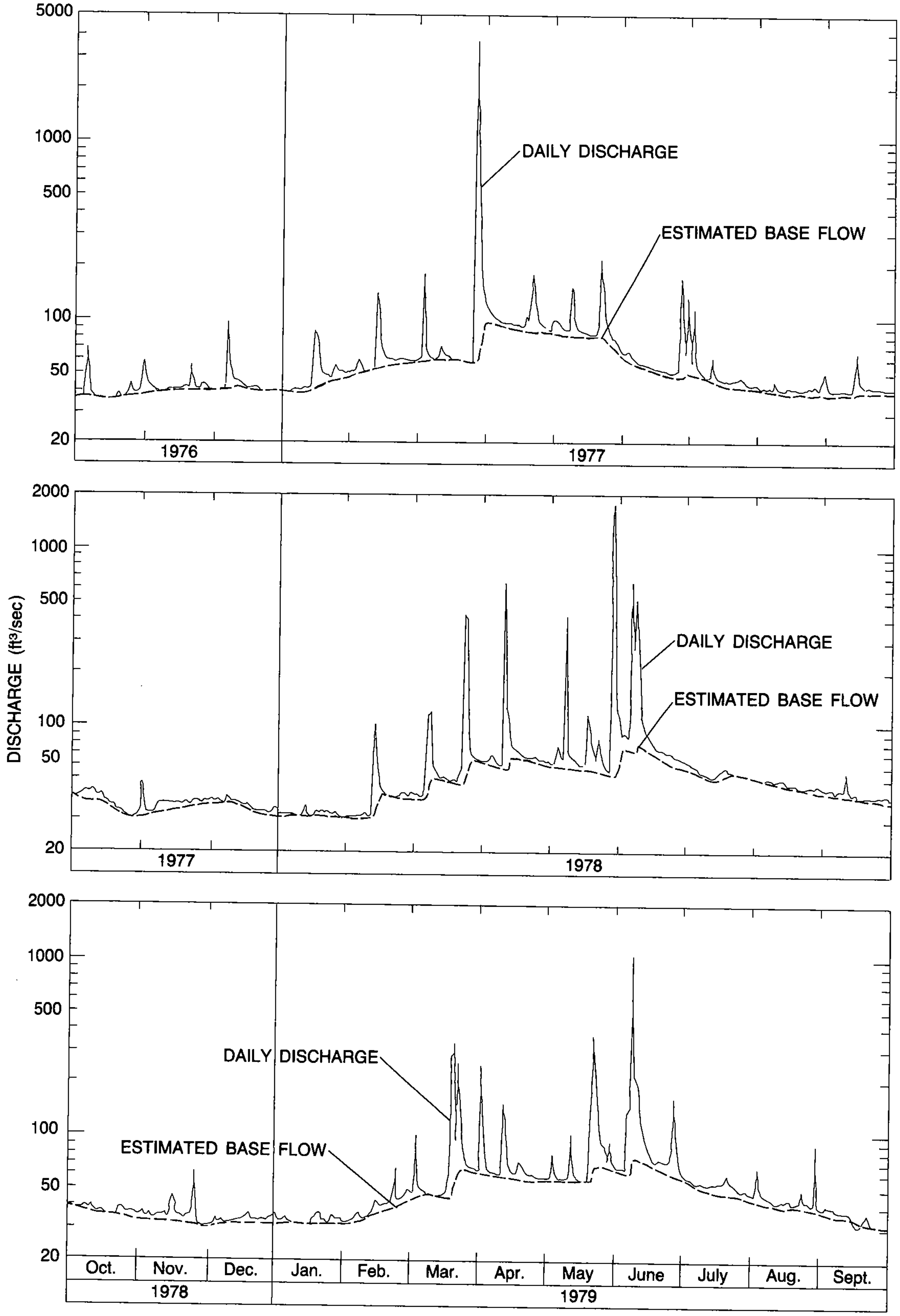

Figure 7. Hydrograph of daily discharge and estimated base flow of Blue River near Connerville, 1977–79 water years.

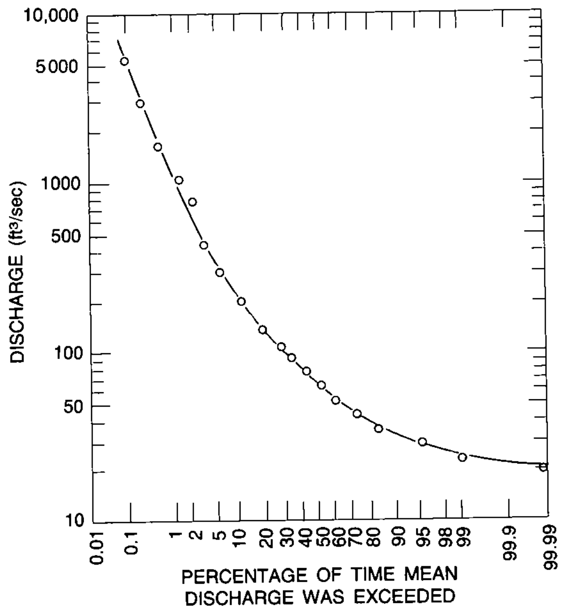

Figure 8. Duration curve of mean daily flow for Blue River at Milburn, 1966–79 water years.

periods 1969–71 and 1977–79 were entered in Figure 10 to obtain corresponding approximate annual discharges for Mill Creek near Mill Creek.

Pennington Creek near Reagan

As with Mill Creek, periodic miscellaneous discharge measurements obtained at Pennington Creek near Reagan were used to estimate annual runoff. Discharge measurements obtained during the period 1969–79 were used to define the relation between daily mean discharge at Mill Creek near Ravia and instantaneous discharge at Pennington Creek near Reagan (Fig. 11). Annual runoff values for the Ravia site were then entered in Figure 11 to obtain approximate annual runoff values for Pennington Creek near Reagan for the periods 1969–71 and 1977–79.

The estimates of annual discharge derived from Figures 10 and 11 assume that instantaneous measured discharges represent the daily average discharge for the gaging site. This assumption is not correct if there is a significant change in stage in the stream during the day of the discharge measurement. A greater source of possible error in the derived annual discharge is the assumption that the relation of mean daily

TABLE 4.—MEAN ANNUAL OBSERVED AND ESTIMATED DISCHARGE FOR BLUE RIVER NEAR CONNERVILLE, MILL CREEK NEAR MILL CREEK, AND PENNINGTON CREEK NEAR REAGAN, WATER YEARS 1969–71 AND 1977–79

Water year	Average annual precipitation[a] (in.)	Mean annual discharge					
		Blue River near Connerville (in.)	Blue River near Connerville (ft^3/sec)	Mill Creek near Mill Creek[c] (in.)	Mill Creek near Mill Creek[c] (ft^3/sec)	Pennington Creek near Reagan[c] (in.)	Pennington Creek near Reagan[c] (ft^3/sec)
1969	38.2	9.8[b]	117[b]	8.8	30	19.6	95
1970	43.4	8.1[b]	97[b]	5.6	19	13.4	65
1971	38.9	7.4[b]	88[b]	5.3	18	12.4	60
1977	36.7	6.1	73	3.5	12	9.7	47
1978	32.2	5.4	65	1.8	6	6.8	33
1979	40.9	4.9	58	1.8	6	6.8	33
Average	38.4	7.0	83	4.5	15	11.4	56

Drainage areas: Blue River near Connerville, 162 mi^2; Mill Creek near Mill Creek, 46.4 mi^2; Pennington Creek near Reagan, 65.7 mi^2.
[a]Average of Ada, Sulphur, and Pontotoc gages.
[b]Estimated from relation with Blue River at Milburn.
[c]Estimated from relation with Mill Creek near Ravia.

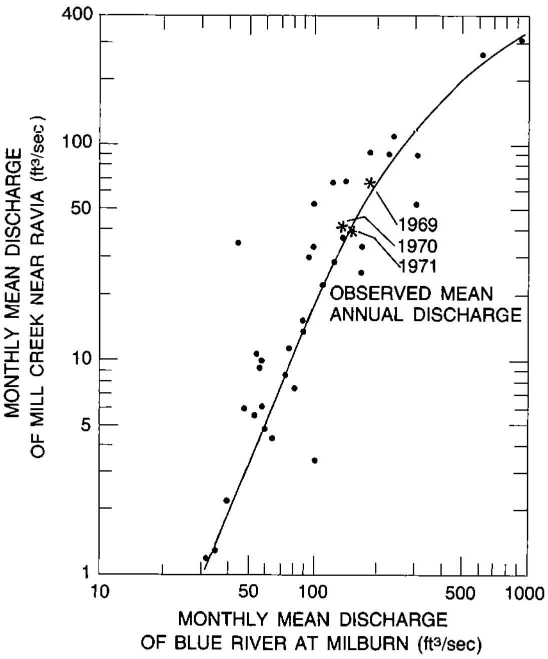

Figure 9. Relation of mean monthly discharge of Blue River at Milburn and Mill Creek near Ravia, 1969–71 water years.

discharges in the figures approximates the relation for annual discharges. To check the reliability of the derived estimates of annual discharge for Mill Creek and Pennington Creek, the respective 6-yr mean values of 15 ft^3/sec and 56 ft^3/sec (Table 4) were plotted on a graph (not included in this report) of drainage areas versus 6-yr mean discharges (1969–71 and 1977–79) for selected streams in south-central Oklahoma. The scatter of points in this plot is large; however, the Mill Creek and Pennington Creek 6-yr means plot well within the scatter.

Table 4 gives the mean annual discharge from Blue River, Mill Creek, and Pennington Creek for the six water years 1969–71 and 1977–79. The combined annual average discharge from these three streams was 154 ft^3/sec from a total drainage area of 274 mi^2, or 7.6 in./yr. A comparison of this runoff with the average of the Ada, Sulphur, and Pontotoc annual precipitation of 38.4 in. during this 6-yr period (Table 2) indicates that surface runoff from the outcrop area accounts for ~20% of the precipitation.

The average annual precipitation of 38.4 in. during the 6-yr period (Table 2) agrees closely with the long-term average of 38.2 in./yr (Table 1). The average annual precipitation for the 14-yr period (1966–79) was 40.0 in.; concurrent streamflow records for Blue River at Milburn for the 14-yr (1966–79) and 6-yr (1969–71 and

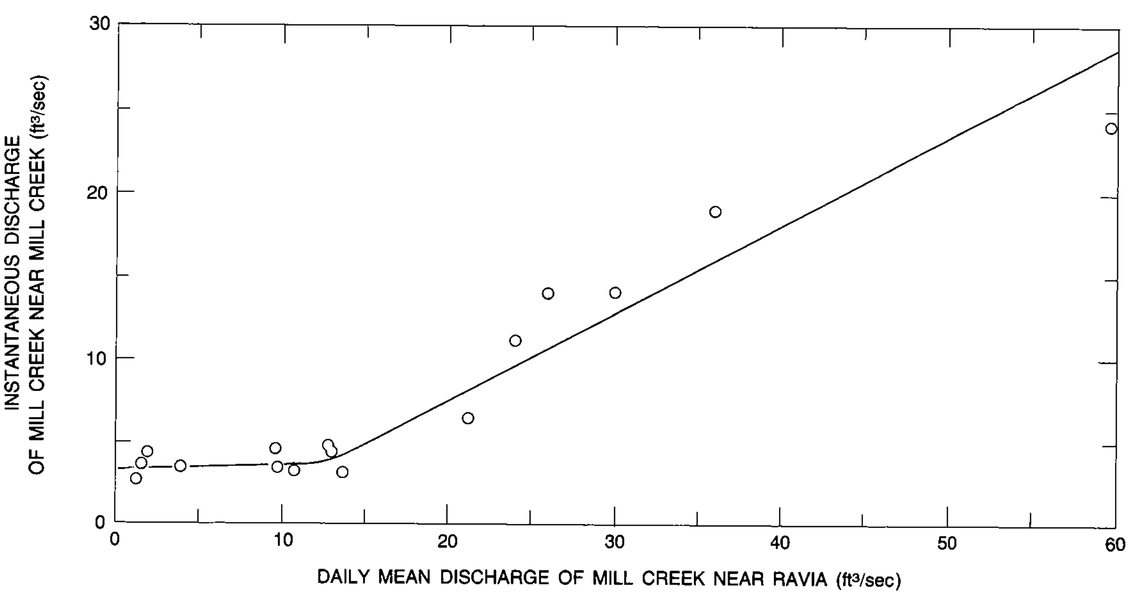

Figure 10. Relation of daily mean discharge in Mill Creek near Ravia and instantaneous discharge in Mill Creek near Mill Creek, 1969–71 and 1977–79 water years.

1977–79) periods show average annual flows of 140 ft³/sec and 120 ft³/sec, respectively. A comparison of the concurrent average annual precipitation and flows indicates that runoff during the 6-yr period was probably about average and runoff during the 14-yr period was above average.

Low-Flow Characteristics

Springs provide base flow to all of the larger streams in the study area throughout the year. Generally, streams from the smaller basins (drainage area < 10 mi²) cease to flow during the summer months. Minimum flows observed in principal streams in the study area are listed in Table 5.

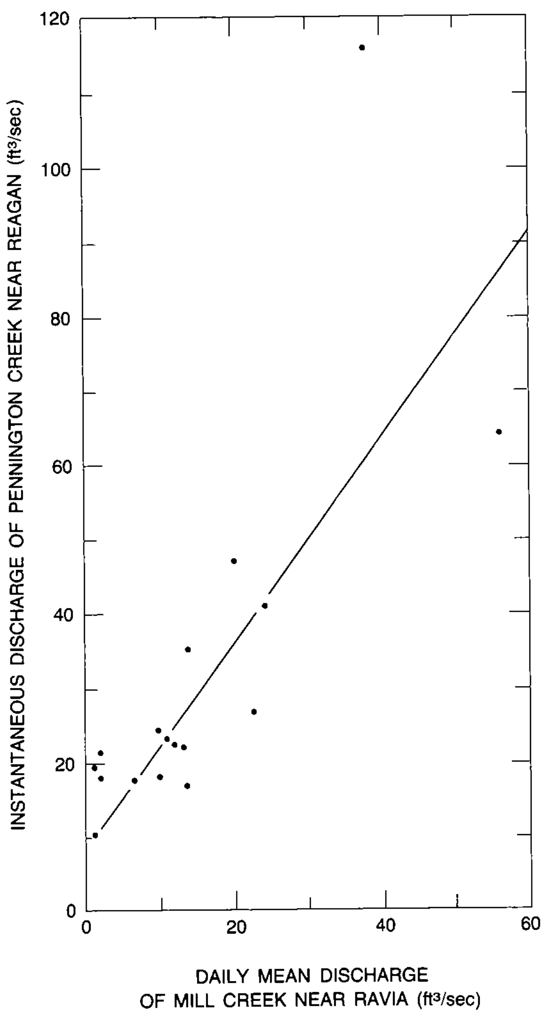

Figure 11. Relation of periodic daily mean discharge of Mill Creek near Ravia and instantaneous discharge of Pennington Creek near Reagan, 1969–79 water years.

TABLE 5.—MINIMUM STREAMFLOW OBSERVED IN PRINCIPAL STREAMS DRAINING ARBUCKLE–SIMPSON OUTCROP AREA

Stream	Drainage area (mi²)	Measurement date	Discharge (ft³/sec)	Period of record* (water years)
Blue River near Connerville	162	1/08/78	29.0	1976–79
Blue River at Milburn	203	8/28/56	13.6	(1955–61), 1966–79
Pennington Creek near Reagan	65.7	2/20/67	6.30	(1951–55, 1958–73, 1976–79)
Mill Creek near Mill Creek	46.4	9/21/55	0.95	(1951–55, 1958–63, 1965–71, 1962–79)
Mill Creek near Ravia	89.2	9/16/71 to 9/18/71	0.09	(1949–50, 1955), 1969–71, (1976–79)

*Years in parentheses represent periods of intermittent measurements.

Knowledge of the amount and duration of low flow is necessary for reliable evaluation of year-round water supply. A study of the frequency of low flow was made for Blue River at Milburn, Pennington Creek near Reagan, and Mill Creek near Mill Creek. Low-flow-frequency curves were computed for the late summer period of high water demand, when flow typically reaches a seasonal minimum, and for the winter season, when flow may reach extreme lows owing to an intensive freeze or to a prolonged drought carried over from the previous summer and fall.

Summer 7-day low-flow curves for the Blue River at Milburn were computed by selecting the lowest mean discharge for 7 consecutive days during the July–September period of each of the 14 water years of record (1966–79). The values were then assigned order numbers, beginning with the smallest 7-day low flow, ranked as 1. The recurrent interval (RI) of each value was then computed from

$$RI = (n+1)/m,$$

where

n is the number of values (14 in this instance); and

m is the order number.

Each flow value and its corresponding RI were then plotted on extreme-log paper, as shown in Figure 12.

A similar procedure was used to define the winter low-flow-frequency curve, using the minimum 7-day low flows for the November–February period of each of the 14 water years.

These curves indicate that, on the average, the summer flow for Blue River at Milburn will be ≤37 ft³/sec for 7 consecutive days once every 2 years (RI = 2), and ≤27 ft³/sec for 7 consecutive days once every 20 years (RI = 20). Similarly, the winter low-flow-frequency curve shows that the 7-day 2-yr low flow is 50 ft³/sec and the 7-day 20-yr low flow is 22 ft³/sec.

The intersection of the curves at RI = 5 indicates that winter low flows fall below the summer low flows only once every 5 years on the average.

The asymptotic trend of the summer curve suggests that 7-day summer low flows at the Milburn site are sustained at ~25 ft³/sec. The probability of the 7-day low flow during the extreme low daily value of 13.6 ft³/sec observed on 28 August 1956 at the Milburn site is unknown, but does correspond to a historically dry period. Possibly, the 28 August 1956 low flow may have been affected by upstream diversion.

The Connerville gage did not have a sufficient number of years of data to define winter and summer frequency curves similar to those for the Milburn site shown in Figure 12. However, relations of the winter and summer 7-day low flows could be defined between these two sites for the common period of record (1977–79). These 7-day low-flow relations are not included here, but are similar to the monthly mean discharge relation shown in Figure 6. The 7-day low flows for Milburn from Figure 12 therefore were used in the 7-day low-flow relations to obtain estimates of the 7-day low flows for Connerville.

Table 6 lists the summer and winter 7-day low-flow values corresponding to recurrence intervals of 2, 10, and 20 years for the Blue River at Milburn and 7-day low flows for recurrence intervals of 2 and 10 years at Blue River near Connerville.

Figure 13 shows summer and winter 1-day low-flow-frequency curves for Pennington Creek

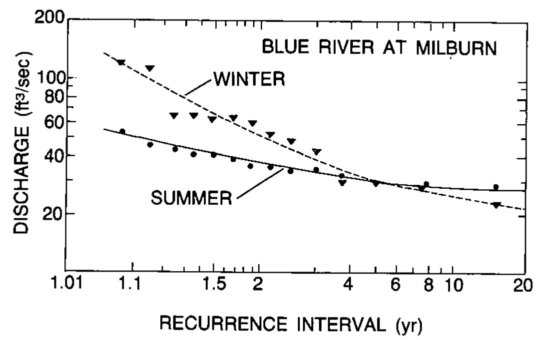

Figure 12. Summer and winter 7-day low-flow frequency curves for Blue River at Milburn, 1966–79 water years.

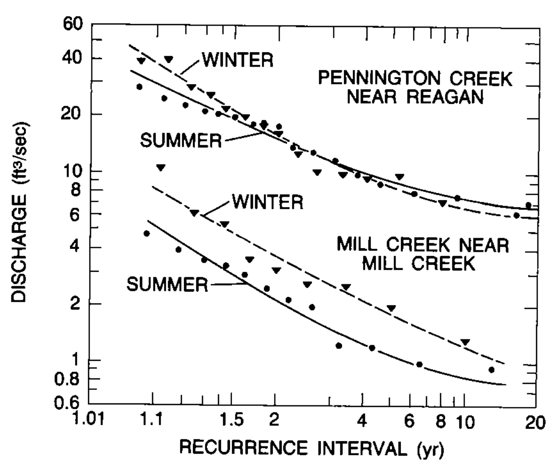

Figure 13. Summer and winter 1-day low-flow frequency curves for Mill Creek near Mill Creek and Pennington Creek near Reagan, 1951–79 water years.

TABLE 6.—SUMMER AND WINTER 7-DAY LOW FLOWS AT RECURRENCE INTERVALS OF 2, 10, AND 20 YEARS FOR BLUE RIVER AT MILBURN AND 2 AND 10 YEARS FOR BLUE RIVER NEAR CONNERVILLE

Station	Period of record (water years)	Summer Recurrence interval (yr)			Winter Recurrence interval (yr)		
		2	10	20	2	10	20
		Seasonal 7-day low flows (ft^3/sec)					
Blue River at Milburn	1966–79	37	28	27	50	25	22
Blue River near Connerville	1977–79	40	35	—	45	25	—

near Reagan and Mill Creek near Mill Creek; the curves were computed from periodic miscellaneous low-flow measurements obtained at these sites. The frequency curves were computed in a manner similar to that used for Blue River at Milburn; however, the low-flow values in this instance represent daily values approximating the minimum low flow for the season, rather than a continuous 7-day minimum low flow for the season. Only partial data are available over the periods of record at Pennington Creek and Mill Creek.

The accuracy of the low-flow-frequency estimates is dependent on the number of years of record used to define the curve, and on how representative of the long-term low-flow characteristics the low flows during this period of record are. The results may not be reliable if the period of record is interrupted by significant upstream regulation or diversions. No significant regulation occurs on streams in the study area, and the only diversion occurs on Pennington Creek at the fish hatchery near Reagan. This diverted water was measured and is included in the low-flow computations.

An extreme and unusual drought (such as that indicated by the 28 August 1956 low flows in the area) or a significantly wet year during the period of record may adversely affect the low-flow-frequency estimates.

Riggs (1972) recommended that at least 10 years of record be available to define the 20-yr low flow. Thus, the 14-yr record for Blue River at Milburn is considered to provide a reliable estimate of the 2-, 10-, and 20-yr low flows. When regression relations are used to define the low-flow values (as for Blue River near Connerville), the correlation coefficient (r) of the relation should be >0.8 (Fiering, 1963). Because r for the winter and summer relations is in both cases >0.8, the 7-day 2-yr and 7-day 10-yr low flows in Table 6 are also considered reliable estimates.

Table 7 lists the summer and winter 1-day low-flow values corresponding to recurrence intervals of 2 and 10 years for Mill Creek near Mill Creek and Pennington Creek near Reagan.

Figures 12 and 13 show that in all instances the summer low flows fall below the winter low flows in the low-frequency range (RI ≤ 2 yr). This reflects the effect of annual depletion of ground water owing to high summer evapotranspiration rates. However, at the higher frequencies (RI ≥ 10 yr) for Blue River and Pennington Creek, summer low flows exceed the winter values. This reflects the occasional effect of a prolonged drought extending through the fall season and into the winter months. Streamflow records show that extremely low winter flows occur in the study area as a result of an unusually severe freeze, causing surface flow to go into storage in the form of ice.

The 1-day 2-yr and 1-day 10-yr low-flow discharges for Mill Creek near Mill Creek and Pennington Creek near Reagan are based on periodic discharge measurements obtained during selected winter and summer low-flow periods since November 1950.

Because of the number of values (n, in years) used to define the curves ranging from $n = 17$ (summer curve of Pennington Creek) to $n = 9$ (winter curve for Mill Creek), the 1-day 2-yr and 1-day 10-yr low-flow values are considered reliable estimates of the frequency of low flow at these sites (Table 7).

The shape of the low-flow-frequency curves reflects the hydrologic characteristics of the Arbuckle–Simpson aquifer. Frequency curves that show significant breaks or changes in slope suggest that low flows were derived from more than one aquifer, or from aquifers of different permeabilities. However, the smooth, concave shape of the curves in Figures 12 and 13 suggests that,

TABLE 7.—SUMMER AND WINTER 1-DAY LOW FLOWS FOR RECURRENCE INTERVALS OF 2 AND 10 YEARS FOR MILL CREEK NEAR MILL CREEK AND PENNINGTON CREEK NEAR REAGAN

Station	Period of record (water years)	Summer Recurrence interval (yr)		Winter Recurrence interval (yr)	
		2	10	2	10
		Seasonal 1-day low flows (ft^3/sec)			
Mill Creek near Mill Creek	1952–79*	2.1	0.8	3.6	0.9
Pennington Creek near Reagan	1951–79*	15	7.0	16	6.0

*Partial record only.

on a regional basis, the aquifer is relatively isotropic, with no significant changes in permeability as ground-water levels decline. In fact, the slopes of the frequency curves are all somewhat similar, except for the summer curve for Blue River, which is flatter, with higher sustained flows at the larger recurrence intervals. This flat slope reflects a sustained ground-water discharge into Blue River from the relatively permeable Arbuckle Group, which crops out in most of the basin's drainage area.

Ground-Water–Surface-Water Relationship

Streams draining the outcrop area of the Arbuckle–Simpson aquifer are fed by numerous springs and seeps that discharge from the aquifer. That portion of streamflow coming from ground-water discharge is base flow and fluctuates directly in response to fluctuations in ground-water levels. Base flow may represent only a fraction of the total flow in the stream during periods of high surface runoff, or it may constitute the total flow during prolonged drought periods.

Figure 14 shows, for the 1978 water year, the relation between precipitation at Pontotoc, streamflow of Blue River near Connerville, and ground-water levels in well 02S-06E-12 CCB 1, located 1.5 mi from the river. The streamflow hydrograph shows an immediate response to most precipitation events, in particular those events ≥1 in. Ground-water-level changes throughout the study area generally lag behind streamflow by several days or weeks, depending on the depth of the ground-water level below land surface.

The average of water levels in five wells throughout the Blue River drainage basin shows a close correlation with base flow of Blue River near Connerville (Fig. 15). The figure shows that ground-water levels and the corresponding base flow from Blue River are higher during the summer than during the winter. Precipitation occurs primarily in the spring and early summer, causing ground-water levels and base flow to reach a maximum by early or mid-summer. The straight line in Figure 15 was drawn to the right of the data points so as to represent that relation defining the minimum average ground-water level that would be expected for a given base flow in Blue River near Connerville.

GEOLOGIC CONTROL OF GROUND WATER

Rocks ranging in age from Precambrian to Quaternary crop out in or near the Arbuckle Mountains. The distribution of these rocks is shown on Plate 1; their thickness, lithology, and water-bearing characteristics are summarized in Table 8.

As shown in Table 8, the Arbuckle–Simpson aquifer comprises several formations that make up the Arbuckle and Simpson Groups. Although each formation in each group may have different water-yielding characteristics, they are considered together.

Rocks of the Arbuckle Group of Cambrian and Ordovician age are primarily limestone and dolomite (carbonate rocks), whereas those of the Simpson Group of Ordovician age are sandstone, shale, and limestone. Approximately two-thirds of the aquifer consists of limestone and dolomite.

Carbonate rocks are readily dissolved by water containing small amounts of acids derived from the atmosphere, soil, and vegetation. The total amount of acid in solution generally is small, and

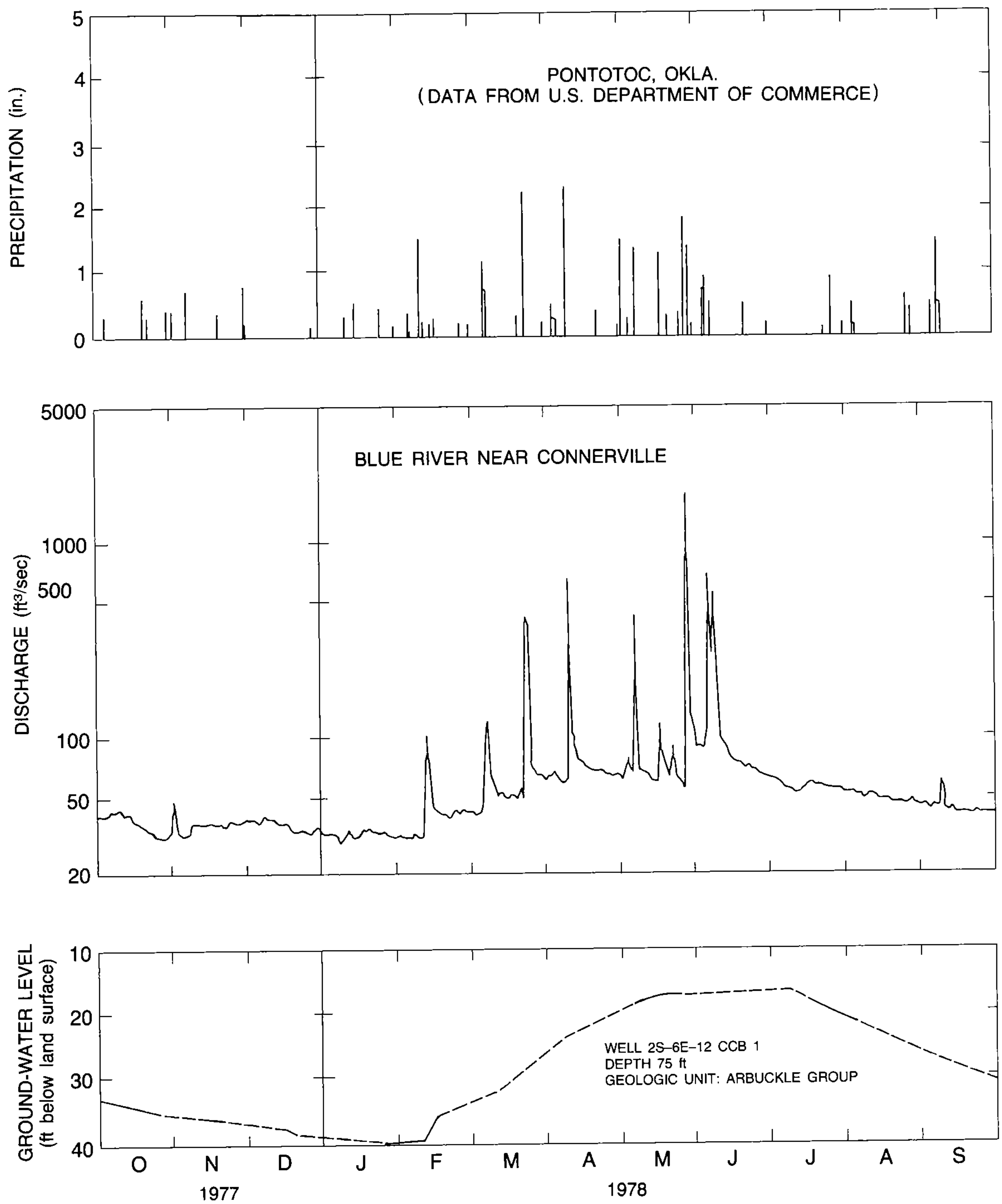

Figure 14. Graphs showing the relation of precipitation at Pontotoc, discharge of Blue River near Connerville, and water levels in well 02S-06E-12 CCB 1.

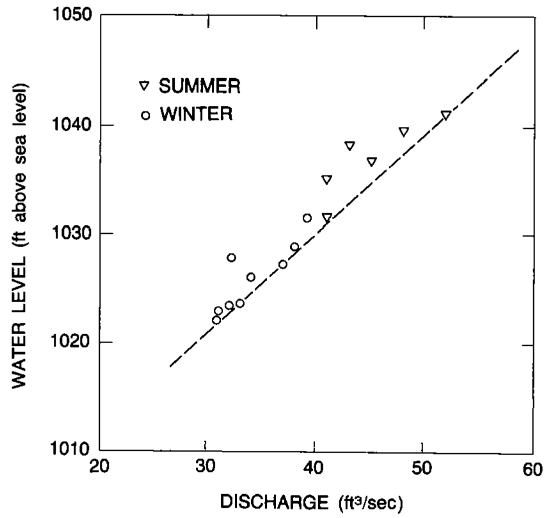

Figure 15. Relation between average of water levels in five observation wells in Blue River basin and base flow of Blue River near Connerville.

the rate at which it dissolves the rock is very slow, but over long periods of time large volumes of rock are removed.

The occurrence and movement of ground water in the Arbuckle–Simpson aquifer are strongly controlled by lithology and structure. As shown on Plate 1, the area has been intensely faulted; only faults 1 mi-long or longer, from maps compiled by Ham and others (1954), are shown. Associated with the major fault zones are numerous minor faults and joints that occur in the more dense beds, such as the Arbuckle Group carbonate rocks. Geologic structure is of significance because fractures caused by folding and faulting provide channels for ground-water movement. Acid water enters the fractures, joints, and bedding planes and enlarges them by solution. The result is an irregular network of openings of all sizes and shapes, extending both vertically and laterally. The association of springs with faults and other fractures indicates the significance of structural control on ground-water flow. Figure 16 shows the effect of faulting on the occurrence

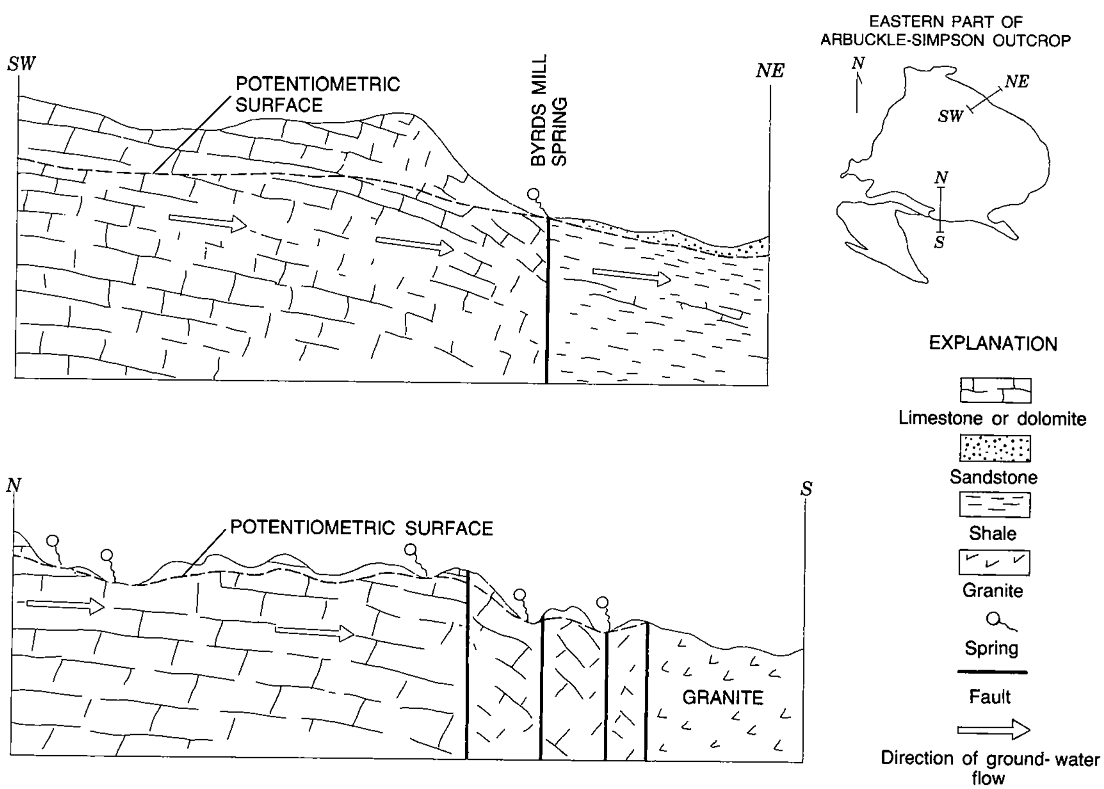

Figure 16. Diagrammatic sections showing the relation of ground water movement to the geology and structure of the Arbuckle–Simpson aquifer in the eastern part of the Arbuckle Mountains.

TABLE 8.—GENERALIZED LITHOLOGIC DESCRIPTION AND WATER-YIELDING CHARACTERISTICS OF STRATA IN THE STUDY AREA

System	Series	Stratigraphic unit		Aquifer	Thickness (ft)	Lithologic description	Water-well yields
Quaternary	Holocene	Alluvium			0–85	Gravel, sand, silt, clay	10–100 gal/min
Cretaceous	Lower	Cretaceous rocks undifferentiated			200–700	White to yellow, medium-grained, weakly indurated sand with varicolored clay	1–50 gal/min
	Lower Permian to Middle Ordovician	Paleozoic rocks undifferentiated			0–5,000 (est.)	Shale, siltstone, sandstone, or other rock types	1–65 gal/min
Ordovician	Middle	Simpson Group	Bromide Formation Tulip Creek Formation McLish Formation Oil Creek Formation Joins Formation	Arbuckle–Simpson aquifer	1,000–2,300	Upper part: buff limestone; grayish-green shale; brown to white, fine- to medium-grained sandstone Lower part: gray to tan, granular limestone with greenish-gray shale and brown, fine- to medium-grained sandstone	Commonly 100–200 gal/min; reportedly as much as 400 gal/min
Ordovician	Lower	Arbuckle Group	West Spring Creek Formation Kindblade Formation Cool Creek Formation McKenzie Hill Formation	Arbuckle–Simpson aquifer	4,000–6,700	Principally limestone in the west and dolomite in the east, with a few thin beds of sandstone that thicken to the east	Commonly 200–500 gal/min; some wells 800–1,000 ft deep produce as much as 2,500 gal/min
Cambrian	Upper	Arbuckle Group	Butterly Dolomite Signal Mountain Formation Royer Dolomite Fort Sill Limestone	Arbuckle–Simpson aquifer		Fine-grained limestone passing eastward into tan to pink, fine- to coarse-grained dolomite	
Cambrian	Upper	Timbered Hills Group	Honey Creek Limestone Reagan Sandstone		175–675	Very glauconitic and silty, gray to greenish-brown, fine to coarsely crystalline limestone and brown, coarse-grained sandstone	Limited
Cambrian	Middle	Colbert Porphyry			Drilled thickness, 4,500	Red-brown rhyolite porphyry	Limited
Precambrian		Tishomingo Granite, Troy Granite			[est. thickness 10 mi]	Pink, coarse-grained granite	Limited

of springs where less-permeable rocks abut rocks of the Arbuckle–Simpson aquifer.

The depth to which the network of solution channels can reach is the maximum depth at which ground-water circulation has taken place. Caliper logs, which show the diameter of a hole with depth, indicate openings at various depths in wells as deep as 2,000 ft. Some of the openings probably were developed during drilling of the well, but many may be solution openings. More and larger openings are usually formed beneath the valleys, where the volume and movement of water from the uplands is greatest. Springs in the eastern part of the area, which is underlain primarily by dolomite, are larger than those in the western part of the area, which is underlain primarily by limestone. However, the difference in the amount of discharge from the springs could result from the difference in size of the catchment areas, rather than from the difference in lithology. The catchment area of the eastern part of the study area is much larger than the catchment area of the western part.

GROUND WATER

Rocks that make up the Arbuckle–Simpson aquifer act as a reservoir in which water is stored in numerous openings. These openings range from small intergranular pores to open fractures and caverns. As water enters or leaves the reservoir, the amount in storage is changed, producing a rise or fall of the water level in a well. Because of the heterogeneity of the aquifer, the amount of water that enters or leaves the aquifer varies throughout the study area.

Occurrence and Movement

The potentiometric surface of the Arbuckle–Simpson aquifer in the eastern and western parts of the Arbuckle Mountains area (data collected winter 1976–77 and winter 1977–78 for the respective parts) is shown on Plate 2. The potentiometric-surface map for the western part of the study area is incomplete, because wells are too sparse for adequate definition of the water-level surface.

The potentiometric surface roughly follows the topography. In general, recharge areas are topographically high, and discharge areas are topographically low. In the eastern part of the area, where ground-water levels are generally lower, the ground-water gradient is generally eastward and ranges from 20 ft/mi to 60 ft/mi. In the western part of the area, the ground-water gradient is generally toward the south at ~50 ft/mi.

Where the Arbuckle–Simpson aquifer dips beneath beds of low permeability, the water is confined, and wells that penetrate below the confining layer may flow all or part of the year. Table 9 lists several wells that flow part or all of the year. Flowing wells occur in western Coal County and in the valley of Oil Creek in southeastern Murray County near Nebo. Flowing wells also occur north of Sulphur in the valley of Rock Creek where the stream has eroded the land surface below the potentiometric surface. These flowing wells obtain their hydraulic head from Arbuckle Group rocks at depth and receive recharge at a higher altitude east of the Sulphur area, where the Arbuckle Group is at the surface.

Recharge

Recharge to the Arbuckle–Simpson aquifer is from precipitation on the area. Most natural recharge takes place by infiltration of precipitation into soil cover, alluvium, or outcrops of porous rock. In some places, water enters small sinkholes or solution pipes in the carbonate rocks. Some recharge to the aquifer also occurs from streamflow infiltrating through alluvial deposits and rock fractures in the stream channel. Some recharge may percolate through overlying younger formations around the periphery of the aquifer outcrop area.

Hydrographs of water levels in wells indicate fairly rapid response of water levels in the aquifer to rainfall. However, the rate of recharge from precipitation varies from place to place be-

TABLE 9.—WELLS IN THE STUDY AREA THAT PENETRATE THE ARBUCKLE–SIMPSON AQUIFER AND FLOW ALL OR PART OF THE YEAR

Well location	Well depth (ft)	Water level* (ft)	Observation date
01S-07E-23 BCC 1	1,400	(flowing)	2-1-77
01S-07E-34 ABC 1	90	(flowing)	2-4-77
01S-08E-32 CCA 1	400	(flowing)	3-9-77
01S-08E-32 CCA 2	600	(flowing)	3-9-77
01S-08E-32 CCA 3	600	(flowing)	3-9-77
01S-08E-32 CCA 4	600	(flowing)	3-9-77
01S-02W-09 BCD 1	16	0.00	4-25-78
02S-03E-13 BBB 1	614	+2.10	8-24-77
02S-03E-25 DCD 1	361	+6.30	12-6-77
02S-06E-34 ACA 1	520	0.00	11-53
02S-07E-03 BBB 1	84	+0.54	2-8-77
02S-07E-04 CAD 1	80	(flowing)	2-2-77

*At or above land surface.

cause of differences in permeability of the aquifer and soil.

The recharge to the aquifer following a significant rainfall can be determined from streamflow hydrographs by using a method described by Rorabaugh (1964). This method assumes (1) that the drainage basin is underlain by an aquifer having homogeneous, isotropic characteristics; (2) that the distances from stream to ground-water divides or geologic boundaries of no flow are equal at all places in the basin; and (3) that the ground-water level is everywhere at stream level. The stream must penetrate the aquifer and must maintain perennial flow. This method was used by Rorabaugh (1964) in the case of a finite sand aquifer having finite boundaries. Although the Arbuckle–Simpson aquifer is not as homogeneous and isotropic as a sand aquifer, it may act as a uniform aquifer when considered regionally throughout the Arbuckle Mountains area. The equation used with this method is

$$V = \frac{4Qa^2S}{\pi^2T} \tag{1}$$

where

V = volume of water recharged to the aquifer as a result of the rainfall event (L^3);

Q = discharge in the stream resulting from the rainfall event (L^3/T);

S = storage coefficient (dimensionless);

a = average distance from the stream to the ground-water drainage divide (L); and

T = transmissivity (L^2/T).

Rorabaugh and Simons (1966) have shown that the quantity a^2S/T is equal to $\Delta t/0.933$, where Δt is the time in days required for the streamflow-hydrograph recession to pass through one log cycle when plotted on semilog coordinates. Therefore, equation (1) can be rewritten as

$$V = \frac{Q\Delta t}{2.3} \tag{2}$$

After a recharge event, the streamflow hydrograph approaches a straight-line recession when time (t) in days, is equal to $0.2(a^2S/T)$, or $0.2\Delta t/0.933$ (Rorabaugh, 1964). Also, when t equals $0.2(a^2S/T)$, half of the ground water in storage from the recharge event has been depleted (Glover, 1966). To calculate the recharge from one event, the effects of all previous events must be subtracted.

Recharge to the aquifer in the Blue River basin was determined by applying this method to the streamflow hydrograph of Blue River near Connerville. The area of the ground-water basin is thought to coincide approximately with the 162 mi^2 area of the surface drainage basin above the Connerville station, and is estimated conservatively to be 150 mi^2.

For the average precipitation of 4.6 in. on 26–28 March 1977 (Table 10), the streamflow hydrograph shows Δt equal to 160 days. The straight-line recession began on 30 April, when t equaled 34 days and streamflow was 72 ft^3/sec. If the 26–28 March precipitation had not occurred, extrapolation of base flow indicates that only 32 ft^3/sec would have been flowing in the river on 30 April. Therefore, the increase in base flow from the 26–28 March event was 40 ft^3/sec. With Q equal to 40 ft^3/sec and Δt equal to 160 days, equation (2) defines the volume of recharged ground water on 30 April from the 26–28 March event as $V = 2.4 \times 10^8$ ft^3. However, because the amount of water recharged on 30 April is only half the total recharge from the 26–28 March

TABLE 10.—RECHARGE TO ARBUCKLE–SIMPSON AQUIFER IN BLUE RIVER BASIN FOR SELECTED RAINFALL EVENTS DURING 1977, 1978, AND 1979

Date	Precipitation (in.)				Q	Δt	Recharge	Ratio of recharge to
	Roff	Sulphur	Pontotoc	Average	(ft^3/sec)	(days)	(in.)	average precipitation
26–28 March 1977	3.7	4.42	5.80	4.6	40.0	160	1.4	0.30
18–21 May 1977	5.8	2.80	1.85	3.5	15.0	150	0.48	0.14
23–24 March 1978	1.2	1.22	2.21	1.5	14.0	170	0.51	0.34
5–8 June 1978	2.5	2.69	2.15	2.4	8.5	155	0.28	0.12
4–10 June 1979		2.58	3.40	3.0	18.0	165	0.65	0.21
								Average 0.22

Note: Q = discharge in Blue River resulting from rainfall; Δt = time required for streamflow hydrograph to decline through one log cycle.

event, total recharge from the 26–28 March event was 4.8×10^8 ft^3. Distribution of this recharge over the entire ground-water basin, which is estimated to be ~150 mi^2, gives an average recharge per unit area of 1.4 in. The results of similar calculations for several other precipitation events are included in Table 10. Also shown in the table is the ratio of recharge to precipitation. The ratios ranged from 0.12 to 0.34 for the five studied rainfall events; they depend on such variables as rainfall intensity, areal distribution, antecedent precipitation, season of the year, and evapotranspiration. The average annual base flow draining the area is a reliable measure of the annual recharge to the aquifer; base flows are discussed in the discharge section of this report.

Water-Level Fluctuations

During the study, water levels in 29 wells that tap the Arbuckle–Simpson aquifer were measured monthly. In addition, continuous records were obtained from two wells in Johnston County and two wells in Pontotoc County (Table 11). Water levels were monitored to determine annual (year-to-year) trends, seasonal fluctuations, and the relation between ground-water storage and surface-water flow. Maximum and minimum levels observed in these wells indicate that the

TABLE 11.—MAXIMUM AND MINIMUM WATER LEVELS IN 33 OBSERVATION WELLS IN THE EASTERN PART OF THE ARBUCKLE MOUNTAINS

Well location	Depth to water (ft)		Range of fluctuation (ft)
	Minimum	Maximum	
01N-04E-02 DDA 1	97.66	150.72	53.06
01N-04E-25 AAC 1	85.61	118.04	32.43
01N-04E-31 CBA 1	118.75	142.01	23.26
01N-04E-33 AAD 1	103.52	127.26	23.74
01N-05E-01 AAB 1	63.79	86.86	23.07
01N-05E-09 ADA 1	79.83	116.36	36.53
01N-05E-27 DCC 1	43.75	80.45	36.70
01N-06E-04 CAD 1	105.64	120.77	15.13
01N-06E-21 ACB 1	87.34	107.12	19.78
01N-06E-24 CAB 1	30.29	56.75	26.46
01N-06E-29 CAB 1	70.16	89.46	19.30
02N-05E-21 DCD 1	59.93	102.04	42.11
01S-03E-22 BAC 1	38.77	47.77	9.00
01S-04E-12 ADA 1	27.50	57.16	29.66
01S-04E-22 CDC 1	35.50	49.12	13.62
01S-05E-27 AAB 1	53.35	81.64	28.29
01S-06E-05 CCC 1	61.20	77.53	16.33
01S-06E-35 BDB 1	4.24	14.85	10.61
01S-07E-02 CBB 1	89.89	99.70	9.81
01S-07E-06 BBB 1	8.11	18.04	9.93
01S-07E-08 BAA 1	13.04	45.30	30.26
01S-07E-20 CAB 1	6.10	17.32	11.22
01S-07E-23 DDD 1	47.21	95.44	48.23
01S-07E-25 CBC 1	51.09	83.49	32.40
02S-03E-13 CCD 1	9.10	23.23	14.13
02S-04E-26 CBA 1	19.74	37.67	17.93
02S-05E-03 CBC 1	93.90	103.30	9.49
02S-06E-04 CAB 1	83.52	132.92	49.40
02S-06E-12 CCB 1	14.75	39.53	24.78
02S-07E-07 AAA 1	38.44	57.20	18.76
03S-04E-06 CCA 1	15.54	27.11	11.57
03S-04E-06 CCD 1	13.00	20.78	7.78
03S-04E-23 ABB 1	18.66	35.25	16.59
Median	47.21	81.64	19.78

median fluctuation is ~20 ft, but fluctuations ranged from 53 ft to 8 ft for individual wells.

As indicated by the graphs in Figure 17, high ground-water levels occur following periods of heaviest rainfall, and low water levels occur during the drier periods of the year. No long-term declines or rises in water levels are apparent from the hydrographs, other than the relation of high levels during wet years.

Of the 33 wells for which water levels were measured during the investigation, hydrographs for wells 01N-04E-02 DDA 1, 01N-05E-27 DCC 1, 01S-07E-06 BBB 1, 02S-04E-26 CBA 1, 02S-06E-12 CCB 1, and 03S-04E-06 CCD 1 are shown in Figure 18. The water levels in all wells monitored during this study generally are lowest during January and February, and highest during May and June.

The rate of rise and decline of the water levels is a function of the hydraulic and geologic properties of the aquifer, the location with respect to topography, and the rate of recharge to or discharge from the aquifer.

Water levels in wells respond to seasonal rainfall, most of which occurs in the spring. An example of the regional (areal) effects of rainfall on water levels is shown on Figure 19. From 25 March to 25 April 1977, rain amounted to an average of 8.3 in. at Pontotoc and Sulphur; most of the rain occurred in late March and during the third week of April. Water levels in wells rose 0.5–25.4 ft in response to this rainfall. The greatest water-level rise occurred in wells in the Arbuckle outcrop area. Water-level fluctuations are usually greatest in recharge areas and less in discharge areas.

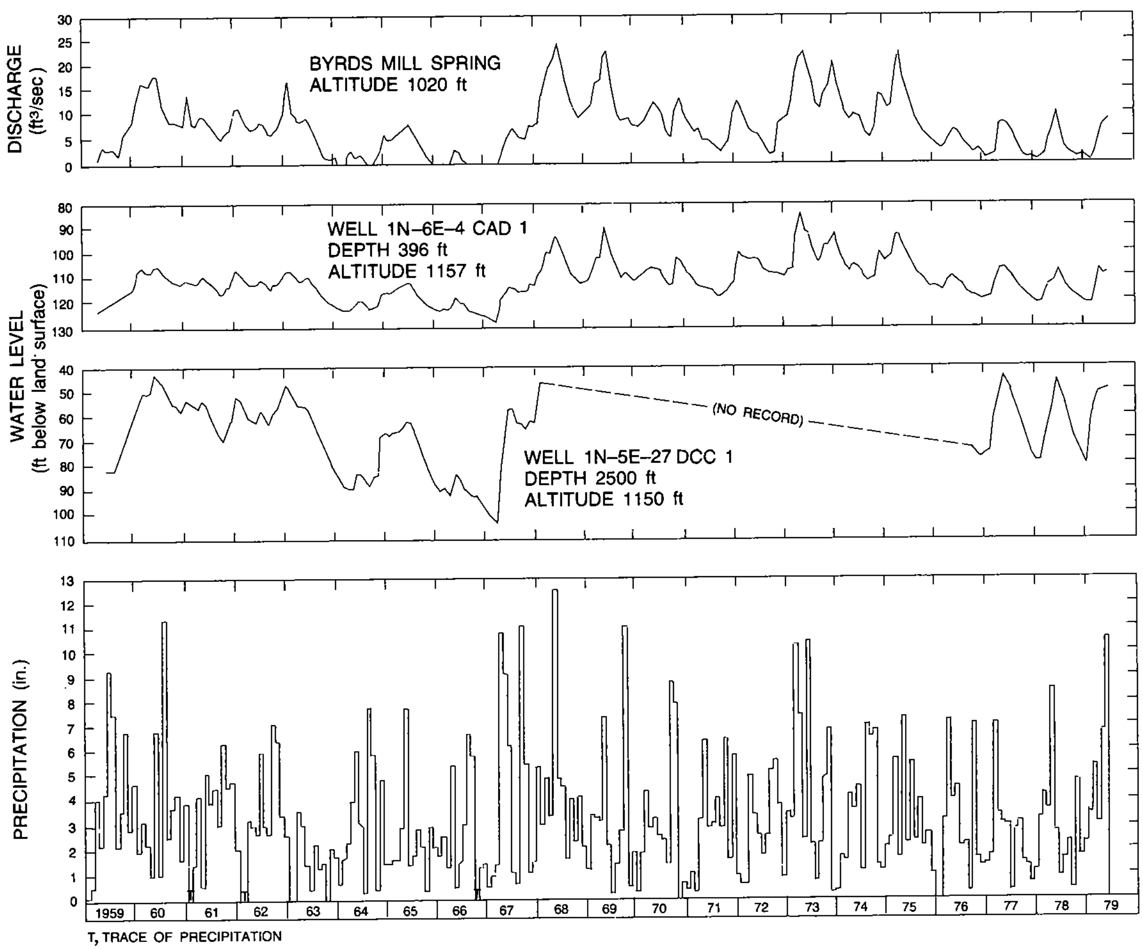

Figure 17. Relation of water levels in wells 01N-06E-04 CAD 1 and 01N-05E-27 DCC 1 and discharge from Byrds Mill Spring to rainfall at Pontotoc (January 1959 through June 1979; source: National Oceanic and Atmospheric Administration.)

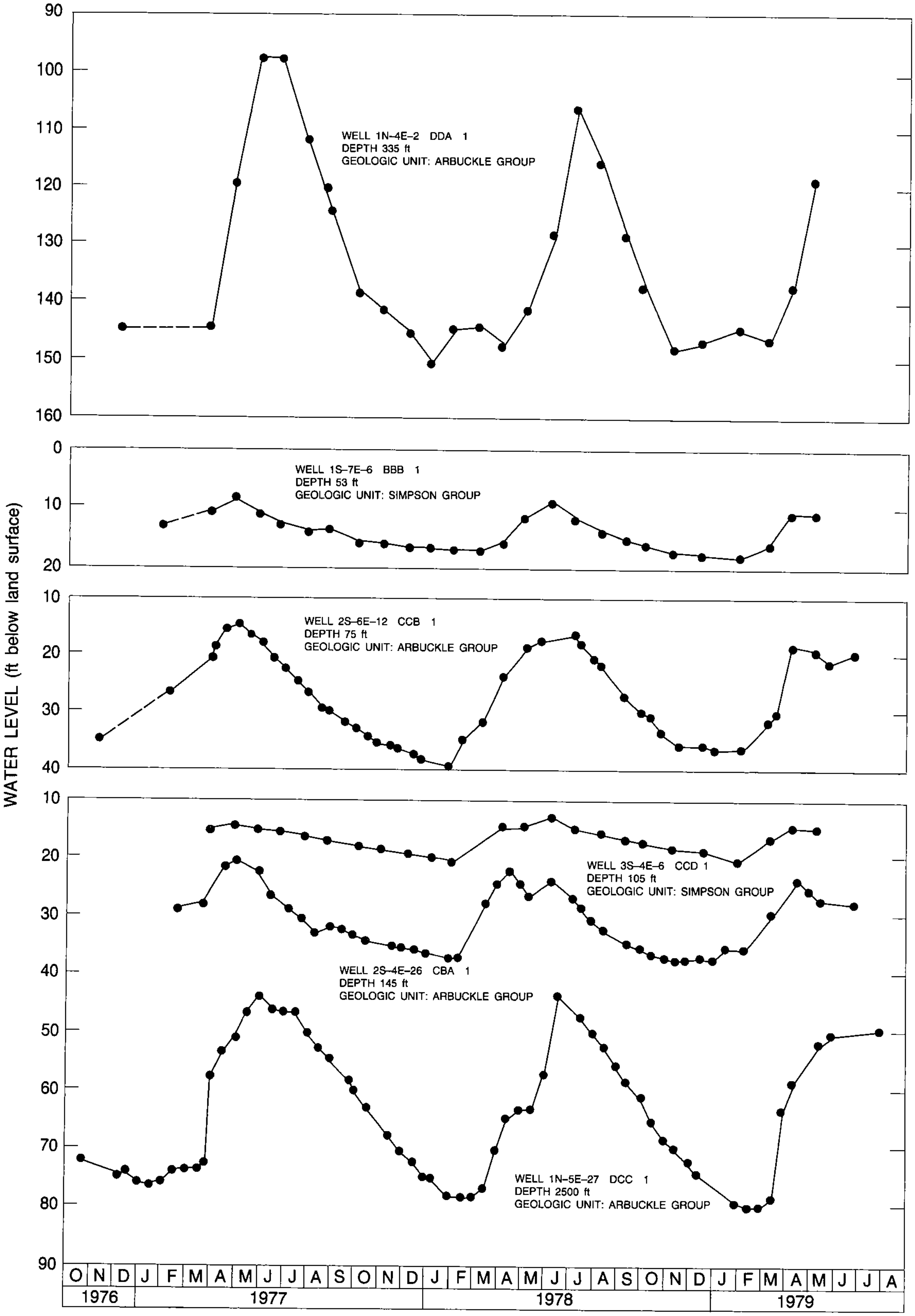

Figure 18. Hydrographs of selected wells in the eastern part of the Arbuckle Mountains.

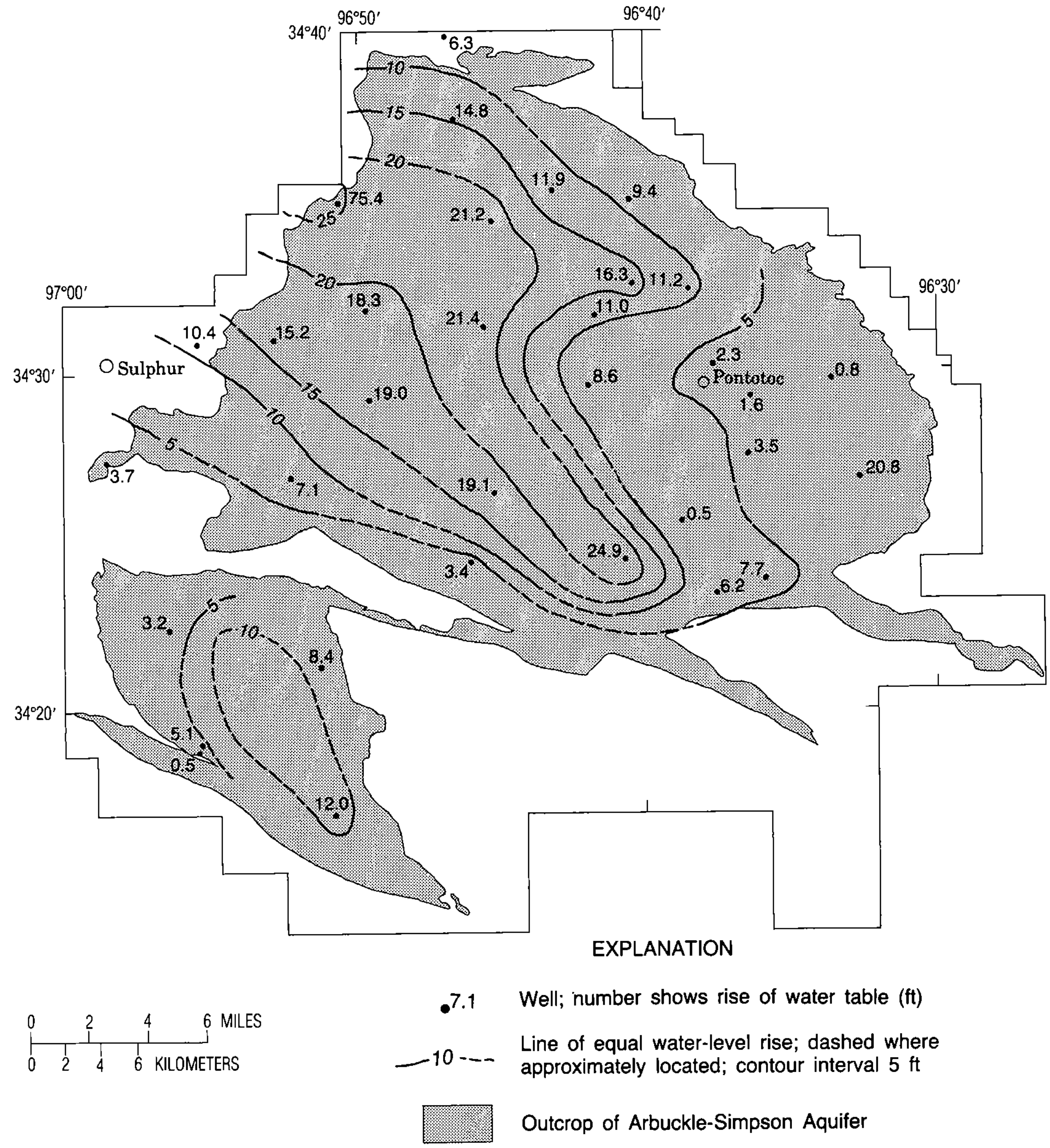

Figure 19. Rise of the water table in the eastern part of the Arbuckle Mountains in response to rainfall from 25 March to 25 April 1977.

Discharge

Although some discharge from the Arbuckle–Simpson aquifer is by evapotranspiration and pumping from wells, by far the largest amount is from springs that provide base flow to streams.

Pumpage

As of 1980, withdrawal of water from the Arbuckle–Simpson aquifer by pumpage accounted for only a minor part of the discharge. Wells that tap the aquifer in the study area produce <1 gal/min to ~500 gal/min. Some wells are capable of yielding greater amounts of water (as much as 2,500 gal/min), but those wells were not in use during this study. The total amount of withdrawal from the aquifer by pumpage was not determined during this study, but is estimated to be <2 Mgal/day.

Springs

Numerous springs discharge water from the Arbuckle–Simpson aquifer in the study area. Information was obtained on 96 springs that issue from the aquifer in its outcrop area (Fig. 3). Most of the springs in the study area are gravity springs, occurring where the potentiometric surface intersects the land surface. The locations of the springs correspond to the areas of natural discharge from the aquifer.

Most springs are near faults or other fractures. In many places the fractures have been enlarged by solution. The enlarged fractures serve as channels for water that enters the aquifer in the recharge area and moves down-gradient, then issues from springs at lower altitudes. In places, springs occur on the up-gradient side of a fault and discharge water that flows a short distance down a stream channel. The water enters an opening, such as a fracture, or seeps into sand in the stream bed. Many are "wet-weather" seeps or springs that discharge during and for a short time after the rainy season. Such springs probably occur where the water table is perched, and go dry when the perched water table recedes below the spring outlet.

In several places faulting has brought less-permeable rocks into contact with rocks that have a greater permeability. Because of the difference in permeability across the fault, water moves to the surface through fractures and discharges from springs and seeps along the fault. An example of this occurs in the southeast part of the area, where faulting has brought the Tishomingo Granite in contact with rocks of the Arbuckle–Simpson aquifer (Fig. 16). The granite, having low permeability, acts as a subterranean barrier to ground-water flow in the aquifer, and a ground-water mound exists on the north side of the barrier. Water is released from the ground-water mound by springs.

Several large springs contribute discharge sufficient to sustain perennial flow in some streams. Byrds Mill Spring, near Fittstown, in the northeast part of the area, is such a spring. Data from a continuous-recording gaging station established on this spring in 1959 indicate that the spring may discharge as much as 40 ft^3/sec.

The relation of discharge from Byrds Mill Spring and the water level in two nearby wells (01N-06E-04 CAD 1, 1 mi southwest of the spring; and 01N-05E-27 DCC 1, 7.5 mi southwest of the spring) that penetrate the Arbuckle–Simpson aquifer is shown in Figure 17. As indicated by the hydrographs in Figure 17, spring discharge varies with the water level in the aquifer. The hydrograph of discharge from Byrds Mill Spring does not include an unmeasured continuous diversion of 6–10 ft^3/sec.

In a study using thermal-infrared images to identify some common rock types (limestone and dolomite) in the Arbuckle Mountains, Rowan and others (1970, p. 3549) found that fault and fracture zones appear cooler (darker) than the surrounding ground. This difference was attributed to a greater water content of the fault and fracture zones and concomitant evaporation of the water. A difference in appearance of lineaments in images taken before dawn and images taken at midday may relate to a combination of spring and vegetation effects; that is, the springs usually are associated with faults and other fractures, and vegetation is usually denser in those areas where springs occur. The study was made during the winter, when evapotranspiration is low and vegetation probably had less effect than it would have had during the summer months.

Base Flow of Streams

Average annual ground-water discharge from the Arbuckle–Simpson aquifer was estimated from base flow separated from the streamflow hydrographs for Blue River near Connerville and Mill Creek near Ravia and miscellaneous low-flow measurements obtained at Pennington Creek, 10 other small streams draining the outcrop area, and spring discharge from Byrds Mill Spring near Fittstown. Table 12 lists the estimates of average annual base flow from each stream obtained by the method of separation described by Olmsted and Hely (1962), which uses monthly low-flow and base-flow recession characteristics of the stream as criteria in defining average monthly base flow. The separation of base flow from the streamflow hydrograph is shown in Figure 7 for Blue River near Connerville for water years 1977, 1978, and 1979. This separation indicates that base flow represents 72% of the average annual discharge at this site, or 60 ft^3/sec for water years 1969–71 and 1977–79.

To obtain an estimate of base flow at the Mill Creek near Mill Creek gage site, a relation of daily discharges between Mill Creek near Ravia and Mill Creek near Mill Creek was defined (Fig. 10), using periodic discharge measurements obtained at Mill Creek near Mill Creek and observed or estimated daily mean discharges at Mill Creek near Ravia during the 1969–71 and 1977–79 water years. Monthly base flow was separated from the hydrograph representing Mill Creek near Ravia for the three years of continuous record (1969–71). These monthly base-flow values were then entered into the relation shown in Figure 10 to obtain an estimate of average annual base flow at the Mill Creek near Mill Creek site for this 3-yr period. A comparison of this average annual base flow with the corresponding estimate of average annual discharge for the Mill Creek near Mill Creek site (Table 12)

TABLE 12.—AVERAGE ANNUAL DISCHARGE AND AVERAGE ANNUAL BASE FLOW OF PRINCIPAL STREAMS DRAINING ARBUCKLE–SIMPSON OUTCROP AREA

Station	Drainage area (mi^2)	Period of record (water years)	Average annual runoff, $\bar{Q}$ (ft^3/sec)	Base flow, Q_b (ft^3/sec)	$Q_b/\bar{Q}S$ (%)
Blue River near Connerville	162	1969–71 1977–79	83	60	72
Mill Creek near Mill Creek	46.4	1969–71 1977–79	15	5	35
Pennington Creek near Reagan	65.7	1969–71 1977–79	56	20	36
Byrds Mill Spring	—	1969–71 1977–79	15	15	100
Buckhorn Creek	1.8	1977–79	—	3*	—
Rock Creek	9.1	1977–79	—	1*	—
Delaware Creek	17.1	1977–79	—	4*	—
Walnut Creek	10.2	1977–79	—	2*	—
Coal Creek	5.8	1977–79	—	1*	—
Goose Creek	2.7	1977–79	—	1*	—
Keel Creek	4.0	1977–79	—	0.5*	—
Buzzard Creek	4.3	1977–79	—	1*	
Sheep Creek	1.3	1977–79	—	3.5*	—
Oil Creek	28.6	1977–79	—	8*	—
Total	359.0			125	

*Approximate median value of low-flow measurements obtained at site during 1977–79.

indicates that base flow represents ~35% of the average annual discharge, or 5 ft^3/sec for the period 1969–71, 1977–79.

Base flow for Pennington Creek near Reagan was estimated from miscellaneous low-flow measurements obtained during 1952–55, 1958–61, 1969–71, and 1976–79. These measurements indicate that the range in base flow is about 15–25 ft^3/sec; thus, an average annual value of 20 ft^3/sec was used for this stream. This base flow represents 36% of the estimated average annual discharge for Pennington Creek near Reagan.

A comparison of the total average annual discharge of 154 ft^3/sec from Blue River, Mill Creek, and Pennington Creek (Table 4) with the total average annual base flow of 85 ft^3/sec from these three streams (Table 12) indicates that ~55% of the total discharge from these three basins is from ground water. Blue River discharges the largest amount of ground water per unit area, 0.37 $(ft^3/sec)/mi^2$, and Mill Creek discharges the smallest amount of ground water per unit area, 0.11 $(ft^3/sec)/mi^2$.

Continuous records of discharge at Byrds Mill Spring near Fittstown indicate an average annual flow of ~15 ft^3/sec, which is essentially all ground-water discharge. This estimate is based on the 6-yr period 1969–71 and 1977–79, which includes an unmeasured diversion estimated to average 8 ft^3/sec throughout the year.

Base flow from each of the 10 small streams draining the outcrop area was estimated as the median of summer and winter low-flow measurements obtained at these sites during the 1977–79 study period (Table 12). Mean annual ground-water discharge from the 10 streams is thus ~25 ft^3/sec from 85 mi^2 of drainage area, or 4.0 in. per unit area.

Average annual ground-water discharge from Blue River, Mill Creek, Pennington Creek, Byrds Mill Spring, and the 10 small streams averages ~125 ft^3/sec from a drainage area of 359 mi^2 (~90,000 acre-ft/yr, or 250 [acre-ft/yr]/mi^2), which includes 90% of the eastern three-fourths of the outcrop area. This discharge represents an average unit amount of 4.7 in./yr, or ~60% of the total annual runoff of 7.6 in./yr from the outcrop area. Also, this discharge probably represents the average annual recharge to the aquifer.

Evapotranspiration

Differences between the summer and winter base-flow recession rates of streams in the area show the consumptive use of water by evapotranspiration (ET). Figure 20 shows composite base-flow recession curves for the summer and winter seasons for Blue River at Milburn and Mill Creek near Ravia. These curves were derived graphically by averaging several recessions selected from the streamflow hydrographs for periods of no precipitation. The steeper slope of the summer recessions reflects the seasonally high rate of evaporation of surface water in the stream and transpiration of ground water by riparian vegetation along the flood plain.

An estimate of the average rate of summer ET from riparian vegetation in the study area was obtained from the average seasonal (winter to summer) depletion in base flow along the 15.2-mi reach of Blue River between the Connerville and Milburn gages. The area between these gages is underlain by granite, with only a thin veneer of soil. Thus, most of the summer consumption of base flow can be attributed to ET. This consumption was determined from the 7-day 2-yr low flows for these two sites listed in Table 6, which approximate the average winter and summer low-flow conditions for Blue River.

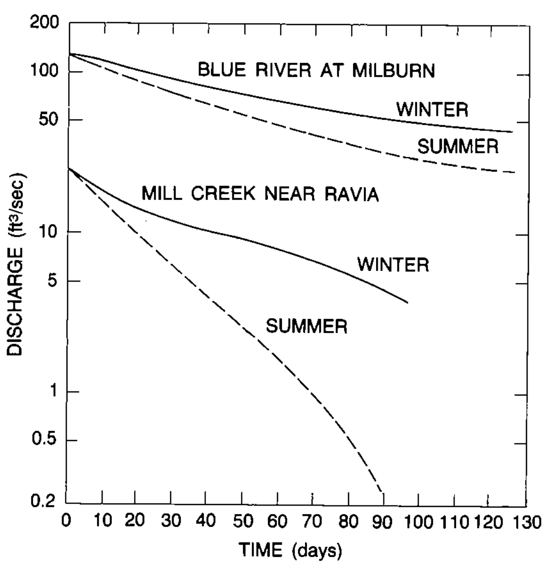

Figure 20. Winter and summer base-flow recession curves for Blue River at Milburn and Mill Creek near Ravia.

These low-flow-frequency values indicate that during the winter (when ET is negligible) the river is a gaining stream, base flow increasing by an average rate of 5 ft^3/sec through the 15.2-mi reach. During the summer (when ET is at a maximum) the river is a losing stream, base flow decreasing by an average of 3 ft^3/sec between the two gage sites. The total summer consumption of base flow by ET is the winter gain of 5 ft^3/sec plus the summer loss of 3 ft^3/sec, or 8 ft^3/sec (480 acre-ft/month). This consumptive use of 8 ft^3/sec is considered a low estimate of the actual rate of summer ET from the flood plain, because the actual gain in base flow through the study reach may be greater than the measured gain of 5 ft^3/sec—i.e., a small increment of winter ET, which was assumed to be negligible in this analysis, may occur during some periods of the winter season. Also, the typically higher ground-water levels in the summer likely discharge ground water into the flood-plain area at a rate higher than the measured rate of 5 ft^3/sec determined from the winter base flow. This depletion probably is a low estimate of the average rate of summer ET from the flood plain between the Connerville and Milburn gages. That is, the actual summer depletion in base flow may be >8 ft^3/sec, owing to ground-water levels typically higher in the summer than in the winter.

The surface area of the flood plain between these two gages, computed from topographic maps, is 1,100 acres. Thus, if the total summer consumption of base flow is 480 acre-ft/month, the average rate of summer ET from open bodies of water and riparian vegetation on the flood plain is 5.2 in./month.

Consumptive-use factors derived by Blaney and Criddle (1962) indicate that, for south-central Oklahoma, ~60% of the annual ET occurs during the 3-month period June–August. Assuming that 5.2 in./month is an average rate of ET for this June–August period, the annual ET is estimated at $3 \times 5.2/0.6 = 26$ in./year.

In two basins in northern Texas, south of the study area, the mean average annual water loss (ET) was determined to be ~30 in. (Williams and others, 1940, p. 52). The area in Texas has climatic and topographic conditions similar to those in the study area.

Variations in ET from similar basins in the same region are caused by such factors as (1) annual rainfall distribution and the volumes and intensities associated with individual storms, (2) sequences of wet and dry years and associated hydrologic and ecologic conditions, and (3) temperature, wind, sunshine, humidity, and other factors. Topography affects ET because it influences land use. In most of the area, the saturated zone is below the effects of ET, except where the potentiometric surface comes close to or intercepts the land surface in the stream valleys. Ground-water ET outside the stream valleys was not determined during this study, but it is thought to be a relatively small part of the total annual ET.

The consumptive-use factors derived by Blaney and Criddle are from empirical data and may explain the difference in yearly ET as determined from base-flow data collected during this study. Also, the estimate of ET from base-flow depletion is considered a conservative estimate, because it does not consider a small component of ET derived from ground water in the depressions and low-elevation fields beyond the stream valleys.

Aquifer Characteristics

The hydraulic characteristics of an aquifer describe its ability to store and transmit water and can be described in terms of the storage coefficient (S) and transmissivity (T). The specific capacity of a well is a measure of the ability of a well to yield water and can be used to give an approximate transmissivity of the aquifer. (All of these terms are defined in Appendix 2.)

Several analytical techniques have been developed to define the hydraulic characteristics of an aquifer. One of the basic assumptions of most techniques is that flow takes place through a homogeneous medium. Rocks of the Arbuckle Group have little or no intergranular porosity; all void space is in the form of joints, fractures, and solution channels. Only the sandstone beds in the Simpson Group may act as a homogeneous unit (granular-type aquifer).

Although the basic assumption of homogeneity is not precisely met for the Arbuckle–Simpson aquifer, some analytical concepts can be considered applicable when used in a regional analysis of the aquifer. The fractures and solution channels are thought to be interconnected through the aquifer, and thus are assumed to approximate a homogeneous aquifer on a regional basis.

Specific-Capacity Tests

No test drilling was conducted during this investigation. Instead, a number of specific-capacity tests and short-term recovery tests were performed on existing wells (Table 13). Included in Table 13 is information from the files of the U.S. Geological Survey from tests on wells in the study area dating back to 1951.

The short-term tests were conducted with a submersible pump rated at 50 gal/min, with a 150-ft lift, and with a gas-powered electric generator. Discharge was regulated by a gate valve, measured in a 57-gal oil drum, and timed with a stopwatch. Water was discharged through a 75-ft flexible plastic hose connected to a leakproof valve. Because the original depth to water in the wells was 50 ft or more below land surface and the tests were of short duration (generally a few hours), return flow can by considered negligible.

Changes in the depth to water were systematically measured to the nearest one-hundredth of a foot.

As indicated in Table 13, the specific capacity of wells ranges from 0.17 to 104 (gal/min)/ft of drawdown. Deep wells have the highest specific capacity because they penetrate more fractures and solution channels than wells that penetrate only the upper part of the aquifer. Information from drillers and land owners suggests that the upper few hundred feet of the Arbuckle Group has a much lower permeability than the lower part. This seems contrary to normal carbonate characteristics (Legrand and Stringfield, 1971), but it may reflect the complex geologic and structural history of the rocks that make up the Arbuckle–Simpson aquifer. In places, wells as deep as 250 ft yield <1 gal/min and have a very slow recovery. Such wells probably were drilled in relatively dense, impermeable rocks and do not penetrate interconnected fractures or solution channels.

Aquifer Tests

As indicated earlier, several short-term aquifer tests were performed on selected existing wells. Estimates of the transmissivity of the aquifer from an analysis of the recovery in water levels following pumping were determined at selected well sites by use of the modified nonequilibrium equation (Ferris and others, 1962, p. 101), in which

$$T = \frac{264Q}{\Delta s'} \qquad (3)$$

where

T = transmissivity (L^2/T);

Q = rate of discharge of well in gallons per minute; and

s' = change in residual drawdown during recovery of the water level, in feet, over one log cycle of time (L).

The method used assumes an ideal aquifer that is homogeneous, isotropic, and of infinite areal extent. It also assumes that the tested well penetrates the entire thickness of the aquifer. Geologic information from previous studies of the area indicates that the Arbuckle–Simpson aquifer does not satisfy these criteria. Therefore, the transmissivity values computed from the tests can be expected to give only a rough estimate of the transmissivity in the tested part of the aquifer and may be equal to or less than the true value obtained from a well that penetrates the entire thickness of the aquifer.

TABLE 13.—SUMMARY OF SPECIFIC CAPACITY OF WELLS AND AQUIFER TESTS OF ARBUCKLE–SIMPSON AQUIFER

Well location	Well depth (ft)	Depth of perforated interval or open hole (ft) top	bottom	Yield (gal/min)	Drawdown (ft)	Duration of test (hr)	Specific capacity ([gal/min]/ft)	Date of test	Transmissivity, T (ft^2/day)	Geologic unit	Remarks
JOHNSTON COUNTY											
02S-05E-08 ABB 1	110	45	105	—	—	24	—	7-6-77	1,740	Simpson Group	Observation well; Rural Water District well no. 1
02S-05E-08 ABB 2	107	75	105	153	34.8	24	4.4	7-6-77	—	Simpson Group	Pumped well; Rural Water District well no. 2
02S-05E-08 ABB 3	167	83	164	—	—	24	—	7-6-77	1,450	Simpson Group	Observation well; Rural Water District well no. 3
MURRAY COUNTY											
01N-04E-21 DDA 1	1,170	—	—	1,700	64	—	27		—	Arbuckle Group	OG&E well no. 1; USGS files
01N-04E-22 DDA 1	780	—	—	2,500	24	24	104		—	Simpson Group	—
				1,000	12	6	83				
				2,000	32	—	62				
01N-03E-26 CCC 1	511	414	511	185	121	6	1.5	8-31-51	—	Simpson Group	Well cased to bottom and perforated
01N-04E-15 BDA 1	133	—	—	53	35.7	1	1.5	12-19-78	125	Simpson Group	Recovery data analyzed
						1.7		12-19-78			
01S-04E-16 CBA 1	122	—	—	16.2	61.8	2	0.26	5-8-79	—	Arbuckle Group	—
01S-01W-35 DCA 1	1,080	—	—	22.4	87.4	2.3	0.26	5-14-79	—	Arbuckle Group	Recovery data analyzed
01S-01W-36 CBC 1	145	—	—	46.2	56.5	1.6	0.82	5-15-79	230	Arbuckle Group	Recovery data analyzed
02S-01E-14 CBD 1	45	—	—	33.2	25.1	2.0	1.3	5-16-79	418	Arbuckle Group	Recovery data analyzed
02S-03E-11 DBB 1	150	—	—	48.8	28.6	2.1	1.7	5-10-79	2,460	Simpson Group	Recovery data analyzed
02S-03E-12 CAA 1	55	40	55	39.6	14.0	0.56	2.8	5-10-79	—	Arbuckle Group	—
02S-03E-13 CCD 1	79	—	—	9.3	55.4	0.74	0.17	5-8-79	—	Simpson Group	Well cased to bottom and perforated; zone of perforations unknown
02S-03E-25 DCD 1	360	25	360	85	49.5	2.0	1.7	12-6-78	—	Arbuckle Group	USGS files
02S-04E-18 BBD 1	88.5	0	88.5	42.2	60.3	2.6	0.70	5-9-79	382	Arbuckle Group	Recovery data analyzed

PONTOTOC COUNTY										
01N-05E-27 DCC 1	2,500	325	2,500	670	19	168	35	2-4-59	—	Arbuckle Group	Well originally 3,262 ft deep; plugged back to 2,500 ft; USGS files
01N-06E-03 CCC 1	700	—	—	1,900	50	240	38	1-18-61	—	Arbuckle Group	USGS files
01N-06E-04 CAD 1	396	122	396	50	0.9	2	56	11-30-78	—	Arbuckle Group	USGS files
	396	122	396	385	5	253	77	1-8-59			
01N-06E-09 ADD 1	1,503	—	—	1,000	80	239	12	1-18-61	—	Arbuckle Group	USGS files
01N-06E-16 AAA 1	1,573	—	—	1,200	85	238	14	1-18-61	—	Arbuckle Group	USGS files
02N-05E-10 DDD 1	2,403	71	2,403	37.1	79	2.05	0.47	5-18-79	40	Simpson and Arbuckle Groups	Recovery data analyzed
02N-05E-22 ADC 1	805	60	850	34.5	33.8	2.0	1.02	5-17-79	—	Arbuckle Group	
02N-05E-25 CCC 1	1,527	250	1,527	555	43	44	13	1-19-59	—	Arbuckle Group	USGS files
	1,527	250	1,527	570	43.5	105	13	1-22-59			
02N-05E-36 AAD 1	2,048	—	—	390	115	120	3.4	3-15-57	—	Arbuckle Group	USGS files

Plots of the recovery of water levels in six wells at various localities in the eastern and western parts of the study area are shown in Figure 21; information about the tested wells and resulting T values computed from equation (3) are listed in Table 13.

Aquifer tests were also performed at three well sites in the northeast part of the area in 1959 (Table 14).

No drawdown occurred in any of the observation wells. Most of the observation wells were <200 ft deep. One observation well used during the test of well 01N-06E-04 CAD 1 was 670 ft deep. This well was also used in the test of well 02N-05E-25 CCC 1, which had two other observation wells, 2,050 and 1,380 ft deep. Recovery of water levels in the pumped wells at two of the sites (wells in secs. 4 and 25) was rapid, and no aquifer characteristics could be determined from the tests. Well 01N-05E-27 DCC 1 had a slower rate of recovery, but the data obtained during the test suggested possible well interference or problems with pre-pumping trends. The results of the test were not accepted.

Estimates of transmissivity were obtained from analysis of an aquifer test of wells in the Simpson Group in Johnston County ~1.5 mi east of the town of Mill Creek (Fig. 22).

Well 02S-05E-08 ABB 2 was pumped, and water levels were measured in observation wells 02S-05E-08 ABB 1 and 02S-05E-08 ABB 3. Information about the pumped well and the two observation wells and the results of the test are shown in Table 13.

Well 02S-05E-08 ABB 2 is 107 ft deep and 8 in. in diameter. Like the observation wells, the pumped well was gravel-packed and the casing was perforated with $\frac{5}{32}$-in. drill holes. None of the wells used in the test fully penetrated the Simpson Group.

Estimates of the transmissivity of the aquifer from analysis of the drawdown in wells 02S-05E-08 ABB 1 and 02S-05E-08 ABB 3 were determined by applying the modified nonequilibrium equation to drawdown data (Ferris and others, 1962, p. 100), in which

$$T = \frac{264Q}{\Delta s} \qquad (4)$$

where

T and Q are as defined in recovery tests; and
Δs is the change in the drawdown, in feet, over one log cycle of time.

The assumptions used to derive equation (4) are the same as those used to derive the equation (3) used in the recovery tests.

Estimates of the storage coefficient of the aquifer were determined from data obtained from the

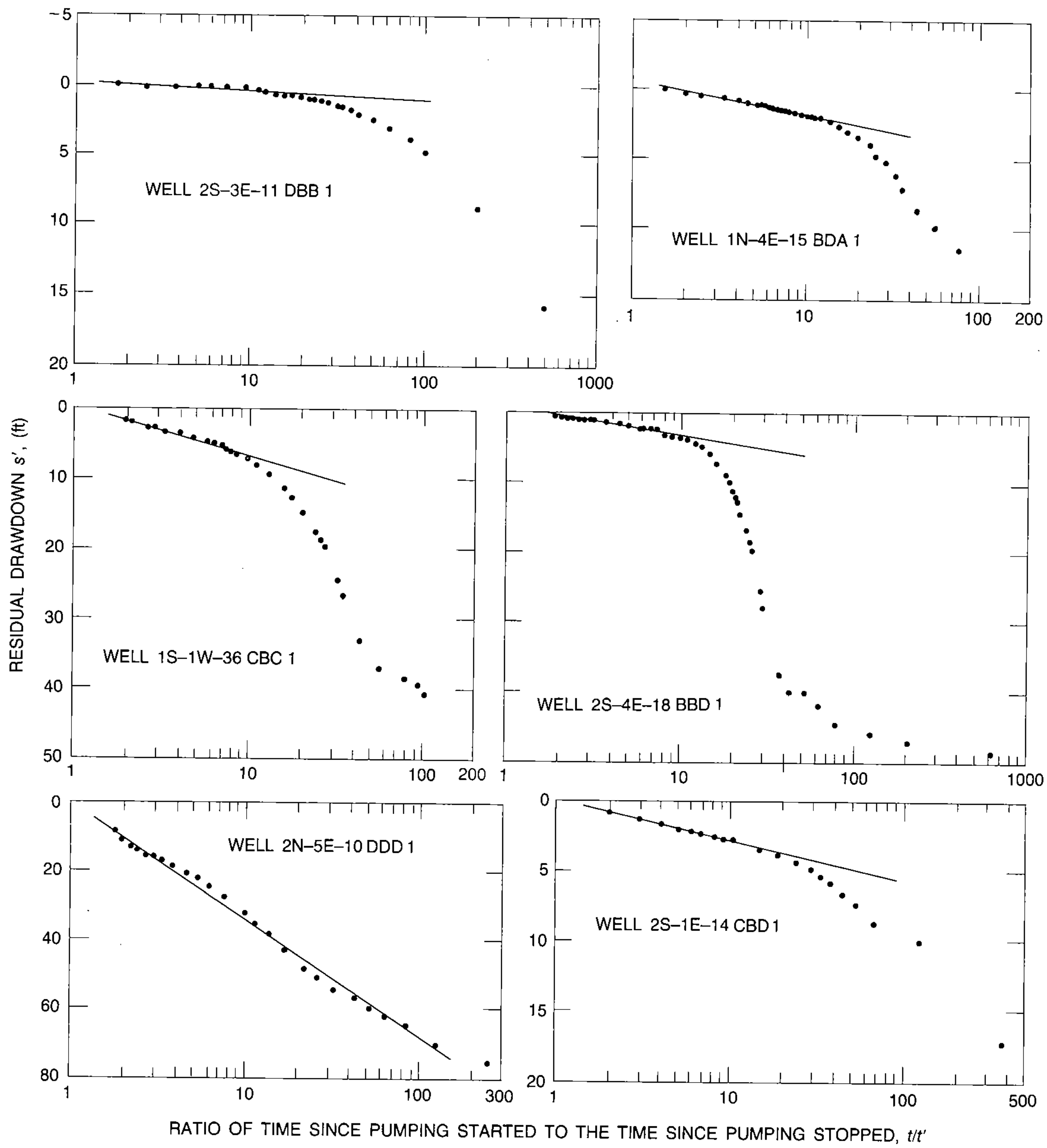

Figure 21. Time-recovery plots of water levels in six selected wells.

same semilog plot of the drawdown data discussed above, and by applying the modified nonequilibrium equation (Ferris and others, 1962, p. 100), in which

$$S = \frac{0.3Tt_0}{r^2} \quad (5)$$

where

T is as previously defined;

S = storage coefficient (dimensionless);

t_0 = the time intercept, in days, where the plotted straight line intersects the zero-drawdown axis; and

r = distance, in feet, from the pumped well (L).

The storage coefficient was 5.0×10^{-5} for well 02S-05E-08 ABB 1, and 3.7×10^{-4} for well 02S-05E-08 ABB 3, suggesting an artesian condition. Variation in the S values can be expected because of lithologic variations in the aquifer at the test site and the slope and placement of the straight line through the drawdown data points.

The transmissivity values obtained from the foregoing recovery and drawdown aquifer tests range from 40 to 2,460 ft²/day (Table 13).

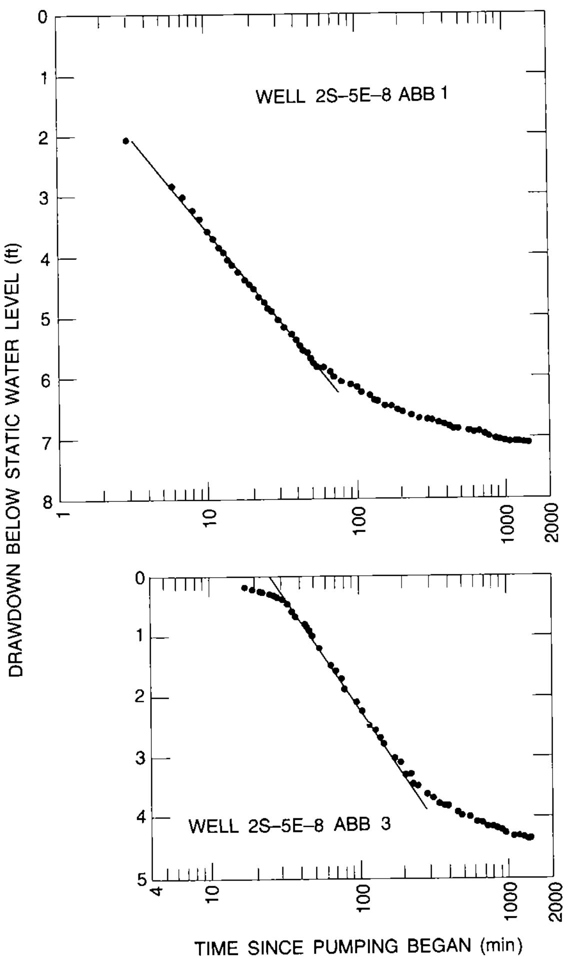

Figure 22. Time-drawdown plots of water levels in two observation wells in the Simpson Group east of the town of Mill Creek.

Determinations from Regional Techniques

Streamflow and ground-water-level hydrographs were also used to determine the aquifer characteristics on a regional basis. The regional methods are valuable in obtaining average values for the aquifer characteristics, because the local anisotropy and heterogeneity of the carbonate aquifer probably tend toward isotropy and homogeneity when analyzed on a regional scale. The regional methods assumed a uniform transmissivity and storage coefficient, and equal distance from the ground-water drainage divide to the discharge point throughout the length of the drainage basin. Recharge to the aquifer is assumed to be uniform and instantaneous. The streamflow gaging station on Blue River near Connerville and continuous ground-water-level recorders at two wells, 01N-05E-27 DCC 1 and 01N-06E-04 CAD 1, were used in this analysis.

The storage coefficient was calculated as the ratio of recharge to the rise of ground-water level. The recharge for the 26–28 March 1977 event has been shown to be 1.4 in. (Table 10), and the corresponding average water-level rise in the two wells was 173.2 in. Therefore, the average storage coefficient for these two sites, as determined from this event, is 0.008. Similar determinations of storage coefficient computed from three other storm events during 1977 and 1978 are shown in Table 15 and indicate a range from 0.006 to 0.011. Differences in the values are due primarily to inaccuracies in the determination of recharge. Recharge is influenced by rainfall duration and intensity.

An estimate of the storage coefficient was also obtained from the seasonal decline in ground-water levels and corresponding ground-water discharge to the stream. Five ground-water wells distributed over the Blue River drainage basin were used to compute the volume of the aquifer dewatered during the seasonal ground-water-level decline. Base flow at the Blue River near Connerville gage site was used to compute the volume of water discharging from the aquifer during the seasonal decline in ground-water levels. Five wells were used to determine the ground-water-level declines occurring during the 8-month season June through January (Table

TABLE 14.—AQUIFER TESTS (1959) AT WELLS IN THE NORTHEASTERN PART OF THE STUDY AREA

Location of pumped well	Well depth (ft)	Number of observation wells	Distances of observation wells from pumped wells (ft)
01N-05E-27 DCC 1	2,500	4	520– 7,000
01N-06E-04 CAD 1	396	9	480– 8,000
02N-05E-25 CCC 1	1,527	11	830–12,000

TABLE 15.—CALCULATED AQUIFER CHARACTERISTICS (USING REGIONAL TECHNIQUES)

Date	Recharge (in.)	Ground-water-level rise (in.) 01N-06E-04 CAD 1	01N-05E-27 DCC 1	Average	Average storage coefficient	Δt (days)	Diffusivity (ft²/day)	Transmissivity (ft²/day)
26–28 March 1977	1.4	113	233	173	0.008	160	1.36×10^6	1.09×10^4
18–21 May 1977	0.48	—	42	42	0.011	150	1.46×10^6	1.16×10^4
23–24 March 1978	0.51	43	115	79	0.006	170	1.28×10^6	1.02×10^4
5–8 June 1978	0.28	—	—	—	—	155	1.41×10^6	—
4–10 June 1978	0.64	70	—	70	0.009	165	1.32×10^6	1.19×10^4

Note: Δt = time required for streamflow hydrograph to decline through one log cycle.

16). The average decline in ground-water levels, calculated from the average water-level changes indicated in Table 16, was 20.5 ft. Considering that the ground-water divide for the Blue River basin defines a drainage area of ~96,000 acres (150 mi²), the total volume of the aquifer dewatered within this area during each 8-month season averaged 1,968,000 acre-ft. The corresponding total volume of ground water discharging from the aquifer as measured by base flow in the stream averaged a total of ~21,100 acre-ft during each of these two 8-month seasons. The ratio of the volume of ground water discharging from the aquifer to the volume of the aquifer dewatered was 0.011. This value defines the specific yield of an aquifer, which under water-table conditions in an unconfined water body is virtually equal to the storage coefficient. The water probably discharges from both confined and unconfined parts of the aquifer.

Methods of estimating the diffusivity of the aquifer, defined as the ratio of transmissivity to storage coefficient (T/S), were determined from streamflow recessions and natural fluctuations of water levels in observation wells. Streamflow data collected at the station on Blue River near Connerville were selected because the basin headwaters lie entirely within the outcrop area of the Arbuckle–Simpson aquifer. Also, the Blue River basin characteristics (geology, topography, and permeability of aquifer rocks) are similar to those of other stream basins in the study area. Thus, diffusivity values determined for the Blue River basin can be considered applicable to the aquifer in other parts of the study area.

Diffusivity was determined from the streamflow hydrograph using a method described by Rorabaugh (1960). In simplified form, the equation is

$$\frac{T}{S} = \frac{0.933\ a^2}{\Delta t} \qquad (6)$$

where

T = transmissivity (L^2/T);
S = storage coefficient (dimensionless);
a = average distance from the stream to the ground-water drainage divide (L); and
Δt = time required for streamflow discharge to decline through one log cycle (T).

The value for a was determined by dividing the area of the ground-water basin by twice the stream length, giving a = 2.9 mi, or ~15,300 ft. The value of Δt, determined from the five streamflow recessions following the storm events listed in Table 10, ranged from 150 days to 170 days and averaged 160 days. Diffusivity for the 26–28 March 1977 storm, calculated from equation (6), is thus 1.36×10^6 ft²/day. Using an

TABLE 16.— MAXIMUM AND MINIMUM GROUND-WATER LEVELS (IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM OF 1929) OF FIVE WELLS AND CORRESPONDING TOTAL GROUND-WATER DISCHARGE FROM THE AQUIFER IN THE BLUE RIVER BASIN FOR TWO RECESSION PERIODS DURING 1977–79

	Period 1		Period 2	
Well location	Maximum elevation (ft) 5-24-77	Minimum elevation (ft) 2-1-78	Maximum elevation (ft) 6-8-78	Minimum elevation (ft) 2-2-79
02N-05E-21 DCD 1	1,110	1,085	1,109	1,083
01N-05E-27 DCC 1	1,106	1,071	1,095*	1,070
01N-06E-29 CAB 1	1,039	1,022	1,038	1,020
01N-06E-24 CAB 1	1,052	1,032	1,053	1,035*
02S-07E-07 AAA 1	908	900	917	903
Average elevation	1,043	1,022	1,042	1,022
Average elevation change	21 ft		20 ft	
Total base-flow discharge	21,065 acre-ft		21,124 acre-ft	

*Estimated

average storage coefficient of 0.008, the corresponding transmissivity was determined to be 1.09×10^4 ft²/day. The results of this and similar calculations for the other four events are listed in Table 15.

Rorabaugh (1960) also described a method of estimating the diffusivity (T/S) from water-level recessions in observation wells. This method is applicable only to conditions where time elapsed after a recharge event is sufficient for the potentiometric-surface profile to become stabilized. The critical time (t) for a potentiometric-surface profile to stabilize can be approximated by

$$t = \frac{0.15\ a^2 S}{T}$$

(Rorabaugh, 1960, p. 315). The potentiometric surface is considered to be stable when water levels decline exponentially with time. After the potentiometric surface has stabilized, an expression for diffusivity is

$$\frac{T}{S} = 0.933\ a^2 \log(h_1/h_2)/(t_2 - t_1) \qquad (7)$$

where

T, S, and a are as previously defined;
h_1 and h_2 = the potentiometric-surface heads at any point in the aquifer (L);
t_1 and t_2 = times following a recharge event (T).

Equation (7) is based on the assumption that the potentiometric surface is horizontal prior to the recharge event, and that the aquifer is finite, with parallel boundaries, and is fully penetrating at the discharge boundary.

Selection of a reasonable value for a first requires that the discharge boundary and the ground-water divide be defined. On the basis of topography and potentiometric contours, the potentiometric surface in the eastern part of the study area has many intermediate divides. However, the western edge of this area defines the "regional" ground-water divide for the aquifer. The discharge boundary was estimated along a line indicated by the location of springs that represent points where the potentiometric surface intercepts the land surface.

To determine diffusivity, water levels (in feet above base level) in five selected wells were plotted on a log scale versus time in days plotted on an arithmetic scale (Fig. 23). Base level represents the altitude of the discharge boundary at a point on a line that passes through the well location and is approximately parallel to the hydraulic gradient.

The resulting diffusivities as computed from equation (7) using the water-level recession at the five selected wells are listed in Table 17. The average diffusivity for these five wells is 2.7×10^6 ft²/day. If the storage coefficient of the aquifer is 0.008, then the transmissivity is 2.2×10^4 ft²/day.

Another estimate of the transmissivity of the aquifer was obtained from an evaluation of the ground-water discharge from Byrds Mill Spring, in the northeast part of the area. The rate of discharge from the spring is dependent on the hydraulic gradient of the ground water up-gradient from the spring outlet and the transmissivity of that part of the aquifer contributing water to the spring. A useful form of Darcy's law can be expressed (Ferris and others, 1962, p. 73) as

$$T = \frac{Q_d}{IL} \tag{8}$$

where

T = transmissivity (L^2/T);
Q_d = discharge in gallons per day;
I = hydraulic gradient in feet per foot; and
L = width, in feet, of the cross section through which the discharge occurs.

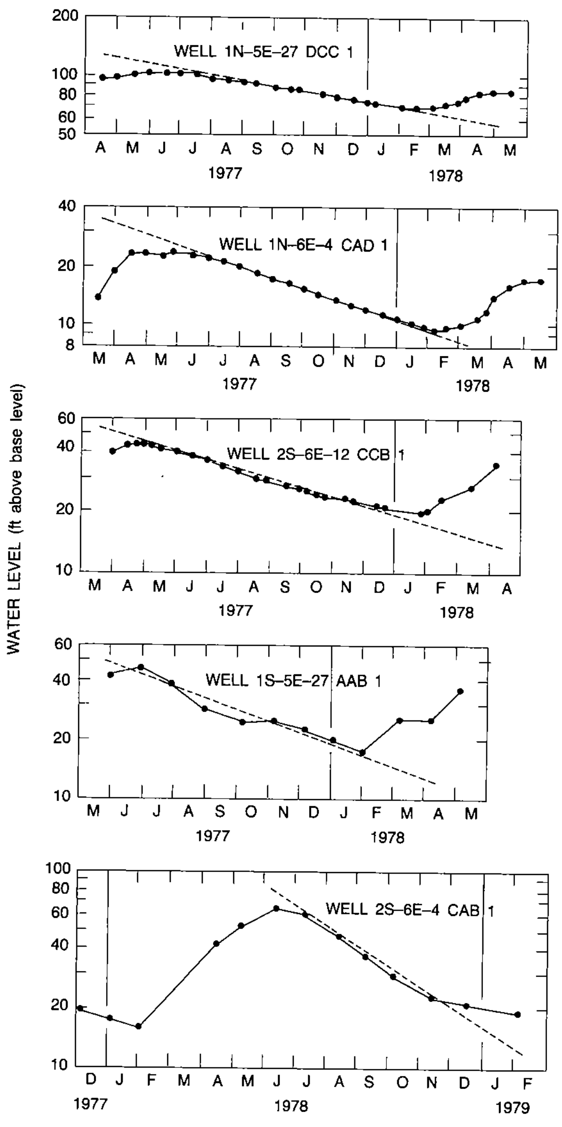

Figure 23. Water-level recessions in five selected wells.

Ground-water-level data used to construct the potentiometric map (Pl. 2) indicate that the hydraulic gradient was ~0.003 ft/ft in the vicinity of the spring during March and April 1977. The width of the aquifer contributing water to the spring is ~2.5 mi (13,200 ft). The rate of discharge from the spring during this period was estimated at 6.1 Mgal/day. Applying this information to equation (8) gives a transmissivity for the aquifer of T = 154,000 (gal/day)/ft, or 20,600 ft^2/day. This is comparable to a determination in 1959 of T, from an unpublished manuscript in the U.S. Geological Survey files, that was estimated at 133,000 (gal/day)/ft, or 17,800 ft^2/day.

Availability of Ground Water

The volume of water stored in the Arbuckle–Simpson aquifer can be computed from the saturated thickness and the storage coefficient. The storage coefficient, as determined from regional techniques, is estimated to be ~0.008.

The average saturated thickness of the Arbuckle–Simpson aquifer is ~3,500 ft in the outcrop area. The volume of water in the aquifer, assuming a storage coefficient of 0.008, is ~9 million acre-ft that is available to wells within the 500 mi^2 of outcrop area. An undetermined amount of fresh water probably exists a short distance downdip in the aquifer; if this water is included, then the total amount of water in storage is much greater.

The long-term trend in water levels in wells 01N-06E-04 CAD 1 and 01N-05E-27 DCC 1 (Fig. 17) indicates that the amount of water in storage averages about the same over the period of record, but varies seasonally and in response to prolonged wet or dry periods. Withdrawal of water from the aquifer by man probably averages <1%/yr of the total volume in storage, and this withdrawal is replenished by recharge.

HYDROLOGIC BUDGET

A generalized hydrologic budget for the study area can be expressed as

$$P = Q + ET,$$

where

P is the average annual precipitation;
Q is the total average annual runoff in the stream, including spring flow; and
ET is the average annual evapotranspiration.

This hydrologic budget assumes that there is no significant change in ground-water storage

TABLE 17.—DIFFUSIVITIES AT FIVE SELECTED WELLS IN THE ARBUCKLE–SIMPSON AQUIFER COMPUTED FROM SELECTED WATER-LEVEL RECESSIONS

Well location	Well depth (ft)	a (ft)	Recession period	Δt (days)	Diffusivity (ft²/day)
01S-05E-27 AAB 1*	267	14,300	May 1977–April 1978	420	0.4×10^6
02S-06E-04 CAB 1	143	32,000	June 1978–Feb. 1979	300	3.2×10^6
01N-05E-27 DCC 1	2,500	84,500	July 1977–Feb. 1978	1,080	6.2×10^6
01N-06E-04 CAD 1**	396	10,600	May 1977–Feb. 1978	555	1.9×10^6
02S-06E-12 CCB 1	75	10,600	May 1977–Jan. 1978	650	1.6×10^6
				Average	2.7×10^6

*Affected by periodic pumping.
**Well originally 1,707 ft deep; obstruction at 396 ft.
Note: a = distance from ground-water divide to discharge boundary; Δt = time interval per log cycle.

from year to year, and no significant pumpage from the aquifer.

Solving this expression for ET, using $P = 38.4$ in. (from Table 2) and $Q = 7.6$ in. (computed as the average runoff from Blue River, Mill Creek, and Pennington Creek in Table 4), gives

$$ET = 38.4 \text{ in.} - 7.6 \text{ in.} = 30.8 \text{ in./yr.}$$

Thus, evapotranspiration from the study area averages ~31 in./yr, or 80% of the average annual precipitation.

The remaining 20% of the average annual precipitation falling on the study area discharges as runoff (Q = 7.6 in.). Runoff can be separated into two parts: direct runoff, which is flow in a stream following a precipitation event, and base flow, which is flow derived from ground-water sources. Table 12 indicates that base flow averages 125 ft³/sec, or 4.7 in./yr, leaving a residual of 2.9 in./yr as direct runoff. Thus, base flow exceeds direct runoff and averages ~12% of the average annual precipitation. Figure 24 shows the proportions of each component in the hydrologic budget and illustrates that the major loss of water from the study area is by evapotranspiration.

A comparison of the above-derived ET = 30.8 in./yr with the previously derived ET = 26 in./yr from a base-flow-depletion analysis supports the assumption that ET derived from base-flow de-

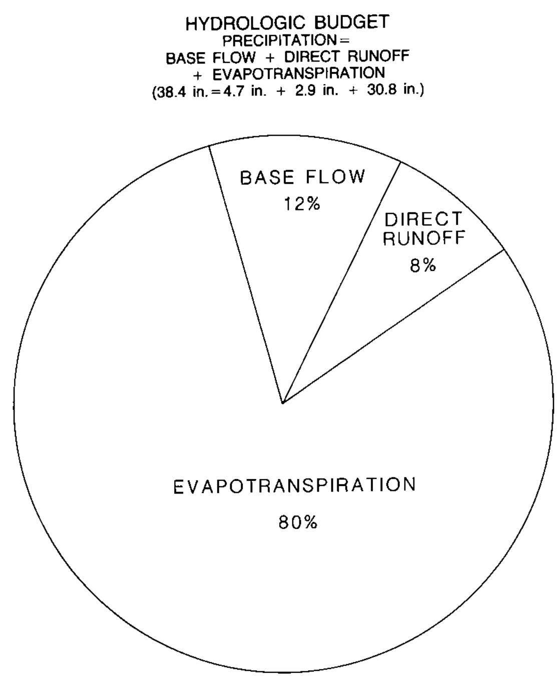

Figure 24. Hydrologic budget of the study area.

pletion does not consider that part of *ET* outside the areas of riparian vegetation. Some of the difference between the two estimates of *ET* also reflects errors in the determination of the components used to derive each *ET* estimate.

WATER QUALITY

Most of the dissolved matter in ground water originates from solution of the rocks through which the water has moved. The amount of dissolved matter in the water depends on the physical and chemical characteristics of the original water and the length of time it is in contact with the rocks. Rainfall contains minor amounts of dissolved gases and some solids from dust.

Temperature, pH, and specific conductance of water from wells, springs, and streams were determined during the field-inventory phase of the study. These field determinations were used as guides in the collection of water samples for laboratory analysis.

Samples of water were collected from wells, springs, and streams and analyzed for comparison of various chemical constituents. Table 18 shows maximum, average, and minimum concentrations of common dissolved chemical constituents of water from these three sources.

The relation between specific conductance and dissolved solids (residue on evaporation at 180°C) in water is shown for wells, springs, and streams in Figures 25, 26, and 27, respectively. The correlation coefficients for these plots of specific conductance versus dissolved solids are 0.96, 0.73, and 0.91, respectively.

Piper diagrams showing the proportions of cations and anions in water from the wells, springs, and streams are shown in Figure 28. The concentration of data points on the left sides of the diagrams indicates that water from all three sources is a calcium magnesium bicarbonate type. The samples were collected when water levels in wells were low and flow in streams was primarily base flow. Magnesium shows the greatest variation in water from all three sources. This variation in magnesium is probably related to the rock type with which the water had been in contact. Dolomite, $CaMg(CO_3)_2$, could be the source of the magnesium. According to Ham (1955, p. 1), the rocks of the Arbuckle Group are mostly limestone, $CaCO_3$, in the west part of the area, but are mostly dolomite in the east and northeast parts of the area.

A few data points plot outside the normal grouping—especially the cations in water from wells. This scatter does not, however, indicate a trend away from the water type indicated by most of the points. One of the wells is outside the outcrop area of the Arbuckle–Simpson aquifer and may yield water from other formations that overlie the aquifer. This well also has a slightly higher chloride concentration than water from other wells. The grouping of all other points in the anion diagrams of water from wells, streams, and springs indicates that the anion concentrations in water from all three sources are similar.

TABLE 18.—MAXIMUM, AVERAGE, AND MINIMUM CONCENTRATIONS OF COMMON DISSOLVED CHEMICAL CONSTITUENTS IN WATER FROM 23 WELLS, 12 SPRINGS, AND 12 STREAMS IN THE STUDY AREA

	Wells			Springs			Streams		
	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum
Calcium	140	91	39	110	83	72	110	68	43
Magnesium	54	27	5.2	41	32	11	40	25	7.7
Hardness as $CaCO_3$	470	338	170	380	336	300	350	275	160
Dissolved solids	554	358	282	441	328	276	379	269	186
Carbon dioxide	55	34	12	77	34	16	22	4.6	1.2
Bicarbonate	460	371	290	440	379	280	370	295	180
Sodium	69	13	1.4	31	5.6	1.9	20	6.5	1.9
Chloride	93	14	1.9	62	9.0	2.3	39	9.3	2.5
Fluoride	0.6	0.2	0.1	0.2	0.1	0.1	0.2	>0.1	0.1
Specific conductance*	875	598	460	790	632	580	600	498	320
Temperature (°C)	25.0	15.5	10.0	22.0	16.5	7.0	33.0	18.3	2.0
pH	7.6	7.3	7.0	7.5	7.3	6.9	8.5	8.2	7.4

*μS/cm at 25°C.
Note: Concentrations in mg/L.

The chemical quality of water from wells that tap the Arbuckle–Simpson aquifer in the study area is suitable for most industrial and municipal uses. Concentrations of most mineral constituents and chemical properties of the water are within the limits recommended or required by the U.S. Environmental Protection Agency (1976). Recommended limits for some of the chemical constituents in public water supply are shown in Table 19.

Water samples from 23 wells in the study area were analyzed for common-ion and trace-element concentrations. All samples were collected at the wellhead and are possibly a composite of water from more than one producing zone.

The concentrations of trace elements in water from wells, springs, and streams are shown in Table 20. Iron exceeded the recommended limit of 0.3 mg/L in a sample from well 02S-03E-09 AAB1 (Fe = 0.550 mg/L), but this would not be a cause for rejection of the ground water in the area as a drinking-water source.

Water from well 01N-05E-27 DCC 1 was sampled at various depths and tested for chemical and physical properties during a well-performance test (Oklahoma Water Resources Board, 1966). A plot of dissolved solids and hardness versus depth at which samples were taken (Fig. 29) indicates that there is little or no change of chemical quality of the water to a depth of at least 2,500 ft. Hardness averages ~270 mg/L, and dissolved solids average ~330 mg/L.

Around the periphery of the outcrop area, beds of the Arbuckle–Simpson aquifer dip steeply beneath younger sedimentary rocks. A short distance outside the outcrop area, information from geophysical logs indicates that water in the aquifer becomes highly mineralized in a downdip direction.

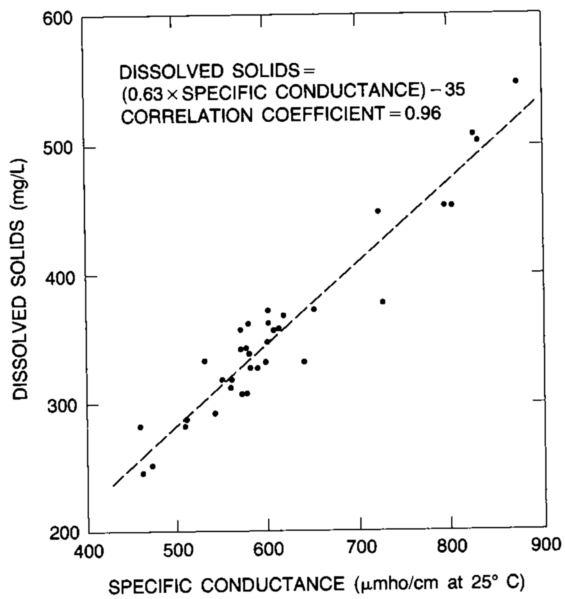

Figure 25. Relation between specific conductance and dissolved solids in water from wells in the study area.

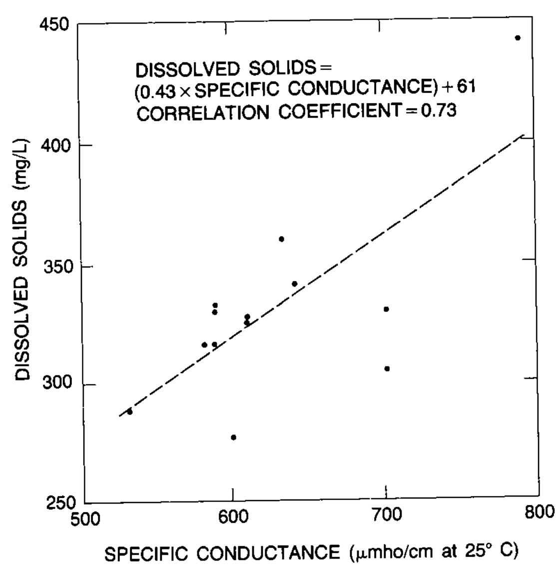

Figure 26. Relation between specific conductance and dissolved solids in water from springs in the study area.

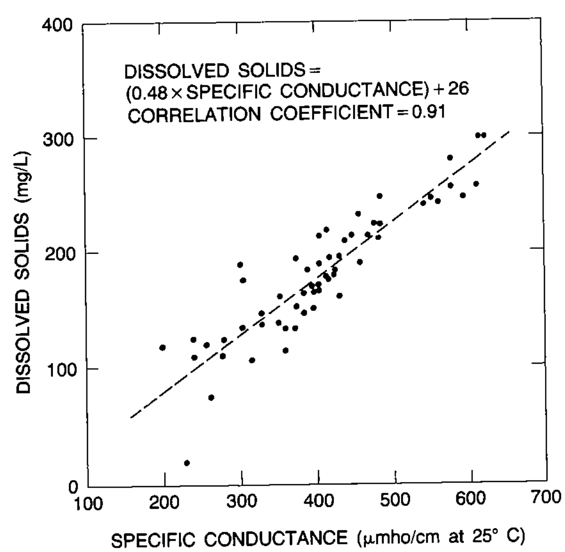

Figure 27. Relation between specific conductance and dissolved solids in water from streams in the study area.

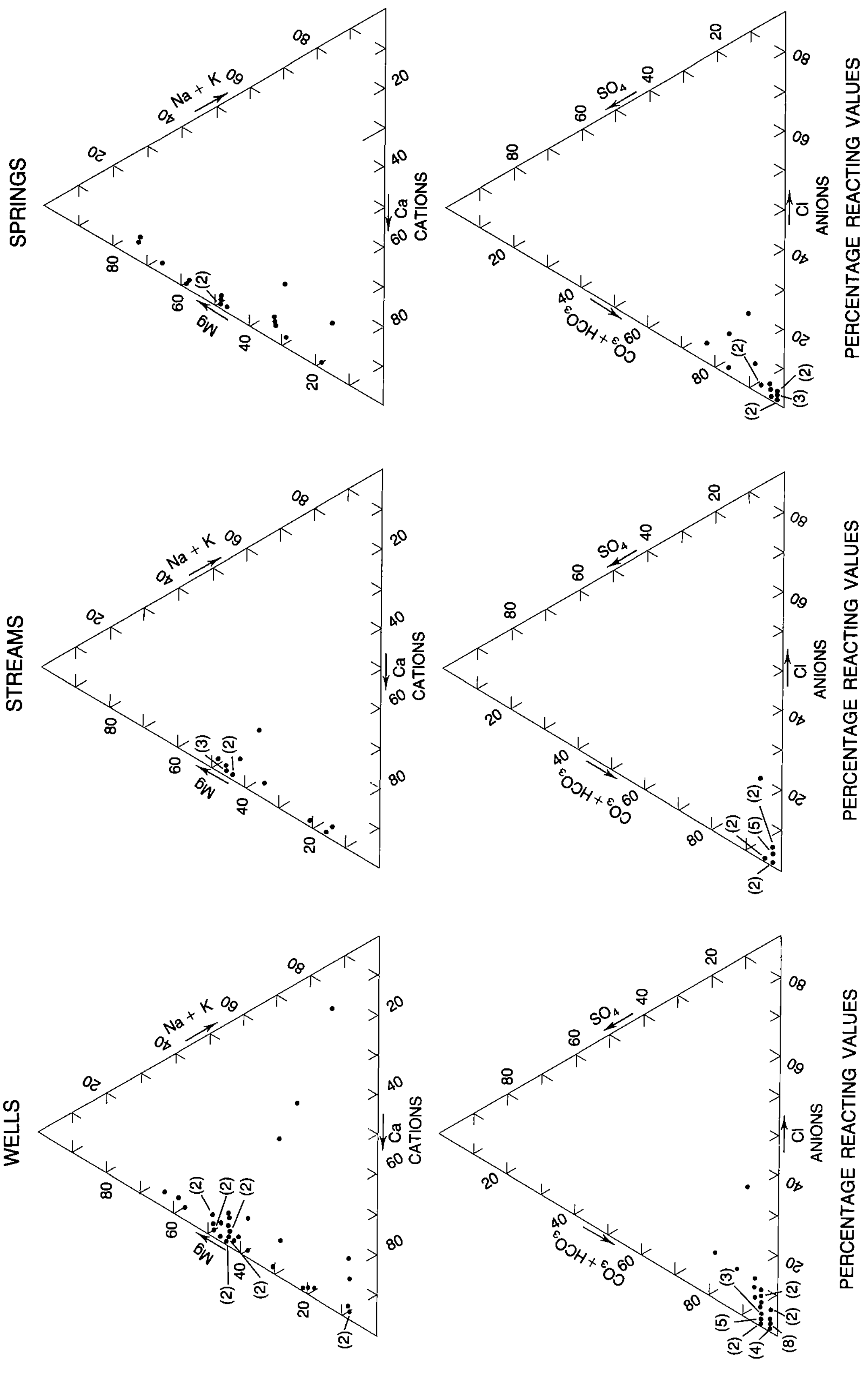

Figure 28. Proportions of cations and anions in water from wells, streams, and springs in the study area.

TABLE 19.—RECOMMENDED OR REQUIRED QUALITY STANDARDS FOR PUBLIC WATER SUPPLIES

Physical or chemical property	Limit not to be exceeded
Color	75 platinum–cobalt units
Odor	Unobjectionable
pH	5.0–9.0
Common ions (mg/L):	
Chloride	250
Fluoride*	1.4–2.4
Sulfate	250
Nitrate (as N)	10**
Trace metals (μg/L):	
Arsenic	0.05**
Cadmium	0.010**
Chromium	0.05**
Copper	1
Iron	0.3
Lead	0.05**
Manganese	0.05
Mercury	0.002**
Zinc	5

*The concentration of fluoride should be between limits expressed, depending on annual average of maximum daily air temperatures at a location being considered.
**Maximum contaminant level as set by U.S. Environmental Protection Agency (1976); primary drinking-water regulations.

Early work by Dott and Ginter (1930) and Case (1934) dealt with the characteristics of waters in Ordovician rocks in a broad area that included the area in this report. Dott and Ginter (1930, p. 1217) found that the concentration of dissolved solids increased rapidly in a downdip direction, at a rate of 10,000 mg/L/mi.

Water from several wells that produce from the Simpson Group contains various amounts of oily residue (asphalt) or gas. Many well owners report that an oily film is visible on the water surface and that the water has an oily taste or odor. Although the water generally is of adequate quality for most domestic purposes, attempts to remove the oil by filtering have had limited success. In a small area ~2 mi south of Sulphur in secs. 14, 15, 22, and 23, T. 1 S., R. 3 E., most wells are no longer used for domestic supplies, and city water from wells that tap the Arbuckle Group is treated and piped to that area.

Water from 12 perennial springs in this area was analyzed for comparison with water from wells that tap the Arbuckle–Simpson aquifer and streams that drain the area. The spring water is chemically similar to water in the Arbuckle–Simpson aquifer. The temperature of water from springs varies slightly with the seasons, averaging ~16.5°C.

The chemical characteristics of water in streams vary seasonally and reflect mineral concentrations lower during rainy seasons than during dry seasons. The base flow of streams in the area is derived from springs discharging from rocks of the Arbuckle–Simpson aquifer. As a result, the quality characteristics of water in streams during low-flow periods is similar to water in springs that discharge from the aquifer.

The maximum, average, and minimum concentrations of some common chemical constituents and physical characteristics of water from streams in the area are listed in Table 18. As shown in the table, the dissolved-solids concentration in stream water is generally less than that in water from wells and springs.

The temperature of water in streams varies seasonally and ranges from 2.0°C to 33.0°C. Streams fed by springs seldom freeze over completely during the winter, although a thin ice sheet may form over the surface of ponded water.

Travertine (calcium carbonate, $CaCO_3$) deposits occur in most stream beds, especially downstream from springs. Precipitation of the travertine suggests that the water is saturated with respect to calcium carbonate and that as water discharges from springs, CO_2 (carbon dioxide) is released and $CaCO_3$ is precipitated on the stream bed materials. Deposition of travertine probably results in a small decrease of dissolved chemical constituents in stream water. This is consistent with the increase in pH observed for the streams.

A prime example of travertine precipitation from stream water is a large deposit in Honey Creek at Turner Falls. Johnson and McCasland (1971) described the deposit and indicated that blue-green algae assist in precipitating the calcium carbonate.

Another large deposit of travertine occurs in Honey Creek about a mile west (upstream) of Turner Falls, on the west side of the East Timbered Hills. The creek flows through a chasm in this deposit, which probably has a depositional history similar to that of the Turner Falls deposit. Several springs are upstream from the Turner Falls deposit. Above the springs, the stream bed material is coated with travertine, although no flow occurs in this reach of the stream during the summer dry season.

WATER USE

Water from the Arbuckle–Simpson aquifer, although used only in small amounts, serves domestic, industrial, commercial, and agricultural purposes. Most of the withdrawn water is used for stock supplies—primarily for dairy and beef

TABLE 20.—MAXIMUM, MEDIAN, AVERAGE, AND MINIMUM CONCENTRATION OF DISSOLVED TRACE ELEMENTS IN WATER FROM 23 WELLS, 12 SPRINGS, AND 12 STREAMS IN THE STUDY AREA

	Trace-element concentration (mg/L)									
	Aluminum (Al)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Manganese (Mg)	Mercury (Hg)	Zinc (Zn)
					Wells					
Maximum	0.070	.001	.003	.022	.025	.350	.030	.010	.000	1.900
Median	.010	.001	0	0	.007	.050	.005	0	.000	.100
Average	.013	.0008	.0003	.0025	.0087	.071	.0086	.0023	.000	.208
Minimum	0	0	0	0	0	0	0	0	.000	0
					Springs					
Maximum	.040	.001	.010	.010	.007	.080	.110	.080	.000	.800
Median	.020	.001	.001	0	.003	.020	.008	.004	.000	.060
Average	.018	.0008	.0018	.0017	.0035	.032	.025	.011	.000	.166
Minimum	0	0	0	0	0	.010	.003	0	.000	.020
					Streams					
Maximum	.020	.001	.001	.010	.006	.650	.170	.020	.000	1.000
Median	.010	.001	0	0	.003	.025	.010	.008	.000	.025
Average	.011	.0008	.0004	.0038	.0027	.078	.025	.0065	.000	.186
Minimum	0	0	0	0	0	.010	0	0	.000	.010

cattle. Irrigation is limited to bottom land and is used mostly to raise hay. Each rural residence has its own water-supply system, and in many cases the water is used for stock supplies.

Water is also supplied to rural areas through distribution lines operated by rural water districts (Oklahoma Water Resources Board, 1980). The water is obtained from wells that tap the Arbuckle–Simpson aquifer, or from the Lake of the Arbuckles, which receives much of its water from springs that issue from Arbuckle and Simpson outcrops.

At the time of this study, only one rural water district in the study area was using water from wells in the Arbuckle–Simpson aquifer (Rural Water District 3, at Mill Creek). Rural Water District 6, at Fittstown, obtains water from Byrds Mill Spring, which issues from the Arbuckle–Simpson aquifer.

Industrial use of the water at the time of this study is limited to cooling water in electric generation and that used in hydraulic mining of glass sand.

Wells that obtain water from the Arbuckle–Simpson aquifer usually are drilled by hydraulic rotary methods. Many of the older wells, drilled with cable tools or hand-dug, are still in use.

The casing of wells depends on the type of penetrated strata. Where wells are drilled into limestone, only 25–50 ft of casing is used, to prevent soil or sand from collapsing or flaking into the well bore; below the casing, the hole is open. Wells drilled into fine sandstone of the Simpson Group often are cased to the bottom of the hole; the casing is perforated and screened through one or more producing intervals to allow water (but not sand) in the well bore. In some cases, the annular space between the walls of the hole and the casing is gravel-packed to increase the yield.

Wells used as a water supply for stock usually are equipped with a windmill. The yield, usually <1 gal/min, is adequate under most conditions. During prolonged drought periods, water levels may decline below the pump piston. In some cases, lowering the pump piston is enough to overcome loss of yield from declining water levels.

Many wells, particularly those used for domestic supply, are equipped with a submersible pump, powered by a 0.5- to 1-hp electric motor. In some cases, a deep-well jet pump is adequate where the water level is 75 ft or less below land surface. A few deep wells used for public supply or irrigation are equipped with turbine pumps.

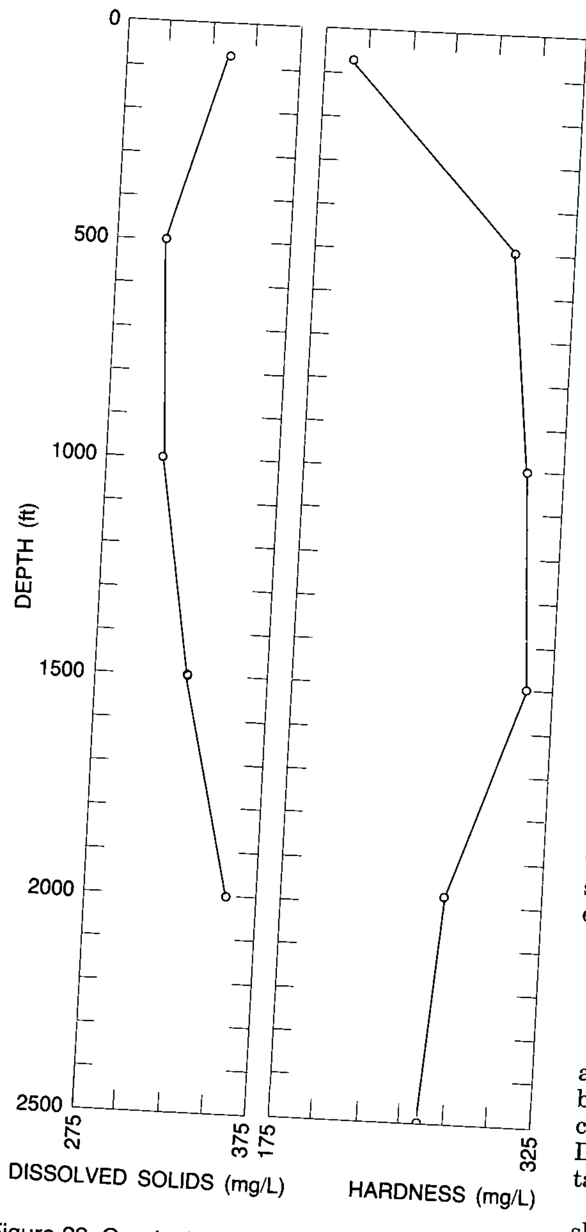

Figure 29. Graph showing dissolved-solids concentration and hardness of water versus depth in well 01N-05E-27 DCC 1.

SUMMARY

Perennial streams in the Arbuckle Mountains area are fed by springs that issue from the Arbuckle–Simpson aquifer. The major streams include Pennington, Mill, Falls, Honey, Oil, and Delaware Creeks, and Blue River and its tributaries.

The Arbuckle–Simpson aquifer crops out over slightly more than 500 mi^2 in the Arbuckle Mountains province in south-central Oklahoma. The Arbuckle and Simpson Groups that make up the aquifer consist of Upper Cambrian to Middle

Ordovician limestone, dolomite, and sandstone. All rocks of the aquifer were structurally deformed during late Paleozoic mountain-building periods and act as a reservoir in which water is stored in numerous interstices—from small intergranular pores to open fractures and caverns.

Secondary permeability is provided by numerous fractures, joints, and solution channels. The average saturated thickness of the aquifer is ~3,500 ft in the outcrop area.

Water in the aquifer is confined in various parts of the outcrop area, while in other parts the water is unconfined. The rapid response of water levels in wells to precipitation indicates that many wells tap a confined part of the aquifer. During the study, water levels were monitored in 33 observation wells to determine long-term trends, seasonal fluctuations, and the relationship between ground water and surface water.

The seasonal fluctuation of water levels is from 53 ft to 8 ft for individual wells, primarily in response to rainfall; the levels are lowest during January and February, and highest during May and June. No long-term trends in the rise or decline in water levels are indicated from the three years of ground-water-level data collected in the study area.

Recharge to the aquifer is from precipitation that falls within the area. Long-term precipitation records from Sulphur and Pontotoc (in the study area) and Ada (about 15 mi north of the area) define an average annual precipitation of 38.2 in./yr. Precipitation was ~80% of the long-term average during the study period. Recharge to the aquifer, based on the total average annual base flow from streams that drain the area, amounts to 4.7 in./yr.

Discharge from the Arbuckle–Simpson aquifer is by evapotranspiration, through springs and seeps, and by pumpage from wells.

Over much of the study area, the depth to the saturated zone is below the effects of evapotranspiration, except where the potentiometric surface comes close to or intercepts the land surface. Almost 100 springs discharge water from the Arbuckle–Simpson aquifer to streams that drain the study area. This discharge occurs as base flow in the streams and amounts to 4.7 in./yr, or ~60% of the total annual runoff from the outcrop area. At the time of this study, withdrawal of water from the aquifer by pumpage, although not determined, accounted for only a minor part of the discharge.

The chemical quality of water from the Arbuckle–Simpson aquifer is suitable for most industrial and municipal uses. The water is hard and of the bicarbonate type; hardness averages 338 mg/L, and dissolved solids average 358 mg/L.

In the central part of the outcrop area, there is little or no change of chemical quality of the water to a depth of at least 2,500 ft. Around the periphery of the outcrop area, beds of the Arbuckle–Simpson aquifer dip steeply beneath younger sedimentary rocks. Water in this region of the aquifer becomes highly mineralized in a downdip direction.

Because springs issue from the aquifer and discharge to streams in the area, the water from springs and streams is similar in water quality to ground water, but the average dissolved-solids concentration in stream water is less than that in water from wells and springs. Precipitation of travertine in the major streams probably results in a decrease of dissolved chemical constituents in the stream water.

Average values of storage coefficient (S) and transmissivity (T) of the Arbuckle–Simpson aquifer were estimated, using several different methods of analysis. These analyses give a rather wide range of values for these two aquifer constants, but values of $S = 0.008$ and $T = 15{,}000$ ft^2/day are considered to be representative estimates for this predominantly carbonate aquifer.

The volume of water in the aquifer is 9 million acre-ft in the 500 mi^2 outcrop area, but the total amount of water in storage is probably greater, because an undetermined amount of fresh water is believed to exist a short distance downdip in the aquifer.

Evapotranspiration from the study area averages about 31 in./yr or 80% of the average annual precipitation. The remaining 20% of precipitation discharges from the area as surface runoff and includes 4.7 in./yr as base flow and 2.9 in./yr as direct runoff. Base flow, which represents primarily ground-water discharge from the Arbuckle–Simpson outcrop area, averages ~12% of the average annual precipitation.

SUMMARY OF INFORMATION REQUIRED TO MEET OKLAHOMA GROUND-WATER LAW

This section of the report is included as agreed upon by the U.S. Geological Survey, the Oklahoma Geological Survey, and the Oklahoma Water Resources Board. The information is provided in order for the Oklahoma Water Resources Board to meet the requirements of Oklahoma State Law (82 Oklahoma Statutes, Supp. 1973, paragraph 1020.1 et seq.). This law requires that the Oklahoma Water Resources Board make a determination of the maximum annual yield of each ground-water basin for a minimum 20-yr life based on the following:

1) The total land area overlying the basin or subbasin;

2) The amount of water in storage in the basin or subbasin;

3) The rate of natural recharge to the basin or subbasin and total discharge from the basin or subbasin;

4) Transmissivity of the basin or subbasin; and

5) The possibility of pollution of the basin or subbasin from natural sources.

According to determinations made by the Oklahoma Water Resources Board, the total amount of ground water established under prior rights is 5,984 acre-ft/yr, and the total amount of land covered by prior rights is 624 acres.

Based upon this study, the following information is provided to assist the Oklahoma Water Resources Board to meet the requirements of Oklahoma ground-water law:

1) The total land area overlying that part of the basin in this study is 326,400 acres. "Ground-water basin" by Oklahoma law means a distinct underground body of water overlain by contiguous land and having substantially the same geologic and hydrologic characteristics and yield capacities. As used in this report, "basin" refers to the area where rocks that make up the aquifer are exposed at the surface.

2) The amount of water in storage in the basin and available for use was estimated at 9 million acre-ft as of 30 September 1979.

3) The rate of natural recharge to the basin is estimated at 128,000 acre-ft/yr. Total discharge from the basin is estimated at 128,000 acre-ft/yr; discharge from wells accounts for $<2\%$ of this amount. If the hydrologic system remained completely static except for recharge, and if all the water available from storage could be removed over the 20-yr life of the basin, then the amount that could be withdrawn from the aquifer is estimated at 1.8 acre-ft/acre/yr.

4) The transmissivity of the basin ranged from 40 to 49,600 ft^2/day, and averaged an estimated 15,000 ft^2/day.

5) No known source of natural pollutants has been identified as of 30 September 1979. Owing to the existence of sinkholes and solution cavities, the possibility of pollution exists—either from natural sources or from man's activities.

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Appendixes

APPENDIX 1: Conversion Factors

Inch–pound unit	Multiply by	To obtain metric units
in. (inch)	25.4	millimeters
ft (foot)	0.3048	meter
ft^2 (square foot)	0.0929	square meter
mi (mile)	1.609	kilometers
mi^2 (square mile)	2.590	square kilometers
gal/min (gallons per minute)	0.0631	liters per second
Mgal/day (million gallons per day)	0.04381	cubic meters per second
acre-ft (acre-foot)	1,233	cubic meters
ft^3/sec (cubic feet per second)	0.0283	cubic meters per second
(gal/min)/ft (gallons per minute per foot)	0.207	liters per second per meter

The conversion from temperature in degrees Fahrenheit (°F) to temperature in degrees Celsius (°C) is expressed by $°C = (5/9)(°F - 32)$.

APPENDIX 2: Glossary of Technical Terms

The following definitions are from Langbein and Iseri (1960), Lohman (1972), Lohman and others (1972), and Meinzer (1923).

Aquifer—A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Base flow—The discharge entering stream channels from ground water.

Confined ground water—Ground water under pressure significantly greater than atmospheric; its upper limit is the bottom of a bed of distinctly lesser hydraulic conductivity than that of the material in which the confined water occurs.

Diffusivity, hydraulic, $T/S(L^2T^{-1})$—The conductivity of the saturated medium when the unit volume of water moving is that involved in changing the head a unit amount in a unit volume of medium.

Evapotranspiration, ET(L)—Water withdrawn from a land area by evaporation from water surfaces and moist soil and by plant transpiration.

Flow-duration curve—A cumulative frequency curve that shows the percent of time during which specified discharges were equaled or exceeded in a given period.

Gaining stream—A stream or reach of a stream for which flow is being increased by inflow of ground water.

Ground-water divide—An imaginary line on a water table on each side of which the water table slopes downward in a direction away from the line.

Homogeneity—The condition of having properties identical everywhere in space; although no known aquifer is homogeneous in detail, models based upon the assumption of homogeneity have been shown empirically to be valuable tools for predicting the approximate relationship between discharge and potential in many aquifers.

Hydraulic gradient (dimensionless)—The change of static head per unit of distance in a given direction; if not specified, the direction generally is understood to be that of the maximum rate of decrease in head.

Intrinsic permeability, $k(L^2)$—A measure of the relative ease with which a porous medium can transmit a liquid under a potential gradient.

Isotropy—That condition in which all significant properties are independent of direction; although no aquifers are isotropic in detail, models based upon the assumption of isotropy have been shown to be valuable tools for predicting the approximate relationship between discharge and potential in many aquifers.

Losing stream—A stream or reach of a stream that is losing water to the ground.

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; formerly called "Mean Sea Level."

Phreatophyte—A plant that obtains its water supply from the zone of saturation or through the capillary fringe and is characterized by a deep root system.

Porosity, n (dimensionless)—The property of a rock or soil containing interstices or voids; may be expressed quantitatively as the ratio of the volume of interstices to total volume.

Potentiometric surface—A surface that represents the static head; as related to an aquifer, it is a surface defined by the levels to which water will rise in tightly cased wells; the water table is a particular potentiometric surface.

Recurrence interval, RI(T)—As applied to streamflow, the average interval of time within which a flood of a given magnitude will be equaled or exceeded once.

Riparian vegetation—Plants that grow in the flood plain of a stream or along its banks.

Secondary porosity—Porosity developed after the formation of a deposit (rock or soil) that results from subsequent fracturing, replacement, solution, or weathering.

Specific capacity (L^2T^{-1})—The rate of discharge of water from a well divided by the drawdown of water level within the well.

Specific yield, Sy (dimensionless)—The ratio of (1) the volume of water which the rock or soil, after being saturated, will yield by gravity to (2) the volume of the rock or soil; the definition implies that gravity drainage is complete.

Storage coefficient, S (dimensionless)—The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

Transmissivity, $T(L^2T^{-1})$—The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient.

Water table—That surface in an unconfined water body at which the pressure is atmospheric; it is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water; in wells that penetrate to greater depths, the water level will stand above or below the water table if an upward or downward component of ground-water flow exists.

APPENDIX 3: Records of Wells

[Depth: in feet below land surface. Principal aquifer: 322VNSS, Vanoss Formation; 364SMPS, Simpson Group; 367 ABCKU, upper Arbuckle Group; 371ABCKL, lower Arbuckle Group; 317TMBH, Timbered Hills Group. Use of water: H, domestic; C, commercial; I, irrigation; P, public supply; S, stock supply; U, unused. Water level: in feet above (+) or below land surface; D, dry; F, flowing. Lift type: J, jet pump; P, piston; S, submergible; T, turbine; U, unknown. Date completed: date well drilled.]

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Carter County									
02S-01E-22 CCD 1	104	—	364SMPS	H	1100	40.0	—	T	—
02S-01E-22 CDA 1	82.0	5.00	364SMPS	H	1110	54.8	02-22-78	J	—
02S-01E-22 DCC 1	72.0	5.00	364SMPS	H	1130	31.5	02-22-78	S	—
02S-01W-24 CDA 1	145	6.00	364SMPS	S	1090	40.4	02-23-78	P	01-01-56
Coal County									
01S-08E-32 CCA 1	400	6.00	364SMPS	U	770	—	03-09-77	-	—
01S-08E-32 CCA 2	600	6.00	364SMPS	U	770	—	—	-	—
01S-08E-32 CCA 3	600	6.00	364SMPS	U	770	—	—	-	—
01S-08E-32 CCA 4	600	6.00	364SMPS	U	770	—	03-09-77	-	—
Johnston County									
01S-04E-02 AAB 1	185	7.00	367ABCKU	S	1210	131	01-18-77	P	—
01S-04E-03 AAC 1	203	8.00	367ABCKU	H	1240.00	60.0	03-01-61	U	- -50
01S-04E-03 AAD 1	230	6.00	367ABCKU	H	1245	170	01-19-77	S	—
01S-04E-11 DCC 1	148	5.00	367ABCKU	U	1190	97.9	01-18-77	-	—
01S-04E-11 DDD 1	130	6.00	367ABCKU	U	1185.00	62.0	03-01-61	-	—
01S-04E-12 ADA 1	110	5.00	367ABCKU	S	1135	48.0	01-25-77	J	—
01S-04E-12 BBB 1	—	7.00	367ABCKU	S	1170	110	01-18-77	P	08- -39
01S-04E-13 ABB 1	235	6.00	364SMPS	H	1165	115	01-18-77	S	- -55
01S-04E-13 BBC 1	44.0	6.00	367ABCKU	U	1185.00	16.0	03-01-61	-	- -40
01S-04E-13 CAA 1	75.0	6.00	364SMPS	H	1200	51.3	06-02-77	J	—
01S-04E-15 ABB 1	100	6.00	364SMPS	U	1150	70.0	02-08-77	-	—
01S-04E-22 BAA 1	30.0	6.00	364SMPS	U	1098.00	26.0	03-01-61	-	—
01S-04E-22 CDC 1	135	6.00	367ABCKU	H	1095	47.2	02-08-77	S	—
01S-04E-23 ABA 1	35.0	18.0	364SMPS	U	1110.00	21.0	03-01-61	-	—
01S-04E-24 BBB 1	119	5.00	364SMPS	U	1135	27.9	02-04-77	-	—

01S-04E-25 ADD 1	86.0	7.00	367ABCKU	S	1095	61.7	01-27-77	P	—
01S-04E-25 CDD 1	185	6.00	367ABCKU	U	1130	72.8	04-27-77	P	—
01S-04E-35 CDD 1	83.0	6.00	367ABCKU	U	1095	19.1	02-04-77	-	—
01S-05E-02 CAC 1	173	6.00	367ABCKU	S	1180	129	01-20-77	P	08- -35
01S-05E-03 DBD 1	230	7.00	367ABCKU	S	1220	122	01-21-77	P	—
01S-05E-06 BDA 1	190	6.00	367ABCKU	S	1190	113	01-20-77	P	—
01S-05E-08 BDD 1	104	6.00	364SMPS	U	1120	39.3	01-25-77	P	—
01S-05E-08 CCC 1	147	5.00	367ABCKU	S	1024.00	20.0	03-01-61	P	- -36
01S-05E-09 ABB 1	176	7.00	367ABCKU	S	1190	116	01-21-77	P	—
01S-05E-12 BBA 1	170	7.00	367ABCKU	S	1160	119	01-20-77	P	- -38
01S-05E-12 CCC 1	160	6.00	367ABCKU	S	1140	114	01-20-77	P	08-10-36
01S-05E-15 BCC 1	129	6.00	367ABCKU	S	1100	52.0	01-21-77	P	—
01S-05E-16 DBA 1	200	—	367ABCKU	S	1120	—	—	P	—
01S-05E-17 DDC 1	202	6.00	364SMPS	H	1105	22.0	04-29-77	S	—
01S-05E-18 AAC 1	106	7.00	367ABCKU	H	1110	11.3	04-29-77	J	01- -40
01S-05E-19 ACC 1	155	6.00	364SMPS	S	1185	75.4	02-03-77	P	—
01S-05E-20 DAA 1	80.0	5.00	364SMPS	U	1105	48.7	04-27-77	-	—
01S-05E-23 ADB 1	171	5.00	367ABCKU	-	1090	30.5	05-24-77	P	—
01S-05E-26 CDD 1	114	8.00	367ABCKU	H	1060.00	75.0	10-01-68	P	- -38
01S-05E-27 AAB 1	267	6.00	367ABCKU	H	1105	55.8	05-24-77	S	—
01S-05E-27 DBA 1	113	6.00	367ABCKU	S	1095	71.5	02-02-77	P	—
01S-05E-28 CCA 1	80.0	—	367ABCKU	S	1090	61.9	02-03-77	P	—
01S-05E-29 CCC 1	165	5.00	367ABCKU	H	1085.00	91.0	10-01-68	P	- -53
01S-05E-31 CBC 1	—	6.00	367ABCKU	U	1060	27.4	02-03-77	P	—
01S-05E-32 BBD 1	203	7.00	367ABCKU	H	1145	113	02-03-77	S	—
01S-05E-32 CAA 1	212	6.00	367ABCKU	S	1155	123	02-03-77	P	—
01S-05E-33 ACC 1	95.0	5.00	367ABCKU	S	1100	88.2	02-03-77	P	—
01S-05E-35 ACA 1	110	6.00	367ABCKU	S	1090	64.1	02-02-77	P	—
01S-05E-36 CCC 1	93.0	6.00	367ABCKU	U	1065.00	67.5	12-09-76	-	—
01S-06E-01 AAB 1	80.0	6.00	364SMPS	H	1065	18.4	01-25-77	S	—
01S-06E-01 DCD 1	60.0	—	364SMPS	-	1030.00	30.0	—	-	—
01S-06E-02 CCA 1	121	6.00	367ABCKU	S	1060	46.0	11-03-76	P	—
01S-06E-04 BCD 1	105	6.00	367ABCKU	S	1075	47.2	11-03-76	P	—
01S-06E-05 CCC 1	123	6.00	367ABCKU	S	1105	72.8	11-03-76	P	—
01S-06E-07 DCD 1	115	6.00	367ABCKU	S	1092.00	63.1	11-03-77	P	—
01S-06E-10 ACA 1	125	6.00	367ABCKU	S	1120	96.2	11-03-76	P	—
01S-06E-12 BAD 2	300	6.00	367ABCKU	H	1010.00	3.04	02-07-77	J	—
01S-06E-12 CCA 1	66.0	6.00	367ABCKU	H	1040	26.9	01-07-77	J	—
01S-06E-13 AAA 1	97.0	6.00	364SMPS	H	990	13.7	02-09-77	S	—
01S-06E-13 CAD 1	30.0	24.0	367ABCKU	U	1020	21.7	01-07-77	J	—

Appendix 3.—*Records of wells*—Continued

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Johnston County—Continued									
01S-06E-13 DDC 1	72.0	6.00	367ABCKU	H	980	9.08	02-09-77	S	—
01S-06E-14 BAA 1	150	8.00	367ABCKU	S	1075.00	51.0	10-01-68	P	—
01S-06E-14 DAB 1	285	6.00	367ABCKU	H	1050	24.4	01-07-77	S	—
01S-06E-18 CDD 1	119	6.00	367ABCKU	S	1085	68.8	11-03-76	P	—
01S-06E-19 CAA 1	90.0	6.00	367ABCKU	H	1090	74.1	11-17-76	S	—
01S-06E-20 BCA 1	138	6.00	367ABCKU	H	1130	112	11-17-76	B	—
01S-06E-23 ADA 1	29.0	8.00	367ABCKU	C	985	9.83	01-09-77	J	—
01S-06E-24 ADD 1	275	6.00	364SMPS	H	980	20.8	02-08-77	S	—
01S-06E-25 CBB 1	146	6.00	367ABCKU	U	1000	18.5	01-06-77	J	—
01S-06E-26 AB 1	100	—	367ABCKU	-	1010.00	4.00	—	-	—
01S-06E-28 CBC 1	177	6.00	367ABCKU	S	1080	88.6	11-04-77	P	—
01S-06E-30 DDC 1	50.0	6.00	367ABCKU	H	1080	22.5	11-17-76	B	—
01S-06E-30 DDC 1	67.0	6.00	367ABCKU	H	1080	57.4	11-17-76	S	—
01S-06E-32 DAA 1	149	—	367ABCKU	U	1045.00	92.1	11-04-76	-	—
01S-06E-33 DBD 1	229	6.00	367ABCKU	H	1060	196	11-04-76	S	—
01S-06E-35 BDB 1	78.0	6.00	367ABCKU	S	990	4.59	11-04-76	P	—
01S-06E-36 AAC 1	127	6.00	364SMPS	H	955	8.84	02-03-77	S	—
01S-06E-36 BBB 1	104	6.00	367ABCKU	H	1010	9.65	01-06-77	J	—
01S-07E-02 CBB 1	130	6.00	364SMPS	S	1080	98.0	02-09-77	P	—
01S-07E-06 BBB 1	53.0	—	364SMPS	U	1060	12.3	01-25-77	-	—
01S-07E-07 ADD 1	225	6.00	364SMPS	H	1030	23.4	02-09-77	S	—
01S-07E-07 ADD 1	44.0	5.00	364SMPS	H	1060.00	18.0	10-01-68	B	- -44
01S-07E-07 BDC 1	16.0	—	364SMPS	U	1025	12.0	02-09-77	P	—
01S-07E-08 BAA 1	200	6.00	364SMPS	S	1120	20.2	02-09-77	P	—
01S-07E-08 DAD 1	101	6.00	364SMPS	H	1070	27.3	02-09-77	S	—
01S-07E-10 ACD 1	263	8.00	364SMPS	S	1010.00	76.9	02-09-77	P	—
01S-07E-13 DBB 1	250	5.00	364SMPS	S	1000	66.6	02-10-77	P	—
01S-07E-14 CCC 1	37.0	6.00	364SMPS	U	970	22.9	02-10-77	B	—
01S-07E-17 AAD 1	130	7.00	364SMPS	S	1080	63.9	02-09-77	P	—
01S-07E-17 BCD 1	92.0	8.00	364SMPS	H	1060	28.4	02-09-77	P	—

01S-07E-18 BCA 1	90.0	6.00	364SMPS	H	1000	16.6	03-09-77	S	—
01S-07E-18 CCA 1	75.0	6.00	364SMPS	H	1040	38.8	03-07-77	S	—
01S-07E-19 AAA 1	72.0	6.00	364SMPS	H	1005	15.8	03-09-77	S	—
01S-07E-19 AAD 1	60.0	6.00	364SMPS	H	1010	11.5	02-08-77	S	—
01S-07E-19 CDB 1	95.0	6.00	364SMPS	H	965	10.9	02-07-77	S	—
01S-07E-19 DDD 1	31.0	36.0	364SMPS	H	970.00	12.0	10-01-68	-	—
01S-07E-20 BAC 1	90.0	6.00	364SMPS	H	1025	15.1	02-08-77	S	—
01S-07E-20 CDA 1	6.0	6.00	364SMPS	H	980	.00	—	C	—
01S-07E-21 BAD 1	27.0	6.00	364SMPS	U	980	11.6	02-01-77	-	—
01S-07E-21 CCA 1	133	6.00	364SMPS	U	1020	39.9	02-03-77	J	—
01S-07E-22 ABA 1	36.0	—	364SMPS	U	875	10.8	02-03-77	-	—
01S-07E-22 CDA 1	51.0	6.00	364SMPS	H	870	21.2	02-03-77	S	—
01S-07E-23 BCC 1	1400	12.0	364SMPS	S	865	—	02-01-77	-	—
01S-07E-23 DDD 1	140	6.00	364SMPS	H	985	47.2	02-04-77	S	—
01S-07E-24 CCC 1	150	6.00	364SMPS	H	925.00	90.0	10-01-68	S	—
01S-07E-25 CBC 1	287	5.00	364SMPS	S	955	52.4	02-04-77	P	—
01S-07E-28 AAB 1	85.0	6.00	364SMPS	H	875	10.8	02-01-77	J	—
01S-07E-29 CAA 1	25.0	6.00	364SMPS	U	970	8.88	02-08-77	B	—
01S-07E-30 ADA 1	147	6.00	364SMPS	H	960	17.9	02-01-77	J	—
01S-07E-30 CAB 1	100	6.00	364SMPS	H	980	21.2	02-09-77	S	—
01S-07E-30 CCD 1	125	—	364SMPS	H	955	25.0	—	-	—
01S-07E-31 BDA 1	29.0	—	364SMPS	U	990	16.1	02-02-77	-	—
01S-07E-31 CCB 1	42.0	6.00	364SMPS	U	990	19.4	11-18-76	S	—
01S-07E-31 DAA 1	19.0	—	364SMPS	U	950	10.3	02-02-77	-	—
01S-07E-32 AAB 1	26.0	6.00	364SMPS	H	1005	20.8	02-08-77	S	—
01S-07E-32 CCB 1	72.0	6.00	364SMPS	H	935	14.9	11-18-76	S	—
01S-07E-32 DDA 1	—	6.00	364SMPS	H	944	38.2	02-02-77	S	—
01S-07E-33 BBC 1	100	—	364SMPS	H	1010	38.3	02-08-77	-	—
01S-07E-34 ABA 1	175	6.00	364SMPS	H	815	17.7	02-04-77	S	—
01S-07E-34 ABC 1	90.0	6.00	364SMPS	H	795	—	02-04-77	C	—
02S-04E-23 CAB 1	17.0	—	371ABCKL	H	1025	3.24	03-15-77	J	—
02S-04E-26 BBC 1	125	7.00	371ABCKL	S	1090	16.7	03-14-77	J	—
02S-04E-26 CBA 1	—	—	371ABCKL	U	1095	29.3	02-07-77	-	—
02S-04E-26 CBD 1	20.0	42.0	367ABCKU	H	1074.00	10.0	10-01-68	J	- -36
02S-04E-26 CCB 1	30.0	6.00	371ABCKL	H	1050	8.23	03-14-77	J	—
02S-04E-35 CBC 1	37.0	6.00	367ABCKU	S	1025	5.05	03-14-77	J	—
02S-05E-01 BCB 1	270	6.00	367ABCKU	H	1055	46.6	12-09-76	S	—
02S-05E-01 BCD 1	65.0	6.00	367ABCKU	H	1040	33.8	12-09-76	S	—
02S-05E-01 DDC 1	58.0	7.00	367ABCKU	H	1035	12.4	12-09-76	J	—
02S-05E-03 ACA 1	140	6.00	367ABCKU	H	1110	95.7	03-25-77	P	—

Appendix 3.—*Records of wells*—Continued

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Johnston County—Continued									
02S-05E-03 CBC 1	180	6.00	367ABCKU	S	1130	100	01-31-77	P	—
02S-05E-06 B 1	110	—	364SMPS	H	—	50.0	—	-	—
02S-05E-06 CD 1	250	7.00	364SMPS	P	1050.00	33.0	12-01-63	S	- -63
02S-05E-08 ABB 1	110	8.60	364SMPS	P	1010	14.2	01-17-77	-	08-31-74
		11.0	—					-	—
02S-05E-08 ABB 2	107	8.00	364SMPS	P	1010	21.1	01-17-77	-	11-05-76
		14.0	—					-	—
02S-05E-08 ABB 3	167	8.00	364SMPS	P	1010	16.8	01-17-77	-	11-15-76
		14.0	—					-	—
02S-05E-09 BBA 1	130	6.00	367ABCKU	S	1095	55.8	01-31-77	P	—
02S-05E-10 AAA 1	180	5.00	367ABCKU	S	1085	50.5	06-02-77	P	—
02S-05E-10 DDD 1	183	6.00	367ABCKU	S	1075	39.7	06-02-77	P	—
02S-05E-13 BAB 1	51.0	6.00	367ABCKU	U	980	22.4	12-09-76	-	—
02S-05E-15 DDC 1	100	6.00	364SMPS	H	1035	24.2	05-25-78	P	—
02S-05E-17 BBB 1	72.0	—	364SMPS	H	980.00	36.0	10-01-68	B	—
02S-05E-24 DDD 1	230	6.00	367ABCKU	H	955	45.1	01-03-77	S	—
02S-05E-25 ADA 1	33.0	6.00	367ABCKU	H	930	14.7	01-03-77	S	—
02S-06E-01 BCB 1	29.0	6.00	364SMPS	U	955	10.6	01-06-77	P	—
02S-06E-02 DAD 1	175	6.00	367ABCKU	S	990	49.1	01-06-77	J	—
02S-06E-03 BCD 1	93.0	—	367ABCKU	U	1010	63.9	11-04-76	P	—
02S-06E-04 CAB 1	143	—	367ABCKU	S	1075	124	11-04-76	P	—
02S-06E-11 CAA 1	138	6.00	367ABCKU	H	980	49.3	12-06-76	S	—
02S-06E-12 ABB 1	100	6.00	367ABCKU	S	955	38.4	02-02-77	S	—
02S-06E-12 CCB 1	75.0	4.00	367ABCKU	U	960	34.9	11-11-76	-	—
02S-06E-13 BBC 1	—	6.00	367ABCKU	H	960	34.0	02-07-77	S	—
02S-06E-13 CDB 1	74.0	6.00	367ABCKU	H	925	11.3	01-04-77	J	—
02S-06E-15 DDB 1	145	6.00	371ABCKL	H	990	21.4	12-06-76	S	—
02S-06E-16 BAA 1	193	6.00	367ABCKU	S	1010.00	19.0	10-01-68	P	—
02S-06E-16 DDC 1	139	6.00	371ABCKL	S	995	27.0	12-06-76	P	—
02S-06E-20 DAA 1	—	—	364SMPS	H	930	8.00	—	S	—

02S–07E–03 BBB 1	84.0	6.00	364SMPS	U	885	–.54	02–08–77	-	—
02S–07E–03 DAC 1	90.0	6.00	364SMPS	H	790	17.4	02–02–77	B	—
02S–07E–04 CAD 1	80.0	6.00	364SMPS	H	840	—	02–02–77	S	—
02S–07E–06 BAA 1	83.0	6.00	364SMPS	H	950	20.8	02–02–77	S	- -73
02S–07E–06 CCB 1	90.0	6.00	367ABCKU	H	950	40.1	01–05–73	J	—
02S–07E–07 AAA 1	160	6.00	367ABCKU	H	955	53.8	01–05–77	J	- -49
02S–07E–08 BDB 1	165	6.00	367ABCKU	S	965	69.3	02–03–77	P	—
02S–07E–09 DCD 1	216	6.00	367ABCKU	H	955	46.9	01–25–77	S	—
02S–07E–16 AAB 1	150	6.00	367ABCKU	U	952.00	117	01–05–77	S	—
02S–07E–16 BBC 1	60.0	6.00	367ABCKU	U	945	42.2	01–05–77	-	—
02S–07E–16 DBB 1	65.0	6.00	367ABCKU	H	920.00	13.0	10–01–68	-	—
02S–07E–17 BCB 1	175	6.00	367ABCKU	H	915	25.2	09–30–76	S	—
02S–07E–17 CBA 1	22.0	—	367ABCKU	U	915	18.2	09–30–76	P	—
03S–04E–02 BDD 1	57.0	5.00	367ABCKU	S	1015	10.5	03–15–77	P	—
03S–04E–15 DAB 1	70.0	6.00	367ABCKU	N	978.00	49.0	10–01–68	S	- -40
03S–04E–22 AAB 1	45.0	6.00	367ABCKU	H	950	24.5	03–15–77	J	—
03S–04E–23 ABB 1	224	6.00	367ABCKU	S	960	38.3	03–15–77	P	—
03S–04E–23 ABB 1	221	9.00	367ABCKU	U	970	30.4	03–15–77	-	—
Murray County									
01N–03E–35 D 1	552	6.00	322VNSS	P	1110.00	18.0	12–06–56	-	- -15
01N–04E–01 DDD 1	71.0	7.00	367ABCKU	S	1245	—	05–27–77	P	—
01N–04E–02 AAA 1	360	6.00	322VNSS	H	1280	186	12–02–76	S	—
01N–04E–02 DDA 1	335	7.00	367ABCKU	S	1270	145	12–03–76	S	—
01N–04E–04 BAA 1	29.0	—	—	H	1190	12.1	06–11–81	C	—
01N–04E–10 BDC 1	210	6.00	364SMPS	H	1225	—	—	S	—
01N–04E–10 DDD 1	—	4.50	364SMPS	U	1210	—	—	-	03–05–77
01N–04E–11 BBC 1	121	—	367ABCKU	U	1230	85.2	06–03–77	-	—
01N–04E–11 CBB 1	122	6.00	364SMPS	H	1230	89.8	06–03–77	P	—
01N–04E–11 CCC 1	—	—	—	U	1230	—	—	-	—
01N–04E–11 DAC 1	158	—	364SMPS	U	1250	—	—	T	—
01N–04E–11 DAC 2	163	—	364SMPS	U	1250	—	—	T	—
01N–04E–11 DAD 1	230	6.00	364SMPS	U	1240	—	—	-	—
01N–04E–13 CBC 1	57.0	7.00	364SMPS	H	1260	17.7	06–03–77	J	—
01N–04E–14 ADD 1	120	7.00	364SMPS	H	1260	40.5	06–03–77	S	—
01N–04E–14 CBA 1	124	5.00	364SMPS	H	1215	5.85	06–02–77	S	—
01N–04E–14 CCB 1	29.0	—	364SMPS	H	1135	17.1	06–02–77	-	- -77
01N–04E–15 AAD 1	102	6.00	364SMPS	S	1200	62.5	06–03–77	J	—
01N–04E–15 BDA 1	133	7.00	364SMPS	U	1190	30.6	06–03–77	-	—
01N–04E–21 DDA 1	1170	18.0	367ABCKU	I	1180	92.4	10–21–76	T	—

Appendix 3.—*Records of wells*—Continued

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Murray County—Continued									
01N-04E-22 DD 1	780	18.0	364SMPS	I	1235.00	115	07-01-59	-	- -57
01N-04E-22 DDA 1	780	18.0	367ABCKU	I	1250	157	10-21-76	T	03-25-57
		10.0	—					-	—
01N-04E-25 AAA 01	—	—	—	-	—	—	—	-	—
01N-04E-25 AAC 1	1020	10.0	367ABCKU	U	1200	110	10-20-76	-	—
01N-04E-25 DBC 1	155	6.00	367ABCKU	S	1210	151	12-07-76	P	—
01N-04E-28 DBD 1	165	5.00	367ABCKU	S	1170	103	11-12-76	P	- -56
01N-04E-29 BAB 1	249	6.00	367ABCKU	U	1200	124	11-18-76	S	—
01N-04E-30 ADB 1	307	6.00	367ABCKU	H	1200	133	11-18-76	S	—
01N-04E-30 DDA 1	190	6.00	322VNSS	H	1195	128	11-18-76	S	- -56
01N-04E-31 CAD 1	195	5.00	322VNSS	U	1190	106	11-18-76	J	—
01N-04E-31 CBA 1	225	6.00	322VNSS	U	1220	129	03-30-77	S	—
01N-04E-32 BBA 1	800	8.00	367ABCKU	H	1160	84.0	11-12-76	S	—
01N-04E-32 BDD 1	188	6.00	367ABCKU	S	1160	54.6	10-22-76	P	—
01N-04E-33 AAD 1	170	7.00	367ABCKU	S	1200	111	11-12-76	P	- -56
01N-04E-33 BBC 1	180	6.00	367ABCKU	S	1150	69.7	11-12-76	S	—
01N-04E-35 CCC 1	152	—	367ABCKU	S	1220	120	01-17-77	S	—
01S-01E-18 BBA 1	60.0	5.00	322VNSS	H	1065.00	15.1	12-16-68	J	- -62
01S-01E-21 CDD 1	19.0	5.00	371ABCKL	H	1190	4.77	02-16-78	J	—
01S-01E-28 DDA 1	107	6.00	367ABCKU	S	1240	40.2	02-16-78	S	—
01S-01E-29 CCA 1	100	8.00	371ABCKL	S	1310	25.2	04-12-78	P	—
01S-01E-31 DAD 1	80.0	5.00	367ABCKU	U	1310	25.2	04-12-78	-	—
01S-01E-33 DBD 1	168	—	367ABCKU	S	1255	77.7	02-24-78	P	—
01S-01W-08 BDB 1	62.0	6.00	367ABCKU	U	1100	45.0	04-25-78	-	—
01S-01W-09 BCD 1	16.0	12.0	371TMBH	U	1080	.48	04-25-78	-	—
01S-01W-25 DCC 1	900	10.0	367ABCKU	H	1375	220	04-13-78	P	—
01S-01W-35 AAB 1	90.0	8.00	367ABCKU	U	1375	18.4	04-13-78	-	—
01S-01W-35 DCA 1	1100	12.0	367ABCKU	S	1360	44.8	04-13-78	P	—
01S-01W-36 AAA 1	69.0	8.00	367ABCKU	H	1350	23.0	04-13-78	S	—
01S-01W-36 CBC 1	145	5.00	367ABCKU	U	1335	23.9	04-13-78	-	—

01S-01W-36 DCC 1	100	8.00	367ABCKU	S	1305	19.5	04-13-78	P	—
01S-02E-31 CAC 1	225	6.00	367ABCKU	S	1115	23.3	12-29-77	P	—
01S-03E-11 DDA 1	110	8.00	364SMPS	H	1165	35.0	06-01-77	S	—
		6.00	—					-	—
01S-03E-13 ABB 1	68.0	6.00	364SMPS	S	1180	10.6	02-09-77	J	—
01S-03E-14 ABD 1	55.0	—	364SMPS	H	1170	19.9	02-09-77	J	- -68
01S-03E-15 CCB 1	—	7.00	322VNSS	U	1050	—	—	-	—
01S-03E-21 AAC 1	188	5.00	364SMPS	S	1030	87.9	07-27-77	P	—
01S-03E-22 BAC 1	254	8.00	364SMPS	U	1045	46.0	02-10-77	-	—
01S-03E-24 ADA 1	102	6.00	367ABCKU	H	1100	59.1	02-09-77	S	—
01S-03E-24 BDA 1	—	—	364SMPS	S	1045	—	—	-	—
01S-03E-25 AAA 1	60.0	6.00	364SMPS	U	1060	12.1	02-10-77	J	—
01S-04E-05 DDD 1	133	6.00	364SMPS	H	1165	61.2	01-19-77	J	—
01S-04E-08 DAB 1	105	5.00	364SMPS	H	1145	72.2	02-09-77	S	—
01S-04E-08 DDD 1	98.0	6.00	364SMPS	H	1130	14.6	02-10-77	J	—
01S-04E-16 ADC 1	40.0	7.00	364SMPS	U	1095	16.3	07-27-77	P	—
01S-04E-16 BBB 1	102	5.00	364SMPS	U	1125	11.1	04-28-77	-	—
01S-04E-16 CBA 1	122	12.0	364SMPS	U	1105	19.5	04-28-77	-	—
01S-04E-16 DAD 1	—	—	364SMPS	U	1085	16.4	07-27-77	-	—
01S-04E-17 BBB 1	186	7.00	364SMPS	H	1175	43.4	06-01-77	S	- -48
01S-04E-18 ADD 1	150	5.00	364SMPS	H	1120	31.8	02-09-77	P	—
01S-04E-18 BAA 1	118	5.00	364SMPS	U	1180	6.84	02-10-77	-	—
01S-04E-18 DDA 1	218	6.00	367ABCKU	H	1135	76.2	02-09-77	S	—
01S-04E-18 DDA 2	106	5.00	367ABCKU	U	1135	72.6	02-09-77	-	—
01S-04E-21 ADA 1	135	6.00	367ABCKU	H	1100	29.0	04-07-77	J	—
01S-04E-32 AAD 1	80.0	6.00	367ABCKU	U	1150	5.32	04-27-77	-	—
01S-04E-33 DBA 1	156	7.00	367ABCKU	U	1090	2.27	04-27-77	P	—
02S-01E-04 BAC 1	147	8.00	367ABCKU	S	1250	34.6	02-15-78	P	—
02S-01E-04 DAC 1	85.0	7.00	367ABCKU	S	1190	55.3	02-15-78	P	—
02S-01E-09 CAB 1	108	6.00	367ABCKU	S	1245	65.1	04-12-78	P	—
02S-01E-09 CDD 1	208	8.00	367ABCKU	U	1240	10.0	02-03-78	-	—
02S-01E-10 DCB 1	420	6.00	367ABCKU	U	1280	30.6	02-03-78	-	—
02S-01E-11 CAA 1	325	6.00	367ABCKU	S	1200	55.7	02-15-78	P	—
02S-01E-12 DBA 1	202	6.00	367ABCKU	S	1205	85.5	01-05-78	P	—
02S-01E-14 CBD 1	45.0	5.00	364SMPS	S	1170	4.55	02-15-78	P	—
02S-01E-16 ADD 1	81.0	6.00	367ABCKU	U	1145	62.5	02-03-78	-	—
02S-01E-16 CCA 1	142	6.00	367ABCKU	U	1190	102	02-03-78	-	—
02S-01W-07 AAA 1	50.0	4.00	364SMPS	S	1170	11.7	05-04-78	P	—
02S-02E-06 CDB 1	347	8.00	367ABCKU	S	1195	118	01-05-78	P	—
02S-02E-07 BDA 1	424	6.00	367ABCKU	S	1170	105	01-05-78	P	—

Appendix 3.—*Records of wells*—Continued

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Murray County—Continued									
02S-02E-08 CDA 1	215	7.00	367ABCKU	S	1150	75.9	12-28-77	P	—
02S-02E-15 BBC 1	200	8.00	367ABCKU	S	1150	90.9	12-30-77	P	—
02S-02E-15 CBD 1	110	8.00	367ABCKU	S	1180	78.4	12-30-77	P	—
02S-03E-09 AAB 1	2500	6.00	364SMPS	H	1075	122	03-31-77	S	—
02S-03E-09 ACD 1	100	10.0	364SMPS	U	1140	67.4	03-31-77	-	—
02S-03E-10 BCA 1	48.0	5.00	364SMPS	U	1030	5.33	03-31-77	-	—
02S-03E-11 AAA 1	145	7.00	364SMPS	U	995	22.0	02-09-79	-	- -70
02S-03E-11 AAD 1	29.0	6.00	364SMPS	S	930	11.5	03-31-77	J	—
02S-03E-11 BBC 1	100	7.00	364SMPS	I	955	16.1	03-31-77	S	—
02S-03E-11 CBC 1	98.0	6.00	364SMPS	H	935	21.6	03-31-77	J	—
02S-03E-11 DBB 1	146	6.00	364SMPS	S	930	15.9	05-10-79	-	- -78
02S-03E-12 AAA 1	117	6.00	364SMPS	U	1010	7.40	03-18-77	-	—
02S-03E-12 CAA 1	58.0	5.00	364SMPS	U	980	30.9	03-17-77	-	—
02S-03E-13 BBB 1	614	12.0	364SMPS	U	920	-2.10	08-24-77	-	- -37
		2.00	—					-	—
02S-03E-13 CCD 1	79.0	5.00	367ABCKU	U	935	17.2	03-17-77	-	—
02S-03E-14 BAD 1	44.0	6.00	364SMPS	U	945	4.65	03-31-77	J	—
02S-03E-14 CDC 1	125	6.00	364SMPS	S	980	9.42	03-31-77	J	—
02S-03E-18 CDD 1	380	6.00	364SMPS	H	751.00	19.6	12-12-68	-	- -58
02S-03E-23 CBC 1	65.0	6.00	364SMPS	H	1035	28.4	03-30-77	J	—
02S-03E-24 ABA 1	66.0	5.00	367ABCKU	H	930	7.96	03-17-77	S	—
02S-03E-25 BAA 1	67.0	6.00	367ABCKU	H	895	13.8	03-18-77	J	—
02S-03E-25 DCD 1	361	6.00	367ABCKU	I	875	-6.30	12-06-78	-	- -76
02S-03E-26 ABB 1	150	6.00	364SMPS	H	925	5.34	04-28-77	S	—
02S-03E-26 CBB 1	24.0	—	364SMPS	U	1025	6.12	04-28-77	-	—
02S-03E-27 AAA 1	65.0	—	364SMPS	H	1000	—	—	S	—
02S-03E-35 AAA 1	60.0	5.00	364SMPS	U	985	2.44	04-28-77	-	—
02S-03E-35 DDB 1	—	—	364SMPS	H	985	3.36	04-28-77	J	—
02S-03E-36 BDB 1	30.0	—	364SMPS	U	930	3.80	03-30-77	-	—
02S-03E-36 BDB 2	76.0	6.00	364SMPS	H	940	33.1	03-30-77	J	—

02S–04E–08 DAC 1	353	6.00	367ABCKU	S	1130	31.8	03–16–77	P	—
02S–04E–15 CCC 1	139	7.00	367ABCKU	S	1110	25.0	03–16–77	P	—
02S–04E–16 BDD 1	235	6.00	367ABCKU	S	1145	49.8	03–16–77	P	—
02S–04E–17 ADD 1	240	6.00	367ABCKU	S	1110	51.5	03–16–77	P	—
02S–04E–18 BBD 1	85.0	6.00	367ABCKU	U	985	20.0	03–17–77	-	—
02S–04E–18 DCA 1	115	6.00	367ABCKU	U	1055	98.5	03–17–77	-	—
02S–04E–19 BCA 1	154	7.00	367ABCKU	S	970	61.4	03–17–77	P	—
02S–04E–19 CAC 1	61.0	7.00	367ABCKU	S	945	32.5	03–17–77	P	—
02S–04E–20 DAA 1	73.0	6.00	367ABCKU	S	1090	52.1	03–16–77	P	—
02S–04E–28 DCB 1	45.5	5.00	367ABCKU	S	1070	43.4	03–16–77	P	—
03S–04E–04 BCD 1	88.0	6.00	367ABCKU	H	975	20.2	03–16–77	J	—
03S–04E–06 CCA 1	70.0	8.00	367ABCKU	U	865	20.9	03–25–77	-	—
03S–04E–06 CCD 1	105	6.00	364SMPS	U	875	15.3	03–25–77	-	—
Pontotoc County									
01N–04E–36 B 1	230	9.00	367ABCKU	H	1159.00	40.0	—	-	- -46
01N–05E–01 AAD 1	124	—	367ABCKU	U	1155	76.5	10–19–76	-	—
01N–05E–03 AAB 1	168	7.00	367ABCKU	S	1210.00	123	01–01–59	P	—
01N–05E–03 ABB 1	157	6.00	367ABCKU	-	1215	133	12–02–76	-	—
01N–05E–03 CCB 1	160	—	367ABCKU	-	1210.00	60.0	—	P	—
01N–05E–03 DDB 1	142	5.00	367ABCKU	S	1180	96.4	12–10–76	P	—
01N–05E–04 BAA 1	300	9.00	367ABCKU	S	1210.00	120	01–01–59	P	—
01N–05E–04 BAA 1	143	6.00	367ABCKU	S	1215	135	12–02–76	P	—
01N–05E–06 AAA 1	195	6.00	367ABCKU	S	1255	174	12–02–76	P	—
01N–05E–06 AB 1	300	8.00	367ABCKU	S	1235.00	128	01–01–59	P	—
01N–05E–06 BAA 1	300	—	367ABCKU	S	1240.00	30.0	10–01–56	P	—
01N–05E–08 BAB 1	—	—	367ABCKU	S	1205	121	12–08–76	P	—
01N–05E–09 ADA 1	150	6.00	367ABCKU	S	1195	109	12–08–76	P	—
01N–05E–10 CCC 1	108	7.00	364SMPS	U	1180.00	76.0	11–01–58	-	—
01N–05E–10 DCC 1	105	6.00	367ABCKU	S	1180	93.6	12–08–76	P	—
01N–05E–10 DDD 1	—	—	367ABCKU	U	1180	57.0	10–20–76	-	—
01N–05E–11 BBA 1	95.0	6.00	367ABCKU	S	1180	93.0	12–10–76	P	—
01N–05E–11 CCD 1	—	—	367ABCKU	U	1160	69.6	10–20–76	-	—
01N–05E–11 DCD 1	259	—	367ABCKU	H	1190	114	10–20–76	S	—
01N–05E–12 ABC 1	113	6.00	367ABCKU	U	1155	85.5	10–19–76	-	—
01N–05E–12 DDA 1	187	—	367ABCKU	H	1170	105	10–19–76	S	—
01N–05E–13 AAA 1	112	6.00	367ABCKU	U	1120.00	55.0	11–01–58	P	—
01N–05E–13 ABB 1	108	—	367ABCKU	U	1135	55.7	10–20–76	-	—
01N–05E–14 CBB 1	194	6.00	367ABCKU	S	1165	82.4	12–10–76	P	—
01N–05E–15 ABB 1	—	7.00	367ABCKU	S	1160.00	71.0	11–01–58	P	—

Appendix 3.—*Records of wells*—Continued

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Pontotoc County—Continued									
01N—05E—15 BCA 1	56.0	—	367ABCKU	U	1185	—	10—20—76	-	—
01N—05E—16 B 1	770	9.00	367ABCKU	H	1205.00	40.0	—	-	—
01N—05E—16 DAD 1	171	6.00	367ABCKU	S	1180.00	93.0	11—01—58	P	—
01N—05E—16 DAD 1	168	6.00	367ABCKU	-	1190	107	12—10—76	P	—
01N—05E—17 DCB 1	—	7.00	367ABCKU	S	1185.00	96.0	01—01—59	P	—
01N—05E—21 CDB 1	235	7.00	367ABCKU	S	1145	63.9	12—07—76	-	—
01N—05E—22 CB	153	5.00	367ABCKU	U	1135.00	49.0	01—01—59	-	—
01N—05E—22 CBB 1	—	—	367ABCKU	U	1135	49.9	10—20—76	-	—
01N—05E—22 DAA 1	—	6.00	367ABCKU	S	1155	92.4	12—08—76	P	—
01N—05E—24 ABA 1	125	—	367ABCKU	S	1135	69.0	01—01—66	S	—
01N—05E—24 DAA 1	125	—	367ABCKU	U	1120.00	42.0	01—01—59	-	—
01N—05E—26 AC 1	—	6.00	367ABCKU	S	1135.00	77.0	01—01—59	P	—
01N—05E—27 CD 1	267	7.00	367ABCKU	U	1145.00	84.0	11—01—58	-	—
01N—05E—27 CDA 1	115	—	367ABCKU	U	1155.00	72.0	01—01—59	-	- -58
01N—05E—27 CDD 1	267	6.00	367ABCKU	S	1170	88.3	12—08—76	P	—
01N—05E—27 DCC 1	2500	12.0	367ABCKU	U	1150	73.0	10—20—76	-	—
01N—05E—27 DCC 2	267	7.00	367ABCKU	U	1150	75.8	10—20—76	-	—
01N—05E—28 ACC 1	—	7.00	367ABCKU	H	1145.00	110	01—01—59	P	—
01N—05E—28 CAA 1	220	6.00	367ABCKU	S	1190	115	12—08—76	S	—
01N—05E—30 ADD 1	—	6.00	367ABCKU	S	1210	108	12—07—76	S	—
01N—05E—30 CAC 1	—	—	367ABCKU	S	1040	—	—	P	—
01N—05E—31 CDB 1	187	—	367ABCKU	H	1220	144	01—20—77	S	—
01N—05E—32 DDC 1	205	7.00	367ABCKU	S	1170	97.4	01—20—77	P	—
01N—05E—33 ACA 1	187	7.00	367ABCKU	S	1180	99.3	01—20—77	P	—
01N—05E—35 AAC 1	165	8.00	367ABCKU	S	1180	76.2	12—08—76	P	—
01N—05E—35 CAB 1	220	—	367ABCKU	S	1185.00	99.0	01—01—59	P	—
01N—06E—03 CCC 1	700	12.0	367ABCKU	P	1170	136	10—26—76	T	- -59
01N—06E—04 AB 1	139	6.00	367ABCKU	U	1173.00	129	11—01—58	-	—
01N—06E—04 BC 1	100	5.00	367ABCKU	S	1133.00	74.0	10—01—58	P	—
01N—06E—04 CAD 1 — FITT	1710	—	367ABCKU	U	1157.00	115	12—01—58	-	- -38

01N-06E-04 CAD 2	163	—	367ABCKU	U	1130.00	117	01-01-59	-	- -58
01N-06E-04 DC 1	—	—	367ABCKU	H	1175.00	157	01-01-59	P	—
01N-06E-04 DCB 1	126	—	367ABCKU	U	1150	117	10-22-76	-	—
01N-06E-05 B 1	668	12.0	367ABCKU	U	1108.00	46.0	11-01-58	-	- -30
01N-06E-05 BA 1	112	6.00	367ABCKU	U	1132.00	89.0	11-01-58	P	—
01N-06E-05 DAA 1	134	6.00	367ABCKU	S	1135.00	106	01-01-59	P	—
01N-06E-07 CDA 1	70.0	—	367ABCKU	U	1110	57.7	10-21-76	-	—
01N-06E-08 BBA 1	107	—	367ABCKU	H	1150	63.6	10-22-76	S	—
01N-06E-09 ADD 1	1500	12.0	367ABCKU	P	1150	114	10-26-76	T	- -59
01N-06E-09 BAD 1	186	7.00	367ABCKU	U	—	149	12-01-58	C	—
01N-06E-09 DBC 1	150	—	367ABCKU	S	1175.00	142	12-01-58	P	—
01N-06E-10 BDC 1	—	6.00	367ABCKU	U	1165.00	145	12-01-58	C	—
01N-06E-10 DCC 1	136	—	367ABCKU	S	1155	136	01-01-77	P	—
01N-06E-11 DAB 1	232	—	364SMPS	H	1185	230	01-24-77	S	—
01N-06E-13 BBC 1	300	6.00	367ABCKU	H	1150	118	02-07-77	S	—
01N-06E-16 AAA 1	1570	12.0	367ABCKU	P	1145	115	10-26-76	T	- -59
01N-06E-16 BCA 1	175	—	367ABCKU	H	1155	120	10-21-76	-	—
01N-06E-17 ADA 1	100	6.00	367ABCKU	-	1130.00	76.0	12-01-58	P	—
01N-06E-17 DAA 1	160	—	367ABCKU	H	1110	73.4	10-21-76	S	—
01N-06E-18 BAB 1	159	—	367ABCKU	H	1150	110	10-21-76	S	—
01N-06E-21 ACB 1	220	6.00	367ABCKU	S	1130	104	01-04-77	S	—
01N-06E-21 ACC 1	129	6.00	367ABCKU	S	1170.00	102	12-01-58	P	—
01N-06E-22 ABD 1	—	6.00	367ABCKU	U	1130.00	91.0	12-01-58	P	—
01N-06E-23 DAC 1	100	—	367ABCKU	H	1115	40.0	01-24-77	P	—
01N-06E-24 ACB 1	83.0	6.00	367ABCKU	U	1095	28.8	02-08-77	S	—
01N-06E-24 BBC 1	175	—	367ABCKU	H	1105	71.4	01-24-77	S	—
01N-06E-24 CAB 1	96.0	6.00	367ABCKU	U	1085	45.6	01-26-77	-	—
01N-06E-26 CA 1	—	7.00	367ABCKU	U	1119.00	83.0	12-01-58	P	—
01N-06E-26 DAD 1	69.0	—	367ABCKU	H	1070	30.0	—	-	—
01N-06E-27 CDD 1	131	—	367ABCKU	H	1130	92.9	10-28-76	S	—
01N-06E-29 ABB 1	130	6.00	367ABCKU	U	1110.00	74.0	01-01-59	-	—
01N-06E-29 CAB 1	180	7.00	367ABCKU	S	1123.00	85.0	12-01-58	-	—
01N-06E-29 CAB 1	102	7.00	367ABCKU	S	1110	85.5	10-27-76	P	—
01N-06E-32 CBC 1	111	—	367ABCKU	S	1080	52.4	10-28-76	P	—
01N-06E-33 BCC 1	100	6.00	367ABCKU	S	1090	56.0	10-28-76	P	—
01N-06E-33 CDA 1	42.0	6.00	367ABCKU	U	1075	40.0	10-28-76	P	—
01N-06E-34 ACD 1	102	6.00	367ABCKU	U	1090	60.4	10-28-76	-	—
01N-06E-36 BBA 1	100	—	367ABCKU	H	1070	36.5	01-24-77	-	—
01N-06E-36 CBC 1	150	—	367ABCKU	H	1070	41.9	01-24-77	-	—
01N-07E-19 CAB 1	200	—	364SMPS	H	1125	60.0	—	S	—

Appendix 3.—*Records of wells*—Continued

Local Well Number	Depth of well (ft)	Diameter of casing (in.)	Aquifer code	Primary use of water	Altitude of land surface (ft)	Water level (ft)	Date water level measured	Type of lift	Date of construction
Pontotoc County—Continued									
01N-07E-30 AAA 1	100	6.00	364SMPS	H	1045.00	22.0	10-01-68	J	- -43
01N-07E-30 ABA 1	100	6.00	364SMPS	H	1160	35.1	01-26-77	J	—
01N-07E-30 DBC 1	32.0	6.00	367ABCKU	U	1085	10.9	01-26-77	J	—
01N-07E-31 BCA 1	122	—	364SMPS	H	1130	33.1	01-25-77	S	—
02N-04E-13 DC 1	500	6.00	364SMPS	H	1200.00	125	01-01-56	T	- -13
02N-04E-13 DCD 1	402	6.00	364SMPS	N	1200	56.1	12-01-76	S	04-25-63
02N-04E-24 AD 1	380	7.00	364SMPS	-	1205.00	60.0	—	T	—
02N-05E-10 DDD 1	534	10.0	364SMPS	U	1240	42.2	05-18-79	-	04-16-60
02N-05E-14 AAB 1	73.0	6.00	364SMPS	H	1245	59.6	02-01-77	S	—
02N-05E-16 CAA 1	62.0	6.00	364SMPS	H	1200	20.0	10-27-76	J	- -56
02N-05E-17 ABA 1	425	6.00	364SMPS	H	1200.00	50.0	08-01-61	P	- -52
02N-05E-17 DAB 1	280	6.00	364SMPS	H	1170	69.3	11-19-76	S	—
02N-05E-19 BDC 1	110	6.00	364SMPS	N	1200	27.7	11-19-76	S	—
02N-05E-19 DCD 1	223	—	367ABCKU	H	1255	157	12-01-76	S	—
02N-05E-20 DBC 1	300	6.00	364SMPS	S	1210	—	—	S	—
02N-05E-21 CAD 1	86.0	5.00	364SMPS	H	1170	69.9	03-25-77	-	—
02N-05E-21 DCD 1	130	7.00	367ABCKU	U	1170	76.5	10-27-76	-	—
02N-05E-21 DCD 2	165	6.00	367ABCKU	S	1170	—	—	S	—
02N-05E-22 CBC 1	600	—	367ABCKU	I	1150	—	—	T	—
02N-05E-23 AAA 1	87.0	—	364SMPS	U	1195	15.2	01-31-77	-	—
02N-05E-23 DDC 1	230	6.00	367ABCKU	H	1155	64.9	01-31-77	S	—
02N-05E-24 CBB 1	117	6.00	367ABCKU	U	1195.00	77.0	12-01-58	-	—
02N-05E-24 DCD 1	—	6.00	367ABCKU	H	1180.00	36.0	11-01-58	-	—
02N-05E-24 DDC 1	280	—	367ABCKU	H	1180	87.5	10-20-76	S	—
02N-05E-25 BCC 1	—	6.00	367ABCKU	-	1150.00	111	02-01-57	-	—
02N-05E-25 CA 1	120	6.00	367ABCKU	U	1130.00	96.0	02-01-57	-	—
02N-05E-25 CCC 1	1530	9.00	367ABCKU	U	1128.00	17.0	11-01-58	-	—
02N-05E-26 AAC 1	270	6.00	367ABCKU	H	1175	100	—	S	—
02N-05E-26 DAD 1	—	5.00	367ABCKU	S	1140.00	76.0	02-01-57	P	—
02N-05E-26 DCD 1	130	—	367ABCKU	H	1155	80.0	—	S	—

02N–05E–27 AAA 1	113	6.00	367ABCKU	U	1160.00	71.0	12–01–58	-	—
02N–05E–27 BBB 1	152	6.00	367ABCKU	S	1150	57.4	12–02–76	S	—
02N–05E–27 BBB 1	148	6.00	367ABCKU	S	1140.00	44.0	12–01–58	J	—
02N–05E–27 CBB 1	36.0	6.00	367ABCKU	U	1135.00	14.0	12–01–58	P	—
02N–05E–27 DCB 1	126	6.00	367ABCKU	S	1150	57.1	12–02–76	-	—
02N–05E–29 ABB 1	—	6.00	367ABCKU	S	1210	118	12–02–76	P	—
02N–05E–29 BCA 1	—	—	367ABCKU	U	1210	86.7	10–22–76	-	—
02N–05E–30 ADA 1	—	—	364SMPS	U	1220	118	10–22–76	P	—
02N–05E–31 DAA 1	300	10.0	367ABCKU	S	1229.00	118	01–01–59	P	—
02N–05E–35 ADD 1	121	6.00	367ABCKU	H	1170	77.1	10–19–76	S	09–05–30
02N–05E–35 CAB 1	300	9.00	367ABCKU	S	1209.00	110	01–01–59	-	—
02N–05E–36 AAB 1	110	5.00	367ABCKU	U	1130.00	105	02–01–57	P	—
02N–05E–36 AAD 1	2050	9.00	367ABCKU	S	1128.00	31.0	01–01–59	-	—
02N–05E–36 ADA 1	87.0	6.00	367ABCKU	H	840.00	20.0	11–01–58	J	- -30
02N–05E–36 BB 1	68.0	—	367ABCKU	U	1130.00	—	—	-	- -58
02N–05E–36 BCC 1	—	10.0	367ABCKU	S	1130.00	49.0	11–01–58	J	—
02N–05E–36 CBC 1	—	6.00	367ABCKU	H	1140.00	58.0	11–01–58	J	—
02N–05E–36 DAA 1	140	—	367ABCKU	H	1150	64.9	10–19–76	S	—
02N–05E–36 DDC 1	147	6.00	367ABCKU	S	1170.00	84.0	01–01–59	P	—
02N–05E–36 DDC 1	—	—	367ABCKU	U	1170	—	—	U	—
02N–06E–14 D 1	995	7.00	364SMPS	H	850.00	—	—	-	—
02N–06E–30 AAA 1	118	—	367ABCKU	S	1200	91.4	10–22–76	S	—
02N–06E–30 BBD 1	102	—	367ABCKU	H	1165	39.6	10–20–76	S	—
02N–06E–31 AAA 1	116	—	367ABCKU	U	1140	55.5	10–19–76	S	—
02N–06E–31 CCC 1	119	6.00	367ABCKU	H	1139.00	48.0	11–01–58	P	—
02N–06E–31 CDD 1	—	—	367ABCKU	H	1135	—	—	S	—
02N–06E–31 DDA 1	455	16.0	367ABCKU	U	1107.00	29.0	01–01–59	-	—
02N–06E–32 CCC 1	136	—	367ABCKU	C	1130	108	10–19–76	S	—
02N–06E–32 DDB 1	170	—	367ABCKU	H	1165	42.2	10–20–76	S	—
02N–06E–33 CCC 1	105	6.00	367ABCKU	U	1140.00	94.0	11–01–58	-	—
02N–06E–34 1	—	—	364SMPS	P	980.00	—	—	-	—
02N–06E–34 ACA 1	520	8.00	364SMPS	U	980.00	.00	11–01–53	-	- -53

APPENDIX 4: Records of Streams

[Site location: The approximate site on a stream where a discharge measurement was made. Sites on a single stream are in downstream order. Discharge, in cubic feet per second; Drainage area, in square miles; Water temperature, in degree Celsius; Specific conductance, in microsiemens per centimeter at 25 degrees Celsius; pH, in pH units.]

Site location	Stream name	Date	Discharge	Drainage area	Water temperature	Specific conductance	pH
Ø2S-Ø5E-31 CBA	Bee Branch	Ø9/92/76	Ø.36	---	2Ø.5	42Ø	8.1
Ø1S-Ø6E-24 CBB	Blue River	Ø2/22/77	35.9	123.	17.Ø	6Ø5	7.4
Ø1S-Ø6E-24 CBB	Blue River	Ø9/22/77	26.9	123.	21.5	575	8.Ø
Ø1S-Ø6E-24 CBB	Blue River	11/14/77	21.9	123.	15.5	56Ø	8.Ø
Ø1S-Ø6E-24 CBB	Blue River	Ø8/23/78	26.Ø	123.	23.Ø	52Ø	7.6
Ø1S-Ø6E-24 CBB	Blue River	Ø2/15/79	24.Ø	---	15.Ø	58Ø	7.8
Ø2S-Ø7E-Ø5 BBB	Blue River	Ø8/24/76	3Ø.3	151.	23.Ø	54Ø	8.2
Ø2S-Ø7E-Ø5 BBB	Blue River	Ø2/23/77	46.Ø	151.	----	---	---
Ø2S-Ø7E-Ø5 BBB	Blue River	Ø9/22/77	34.5	151.	22.5	54Ø	8.1
Ø2S-Ø7E-Ø5 BBB	Blue River	Ø8/21/78	32.Ø	151.	26.Ø	---	---
Ø2S-Ø7E-17 CBB	Blue River	Ø9/3Ø/76	37.Ø	162.	2Ø.Ø	545	8.1
Ø2S-Ø7E-17 CBB	Blue River	1Ø/21/77	34.Ø	162.	17.5	54Ø	8.Ø
Ø3S-Ø7E-Ø9 DBC	Blue River	Ø8/25/76	37.2	19Ø.	23.Ø	428	8.3
Ø3S-Ø7E-Ø9 DBC	Blue River	Ø2/23/77	69.5	19Ø.	----	---	---
Ø3S-Ø7E-Ø9 DBC	Blue River	Ø8/22/78	31.2	19Ø.	29.5	445	8.4
Ø1S-Ø3E-25 BAD	Buckhorn Creek	Ø8/22/77	3.23	---	21.Ø	6ØØ	8.4
Ø1S-Ø3E-25 BAD	Buckhorn Creek	Ø2/14/79	3.Ø6	---	17.Ø	585	8.Ø
Ø1S-Ø3E-24 CDD	Buckhorn Creek	Ø2/22/77	4.83	1.85	19.Ø	6ØØ	8.1
Ø1S-Ø3E-24 CDD	Buckhorn Creek	Ø9/27/77	1.88	1.85	2Ø.Ø	6ØØ	8.3
Ø3S-Ø6E-Ø3 AAC	Buzzard Creek	Ø2/22/77	2.36	4.3Ø	16.Ø	46Ø	7.8
Ø3S-Ø6E-Ø3 AAC	Buzzard Creek	Ø9/22/77	Ø.Ø	4.3Ø	----	---	---
Ø3S-Ø6E-Ø3 AAC	Buzzard Creek	Ø8/21/78	Ø.Ø	4.3Ø	----	---	---
Ø3S-Ø6E-Ø3 AAC	Buzzard Creek	Ø2/14/79	Ø.93	4.3Ø	9.5	426	8.1
Ø2S-Ø1E-3Ø ACA	Camp Creek	Ø2/15/79	1.9Ø	---	8.Ø	473	7.9
Ø1N-Ø7E-22 ACA	Coal Creek	Ø2/23/77	1.91	5.8Ø	14.Ø	46Ø	7.5
Ø1N-Ø7E-22 ACA	Coal Creek	Ø9/21/77	Ø.Ø3	5.8Ø	24.5	51Ø	---
Ø1N-Ø7E-22 ACA	Coal Creek	Ø8/22/78	Ø.Ø	5.8Ø	----	---	---
Ø1N-Ø7E-22 ACA	Coal Creek	Ø2/14/79	3.65	5.8Ø	12.Ø	425	7.5
Ø1S-Ø1E-15 BCB	Colbert Creek	Ø8/22/78	Ø.14	8.ØØ	29.Ø	44Ø	8.3
Ø1S-Ø1E-15 BCB	Colbert Creek	Ø9/Ø7/78	Ø.18	8.ØØ	27.Ø	44Ø	8.3

01S-01E-15 BCB	Colbert Creek	02/14/79	6.19	8.00	14.5	470	8.3
03S-03E-06 CBB	Cool Creek	03/08/77	2.88	10.9	12.5	460	8.3
03S-03E-06 CBB	Cool Creek	09/21/77	0.11	10.9	24.5	520	7.9
03S-03E-06 CBB	Cool Creek	08/21/78	---	10.9	29.0	480	8.0
03S-03E-06 CBB	Cool Creek	02/14/79	8.09	10.9	14.5	400	8.0
02S-02E-11 CAB	Deel Creek	02/15/79	2.85	---	13.5	495	8.0
01S-07E-22 DCC	Delaware Creek	02/22/77	4.19	8.30	18.0	465	8.3
01S-07E-22 DCC	Delaware Creek	09/21/77	0.36	8.30	24.0	340	---
01S-07E-22 DCC	Delaware Creek	02/14/79	9.88	8.30	14.5	460	7.9
01S-07E-34 ADA	Delaware Creek	08/22/78	0.0	---	----	---	---
01S-07E-34 ADD	Delaware Creek	11/15/77	1.47	---	14.5	520	8.4
02S-08E-02 DDA	Delaware Creek	02/23/77	24.8	45.8	17.0	615	8.3
02S-07E-02 DCB	Delaware Creek	02/22/77	8.06	---	14.5	455	8.4
02S-07E-07 BAA	Diamond Spring Creek	02/23/77	3.52	8.60	16.5	610	6.9
01S-01W-07 DCC	Eightmile Creek	08/22/78	0.20	5.81	30.0	415	8.0
01S-01W-07 DCC	Eightmile Creek	02/15/79	9.17	5.81	12.0	400	8.2
01S-02E-33 CBB	Falls Creek	02/24/77	3.64	6.82	14.0	540	8.2
01S-02E-33 CBB	Falls Creek	09/21/77	1.37	6.82	24.0	540	8.0
01S-02E-33 CBB	Falls Creek	08/31/78	1.54	6.82	24.0	470	8.1
01S-02E-33 CBB	Falls Creek	02/14/79	6.68	6.82	17.5	500	7.8
01S-01W-09 BBC	Fivemile Creek	08/22/78	0.0	---	----	---	---
01N-07E-26 DAB	Goose Creek	02/24/77	1.15	2.70	11.0	410	8.2
01N-07E-26 DAB	Goose Creek	09/21/77	0.28	2.70	25.0	470	---
01N-07E-26 DAB	Goose Creek	08/22/78	0.0	2.70	----	---	---
01N-07E-26 DAB	Goose Creek	02/14/79	2.77	2.70	11.5	420	7.7
02S-01E-28 BBC	Henryhouse Creek	08/22/78	0.0	---	----	---	---
02S-01E-29 ADB	Henryhouse Creek	02/16/79	6.40	---	9.5	430	7.5
02S-01W-15 DAD	Hickory Creek	08/24/78	0.43	7.43	21.0	540	7.7
02S-01W-15 DAD	Hickory Creek	09/08/78	0.37	7.43	19.0	570	7.4
02S-01W-15 DAD	Hickory Creek	02/15/79	9.16	7.43	10.0	445	7.8
02S-01E-02 AAA	Honey Creek	01/31/78	0.77	---	12.0	550	7.7
01S-01E-36 ABD	Honey Creek	02/22/77	14.0	16.4	16.0	460	8.3
01S-02E-30 DCB	Honey Creek	09/22/77	1.67	---	32.0	380	---
01S-02E-30 DCB	Honey Creek	08/21/78	1.96	---	28.0	350	8.4
01S-02E-30 DCB	Honey Creek	09/01/78	2.02	---	27.0	320	8.1
01S-02E-30 DCB	Honey Creek	02/14/79	22.0	---	16.0	450	8.2
01S-07E-36 DCC	Houghtubby Branch	02/22/77	0.06	---	17.0	600	7.9
01S-07E-36 DCC	Houghtubby Branch	08/22/78	0.0	---	----	---	---
01S-07E-36 DCC	Houghtubby Branch	02/14/79	0.0	---	----	---	---
02S-06E-29 CCA	Keel Creek	02/23/77	1.04	4.00	14.0	560	7.5

Appendix 4.--*Records of streams*-Continued

Site location	Stream name	Date	Discharge	Drainage area	Water temperature	Specific conductance	pH
Ø2S-Ø6E-29 CCA	Keel Creek	Ø9/21/77	Ø.32	4.ØØ	28.Ø	32Ø	---
Ø2S-Ø6E-29 CCA	Keel Creek	Ø8/21/78	Ø.Ø	4.ØØ	----	---	---
Ø2S-Ø6E-29 CCA	Keel Creek	Ø2/14/79	Ø.37	4.ØØ	12.Ø	457	7.8
Ø1S-Ø6E-12 ACB	Little Blue Creek	Ø2/22/77	Ø.87	11.6	18.5	59Ø	7.7
Ø1S-Ø6E-12 ACB	Little Blue Creek	Ø8/22/78	Ø.58	11.6	21.Ø	57Ø	7.8
Ø1S-Ø7E-19 CDC	Little Blue Creek	11/15/77	1.95	18.9	14.5	52Ø	8.4
Ø1S-Ø7E-19 CDC	Little Blue Creek	Ø2/23/78	3.94	18.9	----	---	---
Ø1S-Ø7E-19 CDC	Little Blue Creek	Ø8/21/78	2.21	18.9	26.Ø	---	---
Ø1S-Ø7E-19 CDC	Little Blue Creek	Ø2/15/79	2.29	18.9	12.Ø	435	7.7
Ø2S-Ø4E-11 BBB	Mill Creek	Ø2/23/77	6.3Ø	46.4	11.5	58Ø	8.1
Ø2S-Ø4E-11 BBB	Mill Creek	Ø9/Ø2/76	3.24	46.4	21.Ø	52Ø	8.2
Ø2S-Ø4E-11 BBB	Mill Creek	Ø9/22/77	3.Ø3	46.4	24.Ø	57Ø	8.3
Ø2S-Ø4E-11 BBB	Mill Creek	1Ø/2Ø/77	2.43	46.4	17.Ø	6ØØ	8.3
Ø2S-Ø4E-11 BBB	Mill Creek	Ø8/21/78	3.53	46.4	27.5	46Ø	8.3
Ø2S-Ø4E-11 BBB	Mill Creek	Ø2/15/79	3.23	---	11.Ø	61Ø	8.2
Ø2S-Ø5E-31 DAA	Mill Creek	Ø9/Ø2/76	4.ØØ	---	22.5	4ØØ	8.3
Ø3S-Ø5E-32 BBB	Mill Creek	Ø7/Ø1/76	1Ø.Ø	89.2	22.Ø	365	8.2
Ø3S-Ø5E-32 BBB	Mill Creek	Ø2/23/77	22.3	89.2	14.Ø	4ØØ	8.7
Ø3S-Ø5E-32 BBB	Mill Creek	Ø9/23/77	3.92	89.2	25.5	29Ø	8.7
Ø3S-Ø5E-32 BBB	Mill Creek	Ø8/24/78	1.65	89.2	29.Ø	34Ø	8.6
Ø3S-Ø5E-32 BBB	Mill Creek	Ø2/15/79	13.7	89.2	14.Ø	396	7.9
Ø2S-Ø3E-25 BAA	Oil Creek	Ø2/23/77	Ø.74	9.96	12.5	59Ø	8.5
Ø3S-Ø4E-17 BCD	Oil Creek	Ø2/23/77	16.7	28.6	14.5	49Ø	8.1
Ø3S-Ø4E-17 BCD	Oil Creek	Ø9/22/77	3.36	28.6	23.5	45Ø	8.Ø
Ø3S-Ø4E-17 BCD	Oil Creek	1Ø/1Ø/77	1.1Ø	28.6	16.5	41Ø	8.5
Ø3S-Ø4E-17 BCD	Oil Creek	Ø8/22/78	1.Ø6	28.6	26.5	375	8.1
Ø3S-Ø4E-17 BCD	Oil Creek	Ø2/14/79	17.8	28.6	12.Ø	44Ø	7.8
Ø1S-Ø5E-34 DDD	Pennington Creek	Ø9/22/77	7.53	32.8	19.5	58Ø	7.5
Ø1S-Ø5E-34 DDD	Pennington Creek	Ø8/22/78	8.83	32.8	21.Ø	57Ø	8.Ø
Ø2S-Ø6E-19 BCC	Pennington Creek	Ø8/31/76	9.68	44.5	2Ø.5	425	8.3

Ø2S-Ø6E-19 BCC	Pennington Creek	Ø2/22/77	18.4	44.5	----	---	---
Ø2S-Ø6E-19 BCC	Pennington Creek	1Ø/21/77	6.84	44.5	17.5	49Ø	8.4
Ø2S-Ø6E-19 BCC	Pennington Creek	Ø8/22/78	1Ø.5	44.5	27.Ø	5Ø5	7.9
Ø1S-Ø5E-34 DDD	Pennington Creek	Ø2/22/77	11.Ø	32.8	----	---	---
Ø3S-Ø6E-Ø5 CBC	Pennington Creek	Ø2/22/77	32.6	74.5	----	---	---
Ø3S-Ø6E-Ø5 CBC	Pennington Creek	Ø9/22/77	22.3	74.5	25.Ø	48Ø	8.3
Ø3S-Ø6E-Ø5 CBC	Pennington Creek	Ø8/22/78	21.Ø	74.5	26.Ø	---	---
Ø3S-Ø6E-Ø5 CBC	Pennington Creek	Ø2/14/79	16.6	74.5	11.5	5Ø6	7.9
Ø3S-Ø6E-17 CDD	Pennington Creek	Ø8/31/76	23.3	---	----	---	---
Ø2S-Ø5E-25 DDC	Reagan Creek	Ø2/14/79	Ø.9Ø	---	14.Ø	---	---
Ø2S-Ø5E-21 CDC	Rock Creek	Ø2/Ø2/77	1.61	9.Ø6	2.Ø	---	---
Ø2S-Ø5E-21 CDC	Rock Creek	Ø2/23/77	2.25	9.Ø6	----	---	---
Ø2S-Ø5E-21 CDC	Rock Creek	Ø9/22/77	Ø.15	9.Ø6	28.Ø	32Ø	8.3
Ø2S-Ø5E-21 CDC	Rock Creek	Ø8/22/78	Ø.Ø3	9.Ø6	33.Ø	23Ø	8.5
Ø2S-Ø5E-21 CDC	Rock Creek	Ø2/14/79	Ø.8Ø	9.Ø6	8.Ø	426	7.9
Ø1N-Ø6E-Ø1 CCC	Sheep Creek	Ø2/23/77	4.3Ø	1.34	16.Ø	53Ø	7.8
Ø1N-Ø6E-Ø1 CCC	Sheep Creek	Ø9/21/77	3.15	1.34	21.Ø	54Ø	---
Ø1N-Ø6E-Ø1 CCC	Sheep Creek	Ø8/22/78	4.84	1.34	23.Ø	---	---
Ø1N-Ø6E-Ø1 CCC	Sheep Creek	Ø2/14/79	2.65	1.34	12.Ø	53Ø	7.9
Ø2S-Ø5E-16 CBC	Sixmile Creek	Ø2/Ø2/77	1.Ø5	---	3.Ø	---	---
Ø2S-Ø6E-19 BDB	Spring Creek	Ø8/31/76	8.2Ø	19.6	17.Ø	6ØØ	7.9
Ø2S-Ø6E-19 BDB	Spring Creek	Ø2/22/77	7.96	19.6	----	---	---
Ø2S-Ø6E-19 BDB	Spring Creek	1Ø/21/77	---	19.6	2Ø.Ø	64Ø	8.1
Ø2S-Ø6E-19 BDB	Spring Creek	Ø8/22/78	9.28	19.6	----	---	---
Ø2S-Ø1W-17 ADA	Spring Creek	Ø2/15/79	Ø.23	---	6.Ø	418	7.9
Ø1S-Ø7E-22 CCC	Tributary to Delaware Creek	Ø2/14/79	Ø.Ø8	---	12.5	44Ø	7.8
Ø1S-Ø7E-22 DDC	Tributary to Delaware Creek	Ø2/14/79	Ø.49	---	13.Ø	43Ø	7.6
Ø1S-Ø7E-21 DCD	Tributary to Delaware Creek	Ø1/14/79	Ø.26	---	12.5	45Ø	7.8
Ø2N-Ø6E-34 BDD	Tribuary to Mill Creek	Ø8/23/76	Ø.Ø7	---	2Ø.8	57Ø	---
Ø2S-Ø1W-Ø8 DCC	Tribuary to Spring Creek	Ø2/15/79	Ø.35	---	7.Ø	421	7.5
Ø1S-Ø8E-34 CBB	Walnut Branch	Ø2/23/77	5.14	---	13.Ø	475	8.2
Ø1S-Ø8E-34 CBB	Walnut Branch	Ø8/22/78	Ø.Ø	---	----	---	---
Ø1S-Ø8E-34 CBB	Walnut Branch	Ø2/14/79	Ø.97	1Ø.2	11.5	435	6.9

APPENDIX 5: Records of Springs

[Method of measurement: C, current meter; E, estimated; V, volumetric; Z, other. Water quality parameter code: 00010, temperature in degrees Celsius; 00095, specific conductance in microsiemens per centimeter at 25 degrees Celsius; 00400, pH in pH units. Type of spring: A, artesian; C, contact; D, depression; F, fracture; J, artesian depression; L, fracture depression; S, seepage, filtration; T, tubular, cave. Geologic unit sampled: 364SMPS, Simpson Group; 367ABCKU, upper Arbuckle Group; 371ABCKL, lower Arbuckle Group.]

Local Well Number	Name of spring	Discharge (gal/min)	Date discharge measured	Method discharge measured	Water-quality parameter code	Value of water-quality parameter	Date quality parameter measured	Type of spring	Geologic unit sampled
Coal County									
01S-08E-32 CCC 1	Bromide Spring	4.00	03-09-77	E	00010	16.0	03-09-77	A	364SMPS
		—	—	-	00095	11,000	03-09-77	-	364SMPS
		—	—	-	00400	7.1	03-09-77	-	364SMPS
01S-08E-32 CCD 1	White Sulphur Spring	4.00	03-09-77	E	00010	18.0	03-09-77	-	364SMPS
		—	—	-	00095	9,800	03-09-77	-	364SMPS
		—	—	-	00400	7.1	03-09-77	-	364SMPS
01S-08E-32 CCD 2	1910 Spring	4.00	03-09-77	E	00010	17.0	03-09-77	A	364SMPS
		—	—	-	00095	970	03-09-77	-	364SMPS
		—	—	-	00400	7.1	03-09-77	-	364SMPS
01S-08E-32 CDC 1	Unnamed	9.00	03-09-77	E	00010	15.0	03-09-77	-	364SMPS
		—	—	-	00095	4,800	03-09-77	-	364SMPS
		—	—	-	00400	7.6	03-09-77	-	364SMPS
Johnston County									
01S-04E-24 BCC 1	Clement Spring	19.7	01-18-77	C	00010	14.0	01-18-77	F	364SMPS
		—	—	-	00095	600	01-18-77	-	364SMPS
		—	—	-	00400	7.4	01-18-77	-	364SMPS
01S-04E-27 DCA 1	Colvert Spring	817	02-04-77	C	00010	16.0	02-04-77	L	367ABCKU
		—	—	-	00095	625	02-04-77	-	367ABCKU
		—	—	-	00400	7.1	02-04-77	-	367ABCKU
01S-05E-34 DDD 1	Unnamed	929	11-03-77	C	00010	17.0	11-03-77	D	367ABCKU
		—	—	-	00095	580	11-03-77	-	367ABCKU
		—	—	-	00400	7.5	11-03-77	-	367ABCKU
01S-05E-34ACD 1	Unnamed	507	08-09-78	C	00010	17.0	08-09-78	S	367ABCKU
		—	—	-	00095	600	08-09-78	-	367ABCKU
		—	—	-	00400	7.1	08-09-78	-	367ABCKU

01S-06E-12 BAD 1	Unnamed	22.0	02-07-77	E	00010	17.0	02-07-77	A	367ABCKU
		—	—	-	00095	590	02-07-77	-	367ABCKU
		—	—	-	00400	6.7	02-07-77	-	367ABCKU
01S-06E-12 BDD 1	Unnamed	660	01-07-77	C	00010	16.5	01-07-77	F	367ABCKU
		—	—	-	00095	590	01-07-77	-	367ABCKU
		—	—	-	00400	6.8	01-07-77	-	367ABCKU
01S-06E-21 ADB 1	Tisdell Spring	673	11-17-76	E	00010	17.5	11-17-76	F	367ABCKU
		—	—	-	00095	610	11-17-76	-	367ABCKU
		—	—	-	00400	7.3	11-17-76	-	367ABCKU
01S-06E-22 BC 1	Unnamed	583	11-18-76	E	00010	17.5	11-18-76	F	367ABCKU
		—	—	-	00095	620	11-18-76	-	367ABCKU
		—	—	-	00400	6.7	11-18-76	-	367ABCKU
01S-06E-22 BC 2	Unnamed	449	11-18-76	E	00010	17.5	11-18-76	F	367ABCKU
01S-06E-22 BC 4	Unnamed	269	11-18-76	E	—	—	—	-	—
01S-06E-22 BCA 3	Unnamed	.00	11-18-76	Z	—	—	—	F	—
01S-06E-24 CAD 1	Cummings Spring	1,790	03-08-77	E	00010	18.0	09-23-77	C	367ABCKU
		1,390	05-26-77	C	00095	610	09-23-77	-	367ABCKU
		—	—	-	00400	7.2	09-23-77	-	367ABCKU
01S-06E-24 CBB 1	Anderson Spring	449	02-04-77	E	00010	15.0	02-04-77	J	367ABCKU
		426	05-26-77	C	00095	610	02-04-77	-	367ABCKU
		—	—	-	00400	6.9	02-04-77	-	367ABCKU
		—	—	-	00010	17.0	05-26-77	-	—
		—	—	-	00095	600	05-26-77	-	—
		—	—	-	00400	7.2	05-26-77	-	—
01S-07E-09 CBB 1	Unnamed	45.0	02-09-77	E	00010	16.0	02-09-77	D	364SMPS
		—	—	-	00095	520	02-09-77	-	364SMPS
		—	—	-	00400	6.5	02-09-77	-	364SMPS
01S-07E-20 CDA 2	Unnamed	4.00	02-10-77	E	00010	12.0	02-10-77	D	364SMPS
		—	—	-	00095	580	02-10-77	-	364SMPS
		—	—	-	00400	6.7	02-10-77	-	364SMPS
01S-07E-28 AAB 2	Unnamed	4.00	02-01-77	E	00010	8.0	02-01-77	D	364SMPS
		—	—	-	00095	710	02-01-77	-	364SMPS
		—	—	-	00400	6.2	02-01-77	-	364SMPS
01S-07E-28 AAB 3	Unnamed	4.00	02-01-77	E	—	—	—	D	—
01S-07E-32 ACB 1	Unnamed	4.00	02-08-77	E	00010	7.0	02-08-77	S	364SMPS
		—	—		00095	400	02-08-77	-	364SMPS
		—	—		00400	7.0	02-08-77		364SMPS

Appendix 5.—*Records of springs*—Continued

Local Well Number	Name of spring	Discharge (gal/min)	Date discharge measured	Method discharge measured	Water-quality parameter code	Value of water-quality parameter	Date quality parameter measured	Type of spring	Geologic unit sampled
Johnston County—Continued									
01S-07E-36 DBC 1	Houghtubby Spring	45.0	02-03-77	E	00010	15.0	02-03-77	F	364SMPS
		—	—	-	00095	630	02-03-77	-	364SMPS
		—	—	-	00400	6.6	02-03-77	-	364SMPS
02S-04E-27 BAD 1	Unnamed	—	—	-	00010	17.0	03-16-77	F	367ABCKU
		—	—	-	00095	570	03-16-77	-	367ABCKU
		—	—	-	00400	6.7	03-16-77	-	367ABCKU
02S-04E-27 BBC 1	Unnamed	—	—	-	00010	16.0	03-16-77	F	367ABCKU
02S-04E-36 CCC 1	South Spring	130	03-14-77	E	00010	17.0	03-14-77	F	371ABCKL
		—	—	-	00095	550	03-14-77	-	371ABCKL
		—	—	-	00400	6.8	03-14-77	-	371ABCKL
02S-05E-09 DBD 1	Unnamed	202	01-31-77	C	00010	14.0	01-31-77	S	367ABCKU
02S-05E-10 CCB 1	Unnamed	449	02-01-77	E	00010	15.5	02-01-77	F	367ABCKU
		—	—	-	00095	420	02-01-77	-	367ABCKU
		—	—	-	00400	7.2	02-01-77	-	367ABCKU
02S-05E-11 ACA 1	Unnamed	450	02-01-77	E	00010	16.0	02-01-77	F	367ABCKU
		121	06-02-77	C	00095	500	02-01-77	-	367ABCKU
		—	—	-	00400	7.2	02-01-77	-	367ABCKU
		—	—	-	00010	18.0	06-02-77	-	—
		—	—	-	00095	560	06-02-77	-	—
		—	—	-	00400	7.7	06-02-77	-	—
02S-05E-17 CBD 1	Unnamed	20.0	09-01-77	E	—	—	—	C	—
02S-05E-23 ABA 1	Unnamed	67.3	06-02-77	C	00010	13.5	02-01-77	F	367ABCKU
		—	—	-	00095	480	02-01-77	-	367ABCKU
		—	—	-	00400	7.2	02-01-77	-	367ABCKU
		—	—	-	00010	15.0	06-02-77	-	—
		—	—	-	00095	550	06-02-77	-	—
		—	—	-	00400	6.9	06-02-77	-	—
02S-06E-01 BDC 1	Unnamed	4.00	01-06-77	E	00010	9.0	01-06-77	D	—
		—	—	-	00095	560	01-06-77	-	—
		—	—	-	00400	7.2	01-06-77	-	—

02S-06E-18 CAA 1	Unnamed	583	12-08-76	C	00010	17.5	12-08-76	A	367ABCKU
		—	—	-	00095	650	12-08-76	-	367ABCKU
		—	—	-	00400	6.7	12-08-76	-	367ABCKU
02S-06E-20 BDA 1	Unnamed	45.0	01-03-77	E	00010	14.5	01-03-77	A	364SMPS
		—	—	-	00095	640	01-03-77	-	364SMPS
		—	—	-	00400	6.7	01-03-77	-	364SMPS
02S-06E-21 BBC 1	Smith Spring	153	12-07-76	C	00010	18.0	12-07-76	A	367ABCKU
		—	—	-	00095	620	12-07-76	-	367ABCKU
		—	—	-	00400	6.6	12-07-76	-	367ABCKU
02S-06E-22 ABB 1	Unnamed	45.0	12-07-76	E	00010	18.0	12-07-76	C	371ABCKL
		—	—	-	00095	550	12-07-76	-	371ABCKL
		—	—	-	00400	6.7	12-07-76	-	371ABCKL
02S-06E-22 DCC 1	Three Springs	108	12-07-76	C	00010	17.5	12-07-76	A	371ABCKL
		—	—	-	00095	540	12-07-76	-	371ABCKL
		—	—	-	00400	6.9	12-07-76	-	371ABCKL
02S-06E-27 BDD 1	Wolf Spring	89.8	12-07-76	C	00010	17.0	12-07-76	A	367ABCKU
		—	—	-	00095	510	12-07-76	-	367ABCKU
		—	—	-	00400	6.9	12-07-76	-	367ABCKU
02S-06E-27 DCA 1	Gum Spring	4.00	03-08-77	E				S	
02S-07E-03 CCB 1	Unnamed	4.00	03-08-77	E	00010	14.5	03-08-77	C	364SMPS
		—	—	-	00095	450	03-08-77	-	364SMPS
		—	—	-	00400	7.5	03-08-77	-	364SMPS
02S-07E-07 BAB 1	Diamond Spring	157	11-04-77	C	00010	18.0	08-24-76	F	367ABCKU
		—	—	-	00095	600	08-24-76	-	367ABCKU
		—	—	-	00300	8.1	08-24-76	-	367ABCKU
		—	—	-	00400	7.3	08-24-76	-	367ABCKU
02S-07E-09 BBB 1	Deadmans Spring	135	01-05-77	E	00010	16.5	01-05-77	C	364SMPS
		—	—	-	00095	790	01-05-77	-	364SMPS
		—	—	-	00400	6.6	01-05-77	-	364SMPS
02S-07E-13 CCA 1	Viola Spring	—	—	-	00010	18.0	01-04-77	C	367ABCKU
		—	—	-	00095	1,750	01-04-77	-	367ABCKU
		—	—	-	00400	7.0	01-04-77	-	367ABCKU
02S-07E-18 AAC 1	Unnamed	45.0	01-04-77	E	00010	17.0	01-04-77	C	367ABCKU
		—	—	-	00095	710	01-04-77	-	367ABCKU
		—	—	-	00400	6.7	01-04-77	-	367ABCKU
02S-07E-32 CDC 1	Desperado Spring	135	01-03-77	E	00010	17.5	01-03-77	C	367ABCKU
		—	—	-	00095	560	01-03-77	-	367ABCKU
		—	—	-	00400	6.8	01-03-77	-	367ABCKU

Appendix 5.—*Records of springs*—Continued

Local Well Number	Name of spring	Discharge (gal/min)	Date discharge measured	Method discharge measured	Water-quality parameter code	Value of water-quality parameter	Date quality parameter measured	Type of spring	Geologic unit sampled
Johnston County—Continued									
03S-04E-04 BCDD1	Tired Spring	50.0	03-16-77	E	00010	16.0	03-16-77	S	367ABCKU
03S-04E-04 DBB 1	Unnamed	.50	03-16-77	E	00010	16.0	03-16-77	S	367ABCKU
03S-04E-05 DBB 1	Chapman Spring	450	03-16-77	E	00010	17.0	03-16-77	T	367ABCKU
		426	05-25-77	C	00095	530	03-16-77	–	367ABCKU
		—	—	–	00400	6.7	03-16-77	–	367ABCKU
		—	—	–	00010	16.5	05-25-77	–	—
		—	—	–	00095	540	05-25-77	–	—
		—	—	–	00400	7.2	05-25-77	–	—
03S-04E-14 AAB 1	Unnamed	40.0	03-15-77	E	00010	16.0	03-15-77	C	367ABCKU
03S-04E-15 DCD 1	Unnamed	50.0	03-15-77	E	00010	16.0	03-15-77	S	367ABCKU
03S-04E-22 AAB 1	Webb Spring	225	03-15-77	E	00010	17.5	03-15-77	F	367ABCKU
		—	—	–	00095	550	03-15-77	–	367ABCKU
		—	—	–	00400	6.8	03-15-77	–	367ABCKU
03S-04E-24 CDB 1	Unnamed	50.0	03-15-77	E	00010	22.0	03-15-77	S	367ABCKU
03S-05E-30 DDC 1	Daube Spring	900	02-24-77	E	00010	18.0	09-23-77	F	367ABCKU
		120	09-23-77	E	00095	570	09-23-77	–	367ABCKU
		—	—	–	00400	7.6	09-23-77	–	367ABCKU
Murray County									
01S-01E-16 BCD 1	Boiling Spring	—	—	–	00010	19.0	08-10-78	F	367ABCKU
		—	—	–	00095	610	08-10-78	–	367ABCKU
		—	—	–	00400	7.4	08-10-78	–	367ABCKU
01S-01E-16 CAC 1	Unnamed	—	—	–	00010	17.0	08-10-78	F	367ABCKU
01S-01W-20 ACD 1	Unnamed	13.5	08-11-78	C	00010	18.0	08-11-78	F	367ABCKU
		—	—	–	00095	560	08-11-78	–	367ABCKU
		—	—	–	00400	7.0	08-11-78	–	367ABCKU
01S-01E-21 CDD 1	Unnamed	1.00	02-16-78	E	00010	12.0	02-16-78	F	371ABCKL
		—	—	–	00095	600	02-16-78	–	371ABCKL
		—	—	–	00400	7.5	02-16-78	–	371ABCKL

01S–01E–27 ADD 1	Unnamed	90.0	02–16–78	E	00010	16.5	02–16–78	F	371ABCKL
		—	—	–	00095	520	02–16–78	–	371ABCKL
		—	—	–	00400	7.3	02–16–78	–	371ABCKL
01S–01E–35 CDD 1	Unnamed	45.0	01–06–78	E	00010	15.5	01–06–78	F	371ABCKL
01S–03E–24 BDA 1	Unnamed	1,700	02–22–77	C	00010	16.0	02–22–77	–	364SMPS
		—	—	–	00095	600	02–22–77	–	364SMPS
		—	—	–	00400	7.5	02–22–77	–	364SMPS
01S–01W–09 CCB 1	Johnson Spring	31.4	04–25–78	C	00010	18.0	04–25–78	F	371ABCKL
		—	—	–	00095	550	04–25–78	–	371ABCKL
		—	—	–	00400	7.1	04–25–78	–	371ABCKL
01S–01W–09 DBD 1	Five Mile Spring	85.5	04–25–78	C	00010	18.0	04–25–78	S	371ABCKL
		—	—	–	00095	570	04–25–78	–	371ABCKL
		—	—	–	00400	7.0	04–25–78	–	371ABCKL
01S–01W–15 DAB 1	Unnamed	75.0	04–25–78	V	00010	17.5	04–25–78	F	371ABCKL
		—	—	–	00095	625	04–25–78	–	371ABCKL
		—	—	–	00400	7.2	04–25–78	–	371ABCKL
01S–01W–17 ABB 1	Pole Spring	250	04–25–78	E	00010	16.0	04–25–78	S	367ABCKU
		—	—	–	00095	470	04–25–78	–	367ABCKU
		—	—	–	00400	7.6	04–25–78	–	367ABCKU
01S–01W–17 CCA 1	Unnamed	956	04–25–78	C	00010	17.0	04–25–78	F	367ABCKU
		—	—	–	00095	500	04–25–78	–	367ABCKU
		—	—	–	00400	7.4	04–25–78	–	367ABCKU
01S–01W–26 ADA 1	Unnamed	50.0	04–18–78	E	00010	17.5	04–18–78	F	371ABCKL
01S–01W–26 ADD 1	Unnamed	50.0	04–18–78	E	00010	17.5	04–18–78	F	371ABCKL
01S–01W–26 BDC 1	Unnamed	30.0	04–18–78	E	00010	17.5	04–18–78	C	371ABCKL
01S–01W–26 CAA 1	Unnamed	135	04–18–78	E	00010	17.5	04–18–78	F	371ABCKL
		—	—	–	00095	470	04–18–78	–	371ABCKL
		—	—	–	00400	7.1	04–18–78	–	371ABCKL
02S–01E–02 AAA 1	Unnamed	100	01–31–78	E	00010	18.5	01–31–78	C	371ABCKL
		—	—	–	00095	590	01–31–78	–	371ABCKL
		—	—	–	00400	7.4	01–31–78	–	371ABCKL
02S–01E–07 DAD 1	Unnamed	90.0	04–13–78	E	00010	16.0	04–13–78	F	367ABCKU
		—	—	–	00095	540	04–13–78	–	367ABCKU
		—	—	–	00400	7.3	04–13–78	–	367ABCKU
02S–01E–08 CBC 1	Unnamed	225	04–12–78	C	00010	17.0	04–12–78	F	367ABCKU
		—	—	–	00095	530	04–12–78	–	367ABCKU
		—	—	–	00400	7.4	04–12–78	–	367ABCKU

Appendix 5.—*Records of springs*—Continued

Local Well Number	Name of spring	Discharge (gal/min)	Date discharge measured	Method discharge measured	Water-quality parameter code	Value of water-quality parameter	Date quality parameter measured	Type of spring	Geologic unit sampled
Murray County—Continued									
02S-01E-08 CCB 1	Unnamed	200	04-12-78	E	00010	17.5	04-12-78	J	367ABCKU
		—	—	-	00095	510	04-12-78	-	367ABCKU
		—	—	-	00400	7.3	04-12-78	-	367ABCKU
02S-01E-18 CCA 1	Unnamed	570	04-13-78	C	00010	17.5	04-13-78	F	367ABCKU
		—	—	-	00095	500	04-13-78	-	367ABCKU
		—	—	-	00400	7.4	04-13-78	-	367ABCKU
02S-01E-18 CCA 2	Unnamed	50.0	04-13-78	E	00010	17.5	04-13-78	F	367ABCKU
02S-01E-19 ABB 1	Jennings Spring	292	02-23-78	C	00010	14.5	02-23-78	F	364SMPS
		—	—	-	00095	500	02-23-78	-	364SMPS
		—	—	-	00400	7.5	02-23-78	-	364SMPS
02S-01E-10 BAB 1	Unnamed	30.0	02-23-78	E	00010	17.0	02-23-78	F	364SMPS
		—	—	-	00095	520	02-23-78	-	364SMPS
		—	—	-	00400	7.2	02-23-78	-	364SMPS
02S-01E-20 ABB 1	Pruett Spring								364SMPS
02S-01W-15 DAD 1	Cold Spring	900	05-04-78	E	00010	17.0	05-04-78	C	367ABCKU
		—	—	-	00095	500	05-04-78	-	367ABCKU
		—	—	-	00400	6.9	05-04-78	-	367ABCKU
02S-02E-05 DCC 1	Unnamed	89.8	12-30-77	C	00010	14.0	12-30-77	F	367ABCKU
		—	—	-	00095	560	12-30-77	-	367ABCKU
		—	—	-	00400	7.6	12-30-77	-	367ABCKU
02S-02E-10 BDD 1	Unnamed	120	12-29-77	V	00010	17.0	12-29-77	F	367ABCKU
		—	—	-	00095	570	12-29-77	-	367ABCKU
		—	—	-	00400	7.5	12-29-77	-	367ABCKU
02S-02E-10 BDD 2	Unnamed	40.0	12-29-77	E	00010	17.0	12-29-77	F	367ABCKU
02S-03E-24 BAA 1	Williams Spring	50.0	03-17-77	E	00010	16.0	03-17-77	F	367ABCKU
		—	—	-	00095	720	03-17-77	-	367ABCKU
		—	—	-	00400	6.6	03-17-77	-	367ABCKU
02S-03E-27 ABA 1	Unnamed	10.0	10-19-77	E	—	—	—	F	—
02S-04E-30 CAC 1	Blue Hole	1,500	04-28-77	E	00010	16.0	04-28-77	-	367ABCKU

02S-04E-31 BDB 1	Buck Irving	1,100	03-16-77	E	00010	18.0	03-16-77	F	367ABCKU
		—	—	-	00095	560	03-16-77	-	367ABCKU
		—	—	-	00400	6.7	03-16-77	-	367ABCKU
02S-04E-32 CCD 1	Unnamed	.10	03-16-77	E	—	—	—	S	—
Pontotoc County									
01N-06E-11 BDA 1	Unnamed	22.0	01-25-77	E	—	—	—	C	—
01N-06E-11 BDC 1	Sheep Creek Spring	1,080	08-24-76	C	00010	17.5	01-25-77	C	367ABCKU
		—	—	-	00095	590	01-25-77	-	367ABCKU
		—	—	-	00400	6.2	01-25-77	-	367ABCKU
		—	—	-	00010	16.0	08-24-76	-	—
		—	—	-	00095	600	08-24-76	-	—
		—	—	-	00400	7.9	08-24-76	-	—
01N-07E-19 ADA 1	Canyon Spring	269	01-26-77	C	00010	19.0	01-26-77	A	364SMPS
		—	—	-	00095	800	01-26-77	-	364SMPS
		—	—	-	00400	6.2	01-26-77	-	364SMPS
01N-07E-21 AAA 1	Wildcat Spring	45.0	03-07-77	E	00010	17.0	03-07-77	C	364SMPS
		—	—	-	00095	490	03-07-77	-	364SMPS
		—	—	-	00400	7.1	03-07-77	-	364SMPS
01N-07E-27 CDD 1	Coffee Pot Spring	135	03-07-77	V	00010	17.0	03-07-77	-	364SMPS
		—	—	-	00095	470	03-07-77	-	364SMPS
		—	—	-	00400	7.5	03-07-77	-	364SMPS
01N-07E-30 CDD 1	Unnamed	202	01-25-77	E	00010	17.5	01-25-77	T	364SMPS
		—	—	-	00095	580	01-25-77	-	364SMPS
		—	—	-	00400	6.8	01-25-77	-	364SMPS
01N-07E-34 CAB 1	Walnut Spring	—	—	-	—	—	—	-	—
01S-07E-28 AAB 2	Unnamed	4.00	02-01-77	E	00010	8.0	02-01-77	D	364SMPS
		—	—	-	00095	710	02-01-77	-	364SMPS
		—	—	-	00400	6.2	02-01-77	-	364SMPS
01S-07E-28 AAB 3	Unnamed	4.00	02-01-77	E				D	364SMPS
02N-05E-16 DBC 1	Lucas Spring	—	—	-	—	—	—	C	—
02N-06E-33 ADD 1	Unnamed	135	03-07-77	Z	00010	17.0	03-07-77	C	367ABCKU
		—	—	-	00095	620	03-07-77	-	367ABCKU
		—	—	-	00400	6.6	03-07-77	-	367ABCKU
02N-06E-34 CCC 1	Byrds Mill Spring **								

** Daily discharge reported in U.S. Geological Survey Water-Data Reports.

APPENDIX 6: Concentration of Common Constituents and Physical Properties of Water from Wells, Springs, and Streams

[Site: GW, well; SP, spring; SW, stream. Geologic unit: 364SMPS, Simpson Group; 367ABCKU, upper Arbuckle Group.]

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)	Car-bonate, total (mg/L as CO3)
Carter County										
02S-01E-22 DCC 1	GW	08-31-78	364SMPS	22.0	570	7.20	38	310	380	0
Johnston County										
01S-04E-03 ADD 1	GW	11-16-77	367ABCKU	16.0	640	7.40	25	320	390	0
01S-04E-27 DCA 1	SP	10-20-77	367ABCKU	17.5	640	7.30	30	310	380	0
01S-05E-27 AAB 1	GW	11-18-77	367ABCKU	17.0	580	7.30	30	310	380	0
01S-05E-34 DDD 1	SP	11-03-77	367ABCKU	17.0	580	7.50	20	330	400	0
01S-06E-19 CAA 1	GW	11-17-77	367ABCKU	17.5	725	7.20	46	380	460	0
01S-06E-21 ADB 1	SP	11-04-77	367ABCKU	18.0	610	7.50	16	250	310	0
01S-06E-24 CAD 1	SP	11-15-77	367ABCKU	17.5	580	7.40	26	340	410	0
01S-06E-25 CBB 1	GW	11-17-77	367ABCKU	17.5	590	7.30	32	330	400	0
01S-07E-19 CDC 1	SW	11-15-77		--	--	8.00	0	--	--	--
	SW	11-15-77		14.5	520	8.40	2.3	300	360	0
01S-07E-23 DDD 1	GW	11-17-77	364SMPS	17.5	600	7.10	48	310	380	0
01S-07E-34 ADD 1	SW	11-15-77		14.5	520	8.40	1.6	210	250	0
02S-04E-11 BBB 1	SW	10-20-77		17.0	600	8.30	2.9	300	360	0
02S-05E-06 BCD 1	GW	10-04-56	364SMPS	13.0	471	7.90	6.1	251	310	--
02S-05E-08 ABB 2	GW	12-05-77	364SMPS	15.5	580	7.40	25	330	400	0
02S-05E-10 DDD 1	GW	11-18-77	367ABCKU	16.5	510	7.40	20	260	320	0
02S-06E-18 CAA 1	SP	10-20-77	367ABCKU	17.0	700	7.30	35	360	440	0
02S-06E-19 CBD 1	SW	10-21-77		17.5	560	8.40	2.2	290	350	0
02S-07E-07 BAB 1	SP	11-04-77	367ABCKU	18.0	600	7.30	33	340	410	0
02S-08E-21 CCB 1	SP	08-15-63	364SMPS	--	633	8.20	4.0	325	400	--
03S-04E-05 DBB 1	SP	10-18-77	367ABCKU	19.0	590	7.10	35	230	280	0
03S-04E-17 BCD 1	SW	10-17-77		16.5	410	8.50	1.2	200	240	0
03S-05E-30 DDC 1	SP	10-20-77	367ABCKU	17.0	700	7.30	27	280	340	0
BLUE RIVER AT CONNERVILLE,	SW	09-10-51		20.5	459	8.00	4.9	251	310	0
OK (01S-06E-24 CBB 1)	SW	11-27-51		12.0	578	8.00	6.3	326	400	0
	SW	01-16-52		11.5	521	8.00	5.8	297	360	0
	SW	03-05-52		7.0	571	7.80	9.7	317	390	0
	SW	04-23-52		15.5	276	7.40	10	132	160	0
	SW	06-11-52		23.5	536	7.90	7.6	311	380	0
	SW	07-22-52		26.0	594	7.60	15	313	380	0
	SW	09-03-52		19.0	525	7.60	14	285	350	0

Local Identifier	Hard- ness (mg/L as CaCO3)	Calcium dis- solved (mg/L as Ca)	Magne- sium, dis- solved (mg/L as Mg)	Sodium, dis- solved (mg/L as Na)	Potas- sium, dis- solved (mg/L as K)	Fluo- ride, dis- solved (mg/L as F)	Chlo- ride, dis- solved (mg/L as Cl)	Sulfate dis- solved (mg/L as SO4)	Solids, residue at 180 deg. C dis- solved (mg/L)
Carter County-Continued									
02S-01E-22 DCC 1	310	110	7.4	15	0.70	0.20	5.3	16	354
Johnston County--Continued									
01S-04E-03 ADD 1	390	85	43	6.3	1.0	0.10	18	16	330
01S-04E-27 DCA 1	310	80	27	4.4	1.3	0.10	5.4	7.3	339
01S-05E-27 AAB 1	350	74	40	2.8	0.70	0.20	7.4	10	334
01S-05E-34 DDD 1	340	72	39	2.5	0.90	0.10	3.5	8.3	314
01S-06E-19 CAA 1	400	85	46	15	0.40	0.10	22	18	375
01S-06E-21 ADB 1	350	74	41	1.9	1.2	0.10	2.3	6.5	325
01S-06E-24 CAD 1	350	77	38	2.7	1.4	0.10	3.7	6.8	315
01S-06E-25 CBB 1	340	68	41	7.9	1.0	0.30	7.1	15	326
01S-07E-19 CDC 1	--	--	--	--	--	--	--	--	--
	320	65	38	3.2	1.4	0.10	3.6	7.0	274
01S-07E-23 DDD 1	350	110	18	2.2	1.0	0.10	5.6	11	346
01S-07E-34 ADD 1	250	67	21	20	2.5	0.10	39	25	284
02S-04E-11 BBB 1	320	62	39	5.1	1.6	0.10	6.2	8.1	275
02S-05E-06 BCD 1	260	40	38	6.1	1.0	0.0	11	12	251
02S-05E-08 ABB 2	350	78	38	4.2	0.80	0.10	4.4	9.8	326
02S-05E-10 DDD 1	310	96	16	1.4	0.40	0.20	1.9	7.8	285
02S-06E-18 CAA 1	350	76	40	2.3	0.80	0.10	3.2	5.8	328
02S-06E-19 CBD 1	310	63	36	2.5	0.90	0.10	3.2	8.1	285
02S-07E-07 BAB 1	350	73	41	3.6	0.90	0.10	6.3	7.3	276
02S-08E-21 CCB 1	340	--	--	8.0	--	--	18	11	359
03S-04E-05 DBB 1	320	110	12	2.0	0.60	0.10	2.7	7.8	330
03S-04E-17 BCD 1	210	57	17	5.2	1.0	0.20	5.9	11	210
03S-05E-30 DDC 1	300	100	11	3.0	0.80	0.10	3.1	6.4	304
BLUE RIVER AT CONNERVILLE, OK	260	55	31	--	--	--	3.5	--	--
	360	94	30	--	--	--	3.5	--	--
	340	87	31	2.6	--	--	2.5	--	--
	340	89	28	2.6	--	--	3.0	--	--
	150	34	17	2.8	--	--	2.2	--	--
	330	57	46	2.7	--	--	2.5	--	--
	330	68	39	5.2	--	--	8.0	--	--
	320	57	43	2.8	--	--	2.8	--	--

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)
Johnston County--Continued									
BLUE RIVER AT CONNERVILLE, OK	SW	11-18-52		15.5	571	8.10	5.0	324	400
	SW	12-23-52		10.5	495	7.90	6.8	278	340
	SW	02-04-53		13.0	587	8.00	6.5	336	410
	SW	03-10-53		11.5	563	8.00	6.2	320	390
	SW	06-02-53		23.0	585	8.10	4.9	322	390
	SW	06-23-53		29.5	547	7.80	9.1	297	360
	SW	08-19-53		23.0	531	8.10	4.6	298	360
	SW	09-30-53		22.0	507	7.90	6.9	283	350
	SW	11-17-53		15.5	592	8.00	6.4	332	410
	SW	01-12-54		6.0	591	8.10	5.1	331	400
	SW	02-25-54		14.0	559	8.10	4.8	310	380
	SW	04-20-54		20.0	448	7.90	6.2	253	310
	SW	05-28-54		20.5	361	8.50	1.1	196	220
	SW	07-14-54		24.0	548	7.90	7.3	300	370
	SW	08-24-54		23.0	524	8.20	4.3	350	430
	SW	09-16-54		20.0	577	7.80	9.4	308	380
	SW	11-23-54		10.0	624	8.30	3.2	336	400
	SW	12-21-54		11.0	599	8.10	5.1	333	410
	SW	02-01-55		13.0	546	7.90	7.0	285	350
	SW	03-02-55		17.0	527	8.00	4.7	241	290
	SW	06-13-55		21.5	607	7.00	58	302	370
	SW	07-27-55		28.0	568	7.20	30	246	300
	SW	09-21-55		22.0	602	8.20	2.7	223	270
	SW	10-31-55		16.0	594	6.90	81	331	400
	SW	01-04-56		15.0	616	7.80	11	351	430
	SW	02-14-56		16.0	353	8.00	3.8	198	240
	SW	03-29-56		17.0	524	8.10	3.2	205	250
	SW	05-21-56		24.0	601	7.70	8.1	210	260
	SW	07-18-56		25.5	577	7.40	26	341	420
	SW	08-21-56		18.5	513	7.70	12	299	360
	SW	08-28-56		19.5	511	7.70	11	295	360
	SW	09-24-56		15.0	497	7.70	11	290	350
	SW	10-19-61		--	399	8.30	1.9	217	240
	SW	11-02-61		--	345	8.50	1.1	192	220
	SW	12-07-61		--	416	8.30	2.2	228	270

Local Identifier	Carbonate, total (mg/L as CO3)	Hardness (mg/L as CaCO3)	Calcium dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Chloride, dissolved (mg/L as Cl)	Sulfate dissolved (mg/L as SO4)	Solids, residue at 180 deg. C dissolved (mg/L)
Johnston County--Continued								
BLUE RIVER AT CONNERVILLE, OK	0	330	67	39	2.5	3.2	--	--
	0	280	48	39	2.7	3.0	--	--
	0	350	75	39	2.6	2.5	--	--
	0	330	70	37	2.5	2.5	--	--
	0	320	74	34	2.7	3.2	--	--
	0	300	59	38	2.6	3.0	--	--
	0	300	59	36	2.3	2.2	--	--
	0	290	69	28	2.6	2.5	--	--
	0	330	84	30	3.6	2.8	--	--
	0	340	74	37	2.4	3.5	--	--
	0	260	61	27	2.4	3.5	--	--
	0	230	38	33	2.4	3.0	--	--
	8	210	11	44	2.0	4.0	--	--
	0	300	28	55	1.9	3.5	--	--
	0	260	34	43	3.7	3.0	--	--
	0	340	64	43	2.2	4.5	--	--
	4	420	85	51	1.4	6.0	--	--
	0	380	88	39	2.4	5.5	--	--
	0	320	74	33	2.6	5.0	--	--
	0	270	53	34	2.9	5.0	--	--
	0	330	68	39	5.0	5.5	--	--
	0	320	69	36	5.0	8.0	--	--
	0	260	29	45	3.6	6.0	--	--
	0	360	70	45	4.2	9.5	--	--
	0	350	74	40	2.7	4.0	--	--
	0	210	18	41	4.0	2.4	--	--
	0	260	56	29	6.1	3.3	--	--
	0	340	66	43	3.4	5.0	--	--
	0	370	67	49	2.4	5.0	--	--
	0	340	51	51	2.6	6.0	--	--
	0	300	50	43	2.4	5.8	--	--
	0	290	40	46	2.8	3.6	--	--
	10	220	37	31	4.1	4.0	4.8	228
	8	200	20	36	4.8	5.7	7.8	--
	4	230	38	34	2.5	2.8	6.9	--

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)	Car-bonate, total (mg/L as CO3)
Johnston County--Continued										
BLUE RIVER AT CONNERVILLE,	SW	01-12-62		--	332	8.50	1.0	186	200	12
OK	SW	03-02-62		--	309	8.30	2.2	236	280	4
	SW	04-04-62		--	313	8.40	1.2	161	190	2
	SW	05-09-62		--	315	8.40	1.3	172	200	4
	SW	06-20-62		--	415	8.20	2.8	226	280	0
	SW	08-14-62		--	352	8.40	1.4	195	230	6
	SW	09-11-62		--	383	8.20	2.6	210	260	0
	SW	02-22-77		17.0	605	7.40	0	--	--	--
	SW	09-22-77		21.5	575	8.00	0	--	--	--
01S-06E-24 CBB 1	SW	11-14-77		15.5	560	8.00	5.7	300	360	0
	SW	08-23-78		23.0	520	7.60	0	--	--	--
BLUE RIVER AT MILBURN, OK	SW	08-28-56		27.0	434	8.00	5.0	259	320	0
(03S-07E-19 DBC 1)	SW	10-02-57		21.0	491	8.70	0.6	174	190	10
	SW	11-12-57		10.0	459	8.10	3.2	207	250	0
	SW	01-17-58		11.5	455	8.70	0.6	168	190	8
	SW	03-19-58		10.5	506	8.70	0.6	164	180	8
	SW	06-11-58		29.5	359	8.40	1.4	192	220	8
	SW	09-05-58		26.0	379	8.50	1	184	190	16
	SW	11-05-58		15.0	402	8.50	1.0	186	210	10
	SW	01-08-59		4.0	276	8.20	1.9	156	190	0
	SW	01-27-60		--	313	8.40	1.1	158	180	8
	SW	03-23-60		--	390	8.20	2.4	194	240	0
	SW	11-20-75		11.0	420	8.60	0	--	--	--
	SW	12-18-75		5.0	500	8.80	0	--	--	--
BLUE RIVER NR CONNERVILLE,	SW	10-21-77		17.5	540	8.00	5.9	303	370	0
OK (02S-07E-17 CBB 1)	SW	09-07-78		22.5	530	--	--	--	--	--
DELAWARE CREEK NR WAPANUCKA	SW	02-24-58		12.0	762	8.20	1.6	128	160	0
OK (02S-08E-02 DDA 1)	SW	04-07-58		15.0	646	7.90	3.6	148	180	0
	SW	01-26-60		--	385	8.30	1	--	120	4
	SW	03-23-60		--	487	8.20	2.0	--	200	0
	SW	05-03-60		--	572	8.20	3.0	--	300	0

Local Identifier	Hard- ness (mg/L as CaCO3)	Calcium dis- solved (mg/L as Ca)	Magne- sium, dis- solved (mg/L as Mg)	Sodium, dis- solved (mg/L as Na)	Potas- sium, dis- solved (mg/L as K)	Fluo- ride, dis- solved (mg/L as F)	Chlo- ride, dis- solved (mg/L as Cl)	Sulfate dis- solved (mg/L as SO4)	Solids, residue at 18Ø deg. C dis- solved (mg/L)
Johnston County--Continued									
BLUE RIVER AT CONNERVILLE, OK	19Ø	18	35	5.8	--	--	4.4	8.Ø	183
	24Ø	32	38	5.1	--	--	2.4	6.8	--
	16Ø	--	--	3.7	--	--	3.4	6.Ø	151
	17Ø	--	--	2.8	--	--	2.4	2.2	153
	23Ø	--	--	3.4	--	--	3.2	6.8	232
	19Ø	--	--	6.Ø	--	--	4.2	5.8	185
	21Ø	--	--	4.4	--	--	2.1	4.2	2Ø3
	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--
Ø1S-Ø6E-24 CBB 1	35Ø	73	4Ø	1.9	1.3	Ø.1Ø	2.5	6.5	272
	--	--	--	--	--	--	--	--	--
BLUE RIVER AT MILBURN, OK	28Ø	34	47	3.1	--	--	5.2	--	--
	19Ø	21	34	2.8	--	--	4.9	--	--
	21Ø	38	29	4.Ø	--	--	5.5	--	--
	19Ø	2Ø	33	4.2	--	--	6.4	--	--
	18Ø	18	32	3.6	--	--	6.3	--	--
	21Ø	2Ø	4Ø	3.8	--	--	4.5	--	--
	18Ø	18	34	6.2	--	--	6.5	--	--
	18Ø	16	33	5.Ø	--	--	9.Ø	--	--
	16Ø	18	29	3.Ø	--	--	6.2	--	--
	17Ø	18	3Ø	5.Ø	--	--	5.6	--	--
	19Ø	22	33	6.Ø	--	--	6.6	--	--
	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--
BLUE RIVER NR CONNERVILLE, OK	31Ø	63	38	2.7	1.4	Ø.1Ø	3.Ø	4.6	275
	--	--	--	--	--	--	--	--	--
DELAWARE CREEK NR WAPANUCKA, OK	18Ø	26	28	34	--	--	7Ø	--	--
	18Ø	3Ø	26	3Ø	--	--	5Ø	--	--
	15Ø	26	2Ø	24	--	--	41	--	--
	21Ø	46	23	25	--	--	46	--	--
	28Ø	69	26	31	--	--	48	--	--

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)
Johnston County--Continued									
MILL CREEK NR MILL CREEK, OK (02S-04E-11 BBB 1)	SW	09-03-52		19.5	490	7.90	6.3	259	320
	SW	10-09-52		13.0	576	8.10	5.6	361	440
	SW	11-18-52		16.0	598	8.10	5.1	329	400
	SW	12-23-52		9.0	558	8.10	4.7	308	380
	SW	02-04-53		13.0	577	8.00	6.1	317	390
	SW	03-10-53		10.0	496	8.30	2.6	273	330
	SW	04-14-53		16.0	554	8.00	5.8	300	370
	SW	06-02-53		28.0	554	8.00	5.7	293	360
	SW	06-23-53		28.5	451	8.30	2.3	239	290
	SW	08-19-53		21.0	471	8.30	2.4	254	300
	SW	09-30-53		22.0	448	8.40	1.8	241	280
	SW	11-23-54		9.0	651	8.30	3.2	348	400
	SW	12-21-54		10.0	600	8.20	4.1	333	410
	SW	02-01-55		13.5	574	8.10	4.7	305	370
	SW	03-01-55		16.0	588	8.20	2.6	217	260
	SW	06-13-55		20.5	466	7.20	24	200	240
	SW	07-27-55		28.5	538	7.20	37	302	370
	SW	09-21-55		23.5	552	8.20	3.6	299	360
	SW	01-27-60		--	485	7.50	15	--	300
	SW	05-03-60		--	431	7.70	9.4	--	300
MILL CREEK NR RAVIA, OK (03S-05E-32 BBB 1)	SW	10-09-68		--	181	8.20	1	80	98
	SW	10-18-68		--	382	8.60	0.8	195	210
	SW	10-31-68		--	443	8.50	1.2	221	250
	SW	11-19-68		--	490	8.40	1.5	192	230
	SW	11-25-68		--	441	8.40	1.4	194	230
	SW	11-27-68		--	185	8.00	1.5	79	96
	SW	12-07-68		--	426	8.50	1.2	217	250
	SW	12-17-68		--	494	8.30	2.3	244	290
	SW	12-28-68		--	224	8.10	1.5	98	120
	SW	01-01-69		--	395	8.50	0.8	141	160

Local Identifier	Carbonate, total (mg/L as CO3)	Hardness (mg/L as CaCO3)	Calcium dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Chloride, dissolved (mg/L as Cl)	Sulfate dissolved (mg/L as SO4)	Solids, residue at 180 deg. C dissolved (mg/L)
Johnston County--Continued								
MILL CREEK NR MILL CREEK, OK	0	290	42	46	5.0	6.5	--	--
	0	310	54	42	4.6	6.8	--	--
	0	340	67	42	4.7	6.0	--	--
	0	320	64	39	4.8	6.5	--	--
	0	330	63	41	4.8	5.8	--	--
	3	270	45	39	4.1	5.5	--	--
	0	310	63	38	4.8	7.0	--	--
	0	310	57	40	5.0	7.2	--	--
	3	230	33	37	5.0	7.0	--	--
	6	250	40	37	5.4	6.5	--	--
	8	240	33	38	5.4	7.2	--	--
	14	380	90	38	3.8	9.0	--	--
	0	340	74	38	4.4	7.0	--	--
	0	340	66	43	4.6	8.0	--	--
	0	280	62	31	4.6	9.5	--	--
	0	220	34	33	4.8	8.8	--	--
	0	320	59	43	4.3	9.0	--	--
	0	310	49	46	5.7	7.0	--	--
	0	260	51	33	5.5	10	--	--
	0	240	51	27	--	6.0	--	--
MILL CREEK NR RAVIA, OK	0	82	--	--	4.5	4.6	4.0	101
	14	200	--	--	6.2	6.4	7.9	221
	12	220	--	--	7.3	7.9	9.2	236
	2	210	--	--	9.9	10	10	223
	4	200	--	--	8.0	7.4	4.4	264
	0	84	--	--	4.0	3.8	8.4	100
	8	220	--	--	6.5	4.9	11	244
	2	250	--	--	7.1	6.2	10	262
	0	100	--	--	5.0	3.8	6.4	140
	4	140	--	--	7.2	7.0	9.3	208

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)
Johnston County--Continued									
MILL CREEK NR RAVIA, OK	SW	01-18-69		--	536	8.60	0.7	154	170
	SW	01-29-69		--	448	8.60	0.6	157	160
	SW	02-01-69		--	483	8.60	0.9	198	230
	SW	02-22-69		--	241	8.20	1.3	103	130
	SW	02-27-69		--	428	8.50	1.1	187	210
	SW	03-05-69		--	415	8.50	1.1	189	210
	SW	03-23-69		--	262	8.40	0.9	125	140
	SW	03-29-69		--	250	8.40	0.8	113	130
	SW	04-07-69		--	393	8.60	0.8	167	200
	SW	04-15-69		--	496	8.70	0.5	138	150
	SW	04-27-69		--	189	8.60	0.4	89	100
	SW	05-07-69		--	207	8.60	0.4	98	110
	SW	05-10-69		--	369	8.40	1.4	187	220
	SW	05-30-69		--	424	8.80	0.4	169	180
	SW	06-09-69		--	386	8.40	1.4	190	220
	SW	06-19-69		--	221	9.00	0.2	102	100
	SW	06-29-69		--	317	8.70	0.6	157	180
	SW	07-02-69		--	322	8.80	0.4	162	170
	SW	07-20-69		--	378	8.70	0.7	195	210
	SW	07-28-69		--	401	8.80	0.5	200	210
	SW	08-07-69		--	366	8.60	0.8	174	200
	SW	08-17-69		--	386	8.80	0.5	174	180
	SW	08-27-69		--	346	8.90	0.3	166	160
	SW	09-05-69		--	380	8.50	1.1	194	210
	SW	09-18-69		--	340	8.50	1.0	177	200
	SW	09-27-69		--	360	8.60	0.8	180	200
PENNINGTON CREEK NR REAGAN, OK (02S-06E-30 DBA 1)	SW	09-10-51		24.0	361	8.20	2.4	194	240
	SW	11-27-51		11.0	542	7.90	7.4	302	370
	SW	01-16-52		11.0	499	8.10	4.3	277	340
	SW	03-05-52		8.5	533	8.00	5.6	290	350
	SW	04-23-52		14.5	396	8.20	2.4	200	240
	SW	06-11-52		22.0	545	8.00	5.6	290	350
	SW	09-03-52		23.5	450	7.90	5.9	243	300
	SW	10-09-52		14.5	508	8.00	5.5	282	340
	SW	11-18-52		15.0	564	8.20	3.9	317	390

Local Identifier	Car-bonate, total (mg/L as CO3)	Hard-ness (mg/L as CaCO3)	Calcium dis-solved (mg/L as Ca)	Magne-sium, dis-solved (mg/L as Mg)	Sodium, dis-solved (mg/L as Na)	Chlo-ride, dis-solved (mg/L as Cl)	Sulfate dis-solved (mg/L as SO4)	Solids, residue at 180 deg. C dis-solved (mg/L)
Johnston County--Continued								
MILL CREEK NR RAVIA, OK	8	160	--	--	17	22	13	323
	16	170	--	--	11	12	11	260
	8	190	--	--	9.8	6.4	13	289
	0	110	--	--	6.0	5.0	8.7	155
	8	190	--	--	7.4	6.5	13	263
	8	200	--	--	7.2	7.7	12	249
	6	130	--	--	6.4	5.9	8.7	157
	2	120	--	--	5.7	5.3	8.8	153
	4	170	--	--	8.0	6.5	11	183
	10	140	--	--	17	23	11	206
	2	90	--	--	4.4	3.5	5.3	140
	6	100	--	--	4.2	2.5	5.0	152
	4	200	--	--	6.9	4.8	9.5	234
	14	180	--	--	6.6	7.2	9.3	200
	4	190	--	--	8.8	6.6	10	218
	12	100	--	--	6.4	3.6	6.4	119
	8	160	--	--	8.6	6.7	8.8	175
	14	160	--	--	8.4	7.4	8.6	174
	14	200	--	--	8.1	8.3	7.2	214
	16	210	--	--	11	12	9.8	224
	6	180	--	--	7.4	8.4	13	200
	16	180	--	--	10	12	13	179
	22	160	--	--	6.7	8.0	9.0	167
	12	200	--	--	7.3	8.0	13	210
	8	180	--	--	6.3	7.1	9.0	209
	8	190	--	--	6.8	7.2	11	187
PENNINGTON CREEK NR REAGAN, OK	0	210	31	32	--	4.8	--	--
	0	330	83	29	--	3.5	--	--
	0	300	79	25	3.3	4.2	--	--
	0	310	93	18	2.8	4.0	--	--
	0	230	55	23	2.7	3.0	--	--
	0	330	59	45	3.7	4.8	--	--
	0	280	36	45	3.0	3.8	--	--
	0	290	46	42	2.8	4.0	--	--
	0	330	62	42	3.9	4.8	--	--

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)
Johnston County--Continued								
PENNINGTON CREEK NR REAGAN, OK	SW	02-04-53		11.0	539	8.00	6.0	308
	SW	03-10-53		13.0	521	--	--	293
	SW	04-14-53		16.5	504	8.10	4.0	261
	SW	06-02-53		26.0	516	8.10	4.4	289
	SW	06-23-53		28.0	530	7.90	7.0	285
	SW	08-19-53		25.0	435	8.20	2.9	235
	SW	09-30-53		23.0	430	8.40	1.7	234
	SW	11-17-53		13.5	548	8.10	4.7	307
	SW	01-12-54		4.5	485	8.20	3.6	294
	SW	02-25-54		15.0	532	8.20	3.5	286
	SW	04-20-54		18.0	566	8.00	5.5	283
	SW	05-28-54		23.0	356	8.60	0.8	184
	SW	07-14-54		28.0	496	8.20	3.1	251
	SW	08-24-54		25.5	402	8.60	0.9	198
	SW	09-16-54		21.0	510	8.00	5.2	269
	SW	11-23-54		11.5	606	8.40	2.2	305
	SW	12-21-54		11.0	668	8.10	4.8	313
	SW	02-01-55		12.0	556	8.10	4.6	299
	SW	03-02-55		18.0	556	7.90	5.9	243
	SW	06-13-55		23.0	433	7.40	17	220
	SW	07-27-55		28.0	522	7.20	36	294
	SW	09-21-55		21.0	566	8.30	2.5	264
	SW	11-12-57		10.0	588	8.00	6.4	330
	SW	01-17-58		10.5	481	8.80	0.5	184
	SW	03-19-58		11.5	555	8.40	1.8	236
	SW	06-11-58		24.5	415	8.30	2.0	220
	SW	11-05-58		--	335	8.60	0.8	184
	SW	01-08-59		4.5	198	8.40	0.7	107

Local Identifier	Bicarbonate, total (mg/L as HCO3)	Carbonate, total (mg/L as CO3)	Hardness (mg/L as CaCO3)	Calcium dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Chloride, dissolved (mg/L as Cl)
Johnston County--Continued							
PENNINGTON CREEK NR REAGAN, OK	380	0	320	61	40	2.5	4.0
	360	0	300	55	39	2.7	3.8
	320	0	290	51	40	2.7	4.2
	350	0	290	53	38	2.7	3.8
	350	0	290	53	38	3.0	3.5
	290	0	230	34	36	2.6	3.0
	270	10	230	31	37	2.9	4.8
	370	0	310	61	38	2.6	2.8
	360	0	290	56	37	3.0	3.8
	350	0	270	48	37	2.7	4.5
	350	0	310	60	40	2.6	24
	210	9	190	14	38	2.0	4.5
	310	0	230	18	44	2.2	4.5
	230	8	240	19	46	2.5	5.0
	330	0	310	47	47	1.7	5.0
	340	14	390	110	26	1.9	6.0
	380	0	300	64	34	2.8	4.0
	360	0	360	65	48	2.2	5.0
	300	0	250	58	26	2.3	6.0
	270	0	220	26	38	3.7	4.5
	360	0	300	59	37	3.1	4.5
	320	2	300	36	50	3.1	3.0
	400	0	330	72	37	3.9	4.0
	200	12	200	17	38	1.9	3.9
	280	4	250	14	53	1.5	4.0
	250	8	240	25	42	3.6	6.6
	200	12	180	14	36	5.0	5.0
	120	6	100	14	17	2.6	2.5

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)	Car-bonate, total (mg/L as CO3)
Murray County										
Ø1S-Ø1E-15 BCB 1	SW	Ø9-Ø7-78		27.Ø	44Ø	8.3Ø	1.8	19Ø	23Ø	Ø
Ø1S-Ø1E-28 DDA 1	GW	Ø8-31-78	367ABCKU	17.Ø	6ØØ	7.1Ø	52	34Ø	41Ø	Ø
Ø1S-Ø1E-29 CDA 1	GW	Ø9-Ø7-78	371ABCKL	19.Ø	58Ø	7.1Ø	43	28Ø	34Ø	Ø
Ø1S-Ø1W-Ø7 DCC 1	SW	Ø9-Ø8-78		25.Ø	47Ø	8.ØØ	3.3	17Ø	21Ø	Ø
Ø1S-Ø1W-36 DCC 1	GW	Ø9-Ø7-78	367ABCKU	19.Ø	46Ø	7.1Ø	39	25Ø	31Ø	Ø
Ø1S-Ø2E-3Ø CDB 1	SW	Ø9-Ø1-78		27.Ø	32Ø	8.1Ø	2.3	15Ø	18Ø	Ø
Ø1S-Ø2E-31 CAC 1	GW	Ø9-Ø1-78	367ABCKU	18.5	6ØØ	7.1Ø	5Ø	33Ø	4ØØ	Ø
Ø1S-Ø3E-24 BDA 1	SPGW	1Ø-18-77	364SMPS	17.Ø	61Ø	7.4Ø	25	33Ø	4ØØ	Ø
Ø2S-Ø1W-15 DAD 1	SW	Ø9-Ø8-78		19.Ø	57Ø	7.4Ø	22	29Ø	35Ø	Ø
Ø2S-Ø2E-Ø7 BDA 1	GW	Ø9-Ø7-78	367ABCKU	21.Ø	57Ø	7.6Ø	15	31Ø	38Ø	Ø
Ø2S-Ø2E-18 BDD 1	GW	Ø9-Ø1-78	367ABCKU	25.Ø	53Ø	7.5Ø	19	3ØØ	37Ø	Ø
Ø2S-Ø2E-33 CBB 1	SW	Ø8-31-78		24.Ø	47Ø	8.1Ø	3.5	23Ø	28Ø	Ø
Ø2S-Ø3E-Ø9 AAB 1	GW	1Ø-19-77	364SMPS	19.Ø	56Ø	7.6Ø	12	25Ø	31Ø	Ø
Ø2S-Ø3E-24 ABA 1	GW	1Ø-18-77	367ABCKU	18.Ø	57Ø	7.1Ø	48	31Ø	38Ø	Ø
Ø2S-Ø3E-27 AAA 1	GW	1Ø-19-77	364SMPS	19.Ø	79Ø	7.ØØ	54	28Ø	34Ø	Ø
Ø2S-Ø4E-31 BBB 1	SP	1Ø-18-77	367ABCKU	17.5	59Ø	6.9Ø	76	31Ø	38Ø	Ø
HONEY CREEK NR DAVIS, OK	SW	Ø7-23-53		23.Ø	333	8.ØØ	3.1	16Ø	2ØØ	Ø
	SW	Ø2-28-55		18.Ø	317	8.1Ø	2.2	143	17Ø	Ø
	SW	11-Ø1-55		15.5	369	7.7Ø	7.Ø	18Ø	22Ø	Ø
	SW	Ø5-23-56		23.5	435	7.5Ø	14	225	27Ø	Ø
	SW	Ø8-22-56		24.5	39Ø	7.3Ø	19	195	24Ø	Ø
HONEY CREEK NR TURNER FALLS OK	SW	Ø2-24-51		15.Ø	4Ø5	--	--	218	27Ø	--
	SW	Ø5-Ø3-51		23.Ø	4Ø5	8.2Ø	2.5	2Ø8	25Ø	--

Local Identifier	Hard-ness (mg/L as CaCO3)	Calcium dis-solved (mg/L as Ca)	Magne-sium, dis-solved (mg/L as Mg)	Sodium, dis-solved (mg/L as Na)	Potas-sium, dis-solved (mg/L as K)	Fluo-ride, dis-solved (mg/L as F)	Chlo-ride, dis-solved (mg/L as Cl)	Sulfate dis-solved (mg/L as SO4)	Solids, residue at 180 deg. C dis-solved (mg/L)
Murray County--Continued									
01S-01E-15 BCB 1	250	64	21	7.0	0.90	0.20	9.5	53	282
01S-01E-28 DDA 1	350	130	7.0	3.7	0.30	0.20	2.7	11	370
01S-01E-29 CCA 1	330	97	21	7.7	1.0	0.10	14	17	360
01S-01W-07 DCC 1	210	70	7.7	16	0.70	0.10	20	34	256
01S-01W-36 DCC 1	270	98	5.2	4.2	0.40	0.10	3.2	10	282
01S-02E-30 CDB 1	160	43	13	4.8	0.60	0.10	8.0	13	186
01S-02E-31 CAC 1	320	120	6.1	3.6	0.80	0.10	2.4	10	361
01S-03E-24 BDA 1	330	73	36	8.8	1.5	0.10	12	8.7	322
02S-01W-15 DAD 1	330	110	13	6.4	0.50	0.20	5.6	52	379
02S-02E-07 BDA 1	330	73	37	5.1	0.80	0.10	8.5	14	342
02S-02E-18 BDD 1	300	100	13	4.4	0.80	0.10	3.6	12	332
02S-02E-33 CBB 1	280	78	20	3.4	0.80	0.10	5.5	16	250
02S-03E-09 AAB 1	170	39	18	66	4.7	0.30	9.0	6.0	314
02S-03E-24 ABA 1	320	78	30	2.5	1.0	0.20	2.6	5.8	304
02S-03E-27 AAA 1	390	140	9.7	29	1.3	0.50	35	69	452
02S-04E-31 BBB 1	310	100	15	2.5	0.70	0.20	2.6	10	328
HONEY CREEK NR DAVIS, OK	170	45	13	4.4	--	--	7.0	--	--
	140	47	6.7	2.8	--	--	8.0	--	--
	190	54	14	7.6	--	--	8.0	--	--
	230	61	19	6.1	--	--	11	--	--
	210	54	18	6.1	--	--	12	--	--
HONEY CREEK NR TURNER FALLS OK	220	75	8.7	--	--	--	2.8	6.8	228
	210	70	9.2	--	--	--	4.5	23	244

Appendix 6.--*Concentration of common constituents and physical properties of water from wells, springs, and streams*--Continued

Local Identifier	Site	Date	Geo-logic unit	Temper-ature (deg C)	Spe-cific con-duct-ance (us/cm)	pH (stand-ard units)	Carbon dioxide dis-solved (mg/L as CO2)	Alka-linity, total (mg/L as CaCO3)	Bicar-bonate, total (mg/L as HCO3)	Car-bonate, total (mg/L as CO3)
Pontotoc County										
Ø1N-Ø4E-36 BBA 1	GW	Ø9-23-56	367ABCKU	1Ø.Ø	614	7.9Ø	7.6	312	38Ø	--
Ø1N-Ø5E-Ø3 CCB 1	GW	1Ø-Ø3-56	367ABCKU	15.5	831	7.5Ø	2Ø	323	39Ø	--
Ø1N-Ø5E-Ø4 BAA 1	GW	1Ø-Ø3-56	367ABCKU	13.Ø	575	7.8Ø	1Ø	331	4ØØ	--
Ø1N-Ø5E-Ø6 BAA 1	GW	1Ø-Ø3-56	367ABCKU	13.Ø	541	7.8Ø	9.5	3Ø8	38Ø	--
Ø1N-Ø5E-16 BDB 1	GW	Ø9-23-56	367ABCKU	13.Ø	722	7.9Ø	7.5	3Ø7	37Ø	--
Ø1N-Ø5E-27 DCC 1	GW	Ø2-Ø6-59	371ABCKL	--	511	8.2Ø	3.4	282	34Ø	--
Ø1N-Ø5E-31 CDB 1	GW	11-16-77	367ABCKU	16.5	56Ø	7.5Ø	18	29Ø	35Ø	Ø
Ø1N-Ø6E-Ø4 CAD 1	GW	Ø1-18-59	367ABCKU	--	619	7.7Ø	13	336	41Ø	--
Ø1N-Ø6E-Ø5 BBC 1	GW	1Ø-Ø3-56	367ABCKU	1Ø.Ø	652	7.5Ø	23	367	45Ø	--
Ø1N-Ø6E-11 BDC 1	SP	11-16-77	367ABCKU	17.Ø	59Ø	7.2Ø	4Ø	33Ø	4ØØ	Ø
Ø1N-Ø6E-18 BAB 1	GW	11-17-77	367ABCKU	17.5	58Ø	7.4Ø	25	32Ø	39Ø	Ø
Ø1N-Ø7E-19 ADA 1	SP	11-15-77	364SMPS	18.Ø	79Ø	7.3Ø	32	33Ø	4ØØ	Ø
Ø1N-Ø7E-31 BCA 1	GW	11-17-77	364SMPS	17.Ø	875	7.1Ø	54	35Ø	43Ø	Ø
Ø2N-Ø4E-13 DCC 1	GW	Ø9-23-56	364SMPS	16.Ø	553	7.9Ø	7.6	312	38Ø	--
Ø2N-Ø4E-23 DAA 1	GW	11-16-77	367ABCKU	18.5	8ØØ	7.5Ø	15	24Ø	29Ø	Ø
Ø2N-Ø5E-21 DCD 1	GW	11-16-77	367ABCKU	17.5	825	7.2Ø	36	3ØØ	36Ø	Ø
Ø2N-Ø5E-35 CAB 1	GW	1Ø-Ø3-56	367ABCKU	13.Ø	464	7.9Ø	6.5	266	32Ø	--
Ø2N-Ø5E-36 DAD 1	GW	Ø9-23-56	367ABCKU	13.Ø	596	8.ØØ	6.6	341	42Ø	--
Ø2N-Ø6E-14 DCD 1	GW	Ø9-23-56	364SMPS	15.5	577	8.ØØ	6.3	323	39Ø	--
Ø2N-Ø6E-34 ACA 1	GW	Ø5-Ø3-51	364SMPS	--	6Ø8	7.9Ø	8.4	343	42Ø	--
Ø2N-Ø6E-34 CCC 1	SP	Ø9-23-56	367ABCKU	1Ø.Ø	532	7.9Ø	7.4	3Ø5	37Ø	--
BYRDS MILL SPRING NR FITTSTOWN, OK	SW	12-22-54		17.Ø	623	8.1Ø	5.2	338	41Ø	Ø
(Ø2N-Ø6E-34 CCC 1)	SW	11-29-55		15.5	548	7.7Ø	12	299	36Ø	Ø

Local Identifier	Hardness (mg/L as 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)	Fluoride, dissolved (mg/L as F)	Chloride, dissolved (mg/L as Cl)	Sulfate dissolved (mg/L as SO4)	Solids, residue at 180 deg. C dissolved (mg/L)
Pontotoc County--Continued									
Ø1N-Ø4E-36 BBA 1	35Ø	72	41	3.6	1.2	Ø.Ø	11	7.4	356
Ø1N-Ø5E-Ø3 CCB 1	45Ø	93	53	5.2	1.2	Ø.1Ø	3Ø	2Ø	499
Ø1N-Ø5E-Ø4 BAA 1	33Ø	72	37	5.2	1.8	Ø.Ø	3.7	7.2	3Ø8
Ø1N-Ø5E-Ø6 BAA 1	31Ø	68	35	2.6	1.Ø	Ø.Ø	5.2	3.9	292
Ø1N-Ø5E-16 BDB 1	4ØØ	79	49	8.Ø	3.1	Ø.2Ø	25	19	444
Ø1N-Ø5E-27 DCC 1	3ØØ	42	47	7.Ø	1.4	--	1.7	4.5	279
Ø1N-Ø5E-31 CDB 1	33Ø	7Ø	37	6.1	1.Ø	Ø.1Ø	2Ø	12	31Ø
Ø1N-Ø6E-Ø4 CAD 1	37Ø	75	45	4.7	1.6	--	3.1	6.6	363
Ø1N-Ø6E-Ø5 BBC 1	38Ø	86	4Ø	3.9	1.5	Ø.Ø	5.9	1Ø	368
Ø1N-Ø6E-11 BDC 1	34Ø	75	38	2.Ø	1.Ø	Ø.1Ø	2.9	5.5	315
Ø1N-Ø6E-18 BAB 1	34Ø	71	4Ø	12	Ø.9Ø	Ø.1Ø	5.7	12	325
Ø1N-Ø7E-19 ADA 1	38Ø	85	4Ø	31	2.6	Ø.1Ø	62	3Ø	441
Ø1N-Ø7E-31 BCA 1	47Ø	13Ø	36	19	1.Ø	Ø.1Ø	35	5Ø	544
Ø2N-Ø4E-13 DCC 1	31Ø	72	32	15	1.6	Ø.1Ø	4.4	16	316
Ø2N-Ø4E-23 DAA 1	28Ø	66	29	69	5.3	Ø.6Ø	93	3Ø	448
Ø2N-Ø5E-21 DCD 1	46Ø	97	54	12	2.2	Ø.1Ø	23	38	5Ø4
Ø2N-Ø5E-35 CAB 1	26Ø	42	37	4.1	1.2	Ø.Ø	4.4	6.2	246
Ø2N-Ø5E-36 DAD 1	33Ø	78	34	7.2	1.5	Ø.Ø	3.6	8.Ø	332
Ø2N-Ø6E-14 DCD 1	85	16	11	11Ø	3.3	Ø.8Ø	4.6	8.2	34Ø
Ø2N-Ø6E-34 ACA 1	36Ø	81	39	4.3	Ø.8Ø	Ø.Ø	5.5	8.6	357
Ø2N-Ø6E-34 CCC 1	3ØØ	61	37	4.1	1.Ø	Ø.Ø	5.8	6.Ø	288
BYRDS MILL SPRING NR	33Ø	84	29	4.Ø	--	--	7.Ø	--	--
FITTSTOWN, OK	31Ø	58	39	4.7	--	--	5.4	--	--

APPENDIX 7: Concentration of Trace Metals in Water from Wells, Springs, and Streams

[Chemical constituents in micrograms per liter. Site: GW, well; SP, spring; SW, stream. Geologic unit: 364SMPS, Simpson Group; 367ABCKU, upper Arbuckle Group.]

Local number	Site	Geologic unit	Date of sample	Aluminum, dis- solved (ug/L as Al)	Arsenic, dis- solved (ug/L as As)	Cadmium, dis- solved (ug/L as Cd)	Chromium, dis- solved (ug/L as Cr)	Copper, dis- solved (ug/L as Cu)	Iron, dis- solved (ug/L as Fe)	Lead, dis- solved (ug/L as Pb)	Manganese, dis- solved (ug/L as Mn)	Mercury, dis- solved (ug/L as Hg)	Zinc, dis- solved (ug/L as Zn)
Carter County													
Ø2S-Ø1E-22 DCC 1	GW	364SMPS	Ø8/31/78	1Ø	1	Ø	Ø	16	2Ø	Ø	Ø	.Ø	15Ø
Johnston County													
Ø1S-Ø4E-Ø3 ADD 1	GW	367ABCKU	11/16/77	1Ø	1	Ø	Ø	5	3Ø	6	Ø	.Ø	22Ø
Ø1S-Ø4E-27 DCA 1	SP	367ABCKU	1Ø/2Ø/77	3Ø	1	Ø	5	1	2Ø	4	1Ø	.Ø	6Ø
Ø1S-Ø5E-27 AAB 1	GW	367ABCKU	11/18/77	Ø	Ø	Ø	Ø	5	2Ø	4	4	.Ø	11Ø
Ø1S-Ø5E-34 DDD 1	SP	367ABCKU	11/Ø3/77	3Ø	1	Ø	Ø	1	2Ø	3	Ø	.Ø	3Ø
Ø1S-Ø6E-19 CAA 1	GW	367ABCKU	11/17/77	1Ø	1	1	Ø	1Ø	5Ø	1Ø	4	.Ø	1,9ØØ
Ø1S-Ø6E-21 ADB 1	SP	367ABCKU	11/Ø4/77	Ø	1	2	Ø	1	2Ø	7	4	.Ø	2Ø
Ø1S-Ø6E-24 CAD 1	SP	367ABCKU	11/15/77	1Ø	1	1	Ø	7	8Ø	11Ø	1Ø	.Ø	8ØØ
Ø1S-Ø6E-24 CBB 1	SW	---	11/14/77	Ø	1	Ø	Ø	3	1Ø	8	Ø	.Ø	2Ø
Ø1S-Ø6E-25 CBB 1	GW	367ABCKU	11/17/77	1Ø	1	Ø	Ø	11	8Ø	8	Ø	.Ø	14Ø
Ø1S-Ø7E-19 CDC 1	SW	---	11/15/77	1Ø	1	Ø	Ø	3	4Ø	72	8	.Ø	1,ØØØ
Ø1S-Ø7E-23 DDD 1	GW	364SMPS	11/17/77	7Ø	1	Ø	Ø	6	3Ø	5	Ø	.Ø	8Ø
Ø1S-Ø7E-34 ADD 1	SW	---	11/15/77	1Ø	Ø	1	Ø	4	4Ø	17Ø	Ø	.Ø	94Ø
Ø2S-Ø4E-11 BBB 1	SW	---	1Ø/2Ø/77	2Ø	1	1	1Ø	1	2Ø	13	2Ø	.Ø	3Ø
Ø2S-Ø5E-Ø8 ABB 2	GW	364SMPS	12/Ø5/77	4Ø	Ø	2	Ø	4	3Ø	23	Ø	.Ø	28Ø
Ø2S-Ø5E-1Ø DDD 1	GW	367ABCKU	11/18/77	1Ø	1	3	Ø	4	5Ø	3Ø	4	.Ø	2Ø
Ø2S-Ø6E-18 CAA 1	SP	367ABCKU	1Ø/2Ø/77	2Ø	Ø	1	1Ø	Ø	1Ø	6	8Ø	.Ø	3Ø
Ø2S-Ø6E-19 CBD 1	SW	---	1Ø/21/77	2Ø	Ø	1	Ø	1	3Ø	13	4	.Ø	2Ø
Ø2S-Ø7E-Ø7 BAB 1	SP	367ABCKU	11/Ø4/77	1Ø	1	1	Ø	7	2Ø	1Ø	4	.Ø	6Ø
Ø2S-Ø7E-17 CBB 1	SW	--	1Ø/21/77	2Ø	1	1	5	4	1Ø	12	8	.Ø	9Ø
Ø3S-Ø4E-Ø4 BCD 1	GW	367ABCKU	1Ø/19/77	3Ø	1	1	1Ø	1Ø	5Ø	8	4	.Ø	1ØØ
Ø3S-Ø4E-Ø5 DBB 1	SP	367ABCKU	1Ø/18/77	2Ø	1	3	Ø	4	2Ø	11	4	.Ø	18Ø
Ø3S-Ø4E-17 BCD 1	SW	---	1Ø/17/77	2Ø	1	1	1Ø	4	1Ø	12	8	.Ø	6Ø
Ø3S-Ø5E-3Ø DDC 1	SP	367ABCKU	1Ø/2Ø/77	4Ø	1	1	Ø	2	4Ø	14	4	.Ø	2Ø

Murray County													
01S-01E-15 BCB 1	SW	---	09/07/78	5	1	0	10	2	20	0	10	.0	10
01S-01E-28 DDA 1	GW	367ABCKU	08/31/78	5	1	0	0	10	40	0	0	.0	70
01S-01E-29 CDA 1	GW	367ABCKU	09/07/78	10	1	0	0	5	140	0	10	.0	190
01S-01W-07 DCC 1	SW	---	09/08/78	10	1	0	0	1	80	0	0	.0	10
01S-01W-36 DCC 1	GW	367ABCKU	09/07/78	10	1	0	0	7	40	0	0	.0	40
01S-02E-30 CDB 1	SW	---	09/01/78	5	1	0	0	3	650	0	10	.0	10
01S-02E-31 CAC 1	GW	367ABCKU	09/01/78	0	0	0	0	13	130	0	10	.0	90
01S-03E-24 BDA 1	SP	364SMPS	10/18/77	30	1	10	0	5	70	40	4	.0	200
02S-01W-15 DAD 1	SW	---	09/08/78	0	1	0	10	0	50	0	0	.0	10
02S-02E-07 BDA 1	GW	367ABCKU	09/07/78	5	1	0	10	10	20	0	0	.0	40
02S-02E-18 BDD 1	GW	367ABCKU	09/01/78	0	1	0	10	7	50	0	0	.0	500
02S-02E-33 CBB 1	SW	---	08/31/78	10	1	0	0	6	20	0	10	.0	30
02S-03E-09 AAB 1	GW	364SMPS	10/19/77	30	1	2	5	5	350	24	8	.0	160
02S-03E-24 ABA 1	GW	367ABCKU	10/18/77	20	0	3	0	15	60	21	0	.0	160
02S-03E-27 AAA 1	GW	364SMPS	10/19/77	30	0	2	10	25	60	23	10	.0	320
02S-04E-31 BBB 1	SP	367ABCKU	10/18/77	20	0	1	5	6	20	3	4	.0	60
Pontotoc County													
01N-05E-31 CDB 1	GW	367ABCKU	11/16/77	0	1	3	0	6	50	19	0	.0	80
01N-06E-11 BDC 1	SP	367ABCKU	11/16/77	0	1	0	0	2	30	4	8	.0	30
01N-06E-18 BAB 1	GW	367ABCKU	11/17/77	0	1	1	0	15	40	4	4	.0	30
01N-07E-19 ADA 1	SP	364SMPS	11/15/77	10	1	1	0	6	30	86	0	.0	500
01N-07E-31 BCA 1	GW	364SMPS	11/17/77	0	1	0	12	5	30	2	0	.0	60
02N-04E-23 DAA 1	GW	367ABCKU	11/16/77	0	1	1	0	0	280	4	4	.0	10
02N-05E-21 DCD 1	GW	367ABCKU	11/16/77	0	1	0	0	6	30	6	0	.0	30

APPENDIX 8: Water Levels in Observation Wells

[The highest and lowest water levels given for each well are for the record listed in the table. Column headed "MS"--M = Method of measurement: M, analog (float); S, steel tape; T, electric tape; S = Status: F, flowing; P, pumping; R, pumped recently.]

LOCAL NUMBER, 01N-04E-02 DDA 1.
LOCATION.--LAT 34 34'50", LONG 096 50'45", HYDROLOGIC UNIT 11140102, OWNER: J. SANDERS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 7 IN, DEPTH 335 FT.
DATUM.--MEASURING POINT: TOP OF CASING 0.6 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 97.66 FEET BELOW LAND SURFACE DATUM MAY 24,1977; LOWEST WATER LEVEL 150.72 FEET BELOW LAND SURFACE DATUM JAN 02,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
DEC 03, 1976	144.70	S	OCT 03, 1977	138.62	S	MAY 03, 1978	141.79	S	DEC 14, 1978	147.04	S
MAR 24, 1977	144.77	S	NOV 02	141.70	S	JUN 08	128.86	S	FEB 01, 1979	145.01	S
APR 25	119.32	S	DEC 05	145.14	S	JUL 06	106.22	S	MAR 08	146.76	S
MAY 24	97.66	S	JAN 02, 1978	150.72	S	AUG 08	115.75	S	APR 05	137.49	S
JUN 23	97.84	S	FEB 01	144.90	S	SEP 11	128.91	S	MAY 04	119.11	S
JUL 26	111.89	S	MAR 06	144.68	S	OCT 03	137.74	S			
AUG 25	124.33	S	APR 05	147.54	S	NOV 08	148.13	S			

LOCAL NUMBER, 01N-04E-25 AAC 1.
LOCATION.--LAT 34 31'58", LONG 096 49'47", HYDROLOGIC UNIT 11130304, OWNER: C. ROOS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED OIL TEST WELL, DIAMETER 10 IN, DEPTH 1,020 FT.
DATUM.--MEASURING POINT: TOP OF CASING 0.5 FT ABOVE LAND-SURFACE DATUM.
REMARKS.--WELL ORIGINALLY 3,459 FT DEEP.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 85.61 FEET BELOW LAND SURFACE DATUM JUL 06,1978; LOWEST WATER LEVEL 118.04 FEET BELOW LAND SURFACE DATUM MAR 08,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
OCT 20, 1976	109.68	S	OCT 03, 1977	102.07	S	MAY 03, 1978	108.76	S	DEC 07, 1978	111.58	S
MAR 24, 1977	116.32	S	NOV 03	105.71	S	JUN 08	97.69	S	FEB 01, 1979	117.56	S
APR 25	98.04	S	DEC 05	109.85	S	JUL 06	85.61	S	MAR 08	118.04	S
MAY 23	92.47	S	JAN 03, 1978	113.35	S	AUG 08	92.02	S	APR 05	106.31	S
JUN 23	90.73	S	30	116.45	S	SEP 11	98.58	S	MAY 09	96.62	S
JUL 26	87.20	S	MAR 06	118.02	S	OCT 03	102.45	S			
AUG 25	96.34	S	APR 05	113.88	S	NOV 08	107.86	S			

LOCAL NUMBER, 01N-04E-31 CBA 1.
LOCATION.--LAT 34 30'45", LONG 096 55'42", HYDROLOGIC UNIT 11130304, OWNER: WILLIAMS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 6 IN, DEPTH 225 FT.
DATUM.--MEASURING POINT: TOP OF SANITARY SEAL AT LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 118.75 FEET BELOW LAND SURFACE DATUM MAY 23,1977; LOWEST WATER LEVEL 142.01 FEET BELOW LAND SURFACE DATUM FEB 01,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
MAR 30, 1977	129.12	S	NOV 02, 1977	132.85	S	JUN 08, 1978	119.80	S	FEB 01, 1979	132.83	S
APR 25	118.76	S	DEC 06	135.80	S	JUL 06	119.96	S	MAR 09	131.59	S
MAY 23	118.75	T	JAN 04, 1978	139.45	S	AUG 08	123.02	S	APR 05	125.49	S
JUN 23	127.80	S	FEB 01	142.01	S	SEP 11	126.25	S	MAY 04	123.36	S
JUL 26	126.46	S	MAR 06	138.72	S	OCT 03	128.38	S			
AUG 25	127.80	S	APR 06	136.05	S	NOV 08	131.35	S			
OCT 03	131.34	S	MAY 02	130.45	S	DEC 14	133.90	S			

LOCAL NUMBER, 01N-04E-33 AAD 1.
LOCATION.--LAT 34 31'05", LONG 096 52'50", HYDROLOGIC UNIT 11130304, OWNER: G. POWELL.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 7 IN, DEPTH 170 FT.
DATUM.--MEASURING POINT: TOP OF STEEL PLATE ON CASING, 0.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 103.52 FEET BELOW LAND SURFACE DATUM JUL 06,1978; LOWEST WATER LEVEL 127.26 FEET BELOW LAND SURFACE DATUM MAR 06,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
DEC 11, 1976	111.25	S	OCT 03, 1977	117.06	S	MAY 03, 1978	119.86	S	DEC 14, 1978	122.89	S
MAR 24, 1977	125.10	S	NOV 02	118.78	S	JUN 08	111.46	S	FEB 01, 1979	126.68	S
APR 25	109.85	S	DEC 06	125.64	S	JUL 06	103.52	S	MAR 09	126.66	S
MAY 23	107.47	S	JAN 04, 1978	123.74	S	AUG 08	109.24	S	APR 05	109.60	S
JUN 23	108.06	S	FEB 01	126.10	S	SEP 11	113.94	S	MAY 04	110.83	S
JUL 26	110.61	S	MAR 06	127.26	S	OCT 03	116.72	S			
AUG 25	112.91	S	APR 06	122.67	S	NOV 08	120.27	S			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, Ø1N-Ø5E-Ø1 AAB 1.
LOCATION.--LAT 34 35'27", LONG Ø96 43'2Ø", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: J. UNDERHILL.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DEPTH 124 FT.
DATUM.--MEASURING POINT: TOP OF PISTON PUMP CASE 3.Ø FT ABOVE LAND-SURFACE DATUM.
REMARKS.--CASING COVERED BY CONCRETE SLAB.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 63.79 FEET BELOW LAND SURFACE DATUM JUL 26,1977; LOWEST WATER LEVEL 86.86 FEET BELOW LAND SURFACE DATUM MAR Ø8,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
OCT 19, 1976	76.51	S	OCT Ø3, 1977	71.Ø2	S	MAY Ø3, 1978	8Ø.43	S	DEC 15, 1978	81.Ø1	S
MAR 25, 1977	83.24	S	NOV Ø3	74.96	S	JUN Ø8	73.79	S	FEB Ø2, 1979	82.57	S
APR 25	71.37	S	DEC Ø2	78.Ø5	S	JUL Ø5	66.Ø4	S	MAR Ø8	86.86	S
MAY 24	66.81	S	JAN Ø5, 1978	81.Ø4	S	AUG Ø8	67.61	S	APR Ø5	78.91	S
JUN 23	66.17	S	FEB Ø1	83.6Ø	S	SEP 11	7Ø.81	S	MAY Ø4	71.56	S
JUL 26	63.79	S	MAR Ø6	85.34	S	OCT Ø3	73.32	S			
AUG 25	66.75	S	APR Ø7	82.35	S	NOV Ø8	77.37	S			

LOCAL NUMBER, Ø1N-Ø5E-Ø9 ADA 1.
LOCATION.--LAT 34 34'23", LONG Ø96 46'33", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: BUXTON.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 15Ø FT.
DATUM.--MEASURING POINT: TOP EDGE OF CONCRETE SLAB, Ø.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 79.83 FEET BELOW LAND SURFACE DATUM JUL 26,1977; LOWEST WATER LEVEL 116.36 FEET BELOW LAND SURFACE DATUM FEB Ø2,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
DEC Ø8, 1976	1Ø8.64	SR	AUG 25, 1977	86.74	S	MAR Ø6, 1978	111.91	S	NOV Ø8, 1978	1Ø2.13	S
MAR 24, 1977	1Ø9.2Ø	SR	OCT Ø3	93.48	S	APR Ø5	1Ø9.ØØ	S	DEC 15	1Ø7.ØØ	S
APR 25	88.Ø5	S	NOV Ø2	97.85	S	MAY Ø3	1Ø6.37	S	FEB Ø2, 1979	116.36	S
MAY 24	8Ø.Ø4	S	DEC Ø6	1Ø3.2Ø	S	JUN Ø7	92.52	S	MAR Ø9	112.9Ø	S
JUN 22	8Ø.54	S	JAN Ø3, 1978	1Ø5.54	S	JUL Ø6	84.38	S	APR Ø5	91.58	S
JUL 26	79.83	S	FEB Ø1	1Ø9.97	S	AUG Ø8	89.86	S	MAY Ø4	87.13	S

LOCAL NUMBER, 01N-05E-27 DCC 1.
LOCATION.--LAT 34 31'20", LONG 096 45'50", HYDROLOGIC UNIT 11140102, OWNER: C. ROOS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED OIL TEST WELL, DIAMETER 12 IN, DEPTH 2,500 FT.
DATUM.--MEASURING POINT: TOP OF 12 IN COUPLING 1.5 FT ABOVE LAND-SURFACE DATUM.
REMARKS.--PREVIOUS RECORDER RECORD FROM 1959 TO 1968.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 43.75 FEET BELOW LAND SURFACE DATUM JUN 15,1978; LOWEST WATER LEVEL 80.45 FEET BELOW LAND SURFACE DATUM FEB 25,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
OCT 20, 1976	73.02	S	JUN 10, 1977	45.44	M	FEB 10, 1978	79.85	M	SEP 11, 1978	57.81	S
DEC 08	75.02	S	15	46.31	M	15	78.85	M	15	58.63	M
10	74.84	M	20	47.18	M	20	79.07	M	20	59.61	M
15	75.06	M	25	48.12	M	25	78.96	M	25	60.48	M
20	75.55	M	30	46.59	M	28	78.87	M	30	61.39	M
25	75.74	M	JUL 05	46.48	M	MAR 10	76.91	M	OCT 05	63.65	M
31	76.21	M	10	46.63	M	15	77.16	M	10	64.25	M
JAN 05, 1977	76.60	M	15	46.99	M	20	77.03	M	15	65.50	M
10	76.98	M	24	48.76	S	25	74.78	M	20	66.20	M
15	76.89	M	25	49.04	M	31	70.36	M	25	67.33	M
26	75.17	S	31	50.26	M	APR 05	67.52	M	30	68.43	M
31	75.24	M	AUG 05	51.03	M	10	67.19	M	NOV 15	70.28	M
FEB 05	75.36	M	10	52.26	M	15	65.02	M	20	71.38	M
10	75.50	M	14	53.04	S	20	64.12	M	25	71.82	M
15	74.33	M	23	54.37	S	25	63.89	M	30	72.31	M
16	73.97	S	25	54.95	M	30	63.64	M	DEC 05	73.12	M
20	73.43	M	31	55.00	M	MAY 05	63.96	M	10	74.41	M
25	74.00	M	SEP 06	55.63	M	10	63.77	M	FEB 01, 1979	79.48	M
28	74.16	M	10	56.92	M	15	63.60	M	05	79.77	M
MAR 05	74.34	M	20	58.52	S	20	63.77	M	10	80.18	M
10	74.18	M	25	59.54	M	25	63.03	M	15	80.22	M
15	74.17	M	30	60.26	M	31	57.10	M	20	80.44	M
16	73.14	S	OCT 05	61.49	M	JUN 10	45.61	M	25	80.45	M
20	73.00	M	10	62.32	M	15	43.75	M	28	80.06	M
25	73.04	M	11	62.47	S	20	43.89	M	MAR 05	78.31	M
26	73.04	S	15	63.31	M	25	44.27	M	10	76.51	M
31	58.26	M	20	64.16	M	30	45.10	M	15	78.86	M
APR 05	54.91	M	NOV 16	68.09	S	JUL 05	45.96	M	20	76.50	M
10	53.78	M	21	69.00	S	10	46.41	M	25	67.20	M
15	53.57	M	25	69.83	M	15	47.33	M	30	63.73	M
26	51.64	S	30	70.49	M	20	48.40	M	APR 05	60.15	M
30	51.32	M	DEC 05	71.34	M	25	49.30	M	10	58.80	M

Appendix 8.--*Water levels in observation wells*--Continued

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
MAY 05	51.37	M	10	72.14	M	31	50.30	M	MAY 10	52.23	M
10	47.32	M	15	72.57	M	AUG 05	51.58	M	15	52.03	M
15	46.95	M	20	73.54	M	10	51.73	M	20	51.85	M
20	46.93	M	25	74.30	M	15	52.67	M	25	50.84	M
23	44.50	M	31	75.15	M	20	53.88	M	31	50.47	M
25	44.13	M	JAN 05, 1978	75.77	M	25	54.66	M	JUL 30	49.44	M
31	44.15	M	31	78.83	M	31	55.63	M			
JUN 05	44.74	M	FEB 05	79.47	M	SEP 05	56.86	M			

LOCAL NUMBER, 01N-06E-21 ACB 1.
LOCATION.--LAT 34 32'38", LONG 096 40'39", HYDROLOGIC UNIT 11140102, OWNER: FLINN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 220 FT.
DATUM.--MEASURING POINT: TOP OF CASING 0.3 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 87.34 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 107.12 FEET BELOW LAND SURFACE DATUM JAN 05,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN 04, 1977	103.90	S	OCT 03, 1977	99.09	S	MAY 03, 1978	94.63	S	DEC 15, 1978	103.82	S
MAR 25	103.68	S	NOV 03	101.08	S	JUN 08	90.85	S	FEB 02, 1979	105.32	S
APR 25	87.34	S	DEC 06	103.68	S	JUL 06	89.70	S	MAR 08	103.93	S
MAY 23	98.35	S	JAN 05, 1978	107.12	S	AUG 08	94.25	S	APR 05	94.95	S
JUN 23	93.50	S	FEB 01	105.10	S	SEP 11	97.89	S	MAY 04	93.73	S
JUL 26	92.88	S	MAR 06	104.41	S	OCT 03	99.84	S			
AUG 25	96.06	S	APR 06	97.51	S	NOV 08	102.32	S			

343457096404501. LOCAL NUMBER, 01N-06E-04 CAD 1.
LOCATION.--LAT 34 34'57", LONG 096 40'45", HYDROLOGIC UNIT 11140102, OWNER: J.H. BRENTZ.
AQUIFER.--ARBUCKLE GROUP.
WELL CHARACTERISTICS.--DRILLED OIL TEST WELL, DIAMETER 18 IN (0.46M), DEPTH 396 FT (121 M).
DATUM.--ALTITUDE OF LAND-SURFACE DATUM IS 1157 FT (353M). MEASURING POINT: BASE OF RECORDER SHELTER AT LAND-SURFACE DATUM.
REMARKS.-- WELL ORIGINALLY 1,707 FT (520 M) DEEP.

PERIOD OF RECORD.--1959 TO CURRENT YEAR; HIGHEST WATER LEVEL 105.64 FEET BELOW LAND SURFACE DATUM MAY 05,1979; LOWEST WATER LEVEL 120.77 FEET BELOW LAND SURFACE DATUM FEB 25,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
AUG 20, 1976	114.38		MAR 25, 1977	115.84		OCT 25, 1977	116.08	M	MAY 31, 1978	111.89	M
25	114.73		31	110.89		31	116.37	M	JUN 05	110.99	M
31	115.11		APR 05	107.90		NOV 05	116.63	M	10	108.78	M
SEP 05	115.41		10	106.75		10	116.99	M	15	106.96	M
10	115.71		15	106.45		15	117.12	M	20	106.26	M
15	116.00		20	106.40		20	117.43	M	25	106.10	M
20	116.23		25	106.44		25	117.66	M	30	106.43	M
25	116.44		30	106.47		30	117.85	M	JUL 05	106.91	M
30	116.72		MAY 05	106.54		DEC 05	118.09	M	10	107.46	M
OCT 05	116.97		10	106.82		10	118.35	M	15	107.99	M
10	117.12		15	107.06		15	118.42	M	20	108.61	M
15	117.37		20	106.14		20	118.68	M	25	109.21	M
25	117.74		25	105.92		25	118.86	M	31	109.93	M
31	117.86		JUN 05	106.01		31	119.07	M	AUG 05	110.45	M
NOV 05	117.76		10	106.36		JAN 05, 1978	119.33	M	10	111.91	M
10	117.73		15	106.86		10	119.58	M	15	112.41	M
15	117.86		20	107.39		25	119.94	M	20	112.94	M
20	118.02		25	107.89		31	120.08	M	25	113.38	M
25	118.09		30	107.69		FEB 05	120.30	M	31	113.92	M
30	118.20		JUL 05	107.80		10	120.40	M	SEP 10	113.73	M
DEC 05	118.33		10	108.07		15	120.13	M	15	114.16	M
10	118.30		15	108.45		20	120.00	M	20	114.59	M
15	118.20		20	108.83		25	119.87	M	25	114.95	M
20	118.37		25	109.22		28	119.79	M	30	115.31	M
25	118.45		31	109.85		MAR 10	119.24	M	OCT 05	115.68	M
31	118.42		AUG 05	110.28		15	118.76	M	10	115.92	M
JAN 05, 1977	118.49		10	110.74		20	118.56	M	15	116.33	M
10	118.58		15	111.22		25	117.90	M	20	116.58	M
15	118.60		20	111.64		31	115.75	M	25	116.87	M
31	117.53		25	112.08		APR 05	115.14	M	31	117.28	M
FEB 05	117.44		31	112.58		10	114.72	M	NOV 05	117.49	M
10	117.42		SEP 05	112.90		15	113.64	M	10	117.77	M
15	117.10		10	113.31		20	112.85	M	15	118.03	M
20	116.48		15	113.57		25	112.54	M	20	118.27	M
25	116.10		20	113.88		30	112.36	M	25	118.41	M
28	116.20		25	114.20		MAY 05	112.49	M	DEC 05	119.02	M

Appendix 8.--*Water levels in observation wells*--Continued

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
MAR 05	116.18		30	114.48		10	112.57	M	10	119.30	M
10	115.92		OCT 10	115.21	M	15	112.59	M	15	119.41	M
15	115.98		15	115.56	M	20	112.92	M	20	119.61	M
20	115.86		20	115.75	M	25	112.97	M	25	119.81	M
DEC 31, 1978	120.13	M	MAR 20, 1979	118.97	M	MAY 25, 1979	110.02	M	AUG 05, 1979	107.90	M
JAN 20, 1979	120.30	M	25	115.80	M	31	109.03	M	10	108.53	M
25	120.41	M	31	113.66	M	JUN 05	108.65	M	15	109.19	M
31	120.52	M	APR 05	112.76	M	10	108.10	M	20	109.74	M
FEB 05	120.56	M	10	107.15	M	15	104.40	M	25	110.29	M
10	120.70	M	15	106.51	M	20	103.07	M	31	110.84	M
15	120.73	M	20	105.92	M	25	102.91	M	SEP 05	111.39	M
20	120.69	M	25	105.66	M	30	103.05	M	10	111.88	M
25	120.77	M	30	105.70	M	JUL 05	103.72	M	15	112.39	M
28	120.59	M	MAY 05	105.72	M	10	104.27	M	20	112.78	M
MAR 05	120.25	M	10	110.70	M	20	105.71	M	25	113.28	M
10	119.79	M	15	110.69	M	25	106.35	M	30	113.62	M
15	119.61	M	20	110.66	M	31	107.21	M			

LOCAL NUMBER, 01N-06E-24 CAB 1.
LOCATION.--LAT 34 32'25", LONG 096 37'50", HYDROLOGIC UNIT 11140102, OWNER: K. HARDEN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 96 FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 30.29 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 56.75 FEET BELOW LAND SURFACE DATUM JAN 04,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN 26, 1977	45.57	S	OCT 03, 1977	46.41	S	APR 06, 1978	50.09	S	OCT 02, 1978	54.40	S
MAR 24	42.04	S	NOV 03	49.53	S	MAY 03	39.70	S	NOV 08	55.62	S
APR 25	30.29	S	DEC 06	54.48	S	JUN 07	31.84	S	DEC 15	53.95	S
MAY 23	32.59	S	JAN 04, 1978	56.75	S	JUL 05	34.89	S			
JUN 23	36.19	S	FEB 01	52.46	S	AUG 08	40.74	S			
AUG 25	43.09	S	MAR 03	51.71	S	SEP 11	52.15	S			

LOCAL NUMBER, Ø1N-Ø6E-29 CAB 1.
LOCATION.--LAT 34 31'37", LONG Ø96 41'59", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: V. STANFORD.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 7 IN, DEPTH 1Ø2 FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.Ø FT ABOVE LAND-SURFACE DATUM.
REMARKS.--WELL SUBJECT TO PUMPING.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 7Ø.16 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 89.46 FEET BELOW LAND SURFACE DATUM FEB Ø2,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
OCT 27, 1976	85.47	S	OCT Ø3, 1977	82.32	SP	MAY Ø3, 1978	79.46	S	FEB Ø2, 1979	89.46	S
MAR 25, 1977	81.11	S	NOV Ø3	84.15	S	JUN Ø8	71.55	S	MAR Ø8	86.82	S
APR 25	7Ø.16	S	DEC Ø7	86.43	SP	JUL Ø6	72.83	S	APR Ø5	77.73	S
MAY 23	7Ø.97	S	JAN Ø5, 1978	87.46	SP	AUG Ø8	77.36	S	MAY Ø4	76.69	S
JUN 23	74.39	SP	FEB Ø1	88.16	S	SEP 11	8Ø.97	S			
JUL 26	76.Ø9	S	MAR Ø6	87.36	S	OCT Ø3	82.96	S			
AUG 25	79.49	SP	APR Ø6	84.Ø7	S	DEC 15	87.52	S			

LOCAL NUMBER, Ø2N-Ø5E-Ø9 BAB 2.
LOCATION.--LAT 34 39'54", LONG Ø96 47'12", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: SANDMANN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED OIL TEST WELL DIAMETER 8 IN, DEPTH REPORTED 2,Ø17 FT.
DATUM.--MEASURING POINT: TOP OF CASING Ø.5 FT ABOVE LAND-SURFACE DATUM.
REMARKS.--WELL FLOWS AT TIMES.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 1.41 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 4Ø.77 FEET BELOW LAND SURFACE DATUM FEB Ø1,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
NOV 3Ø, 1976	19.57	S	OCT Ø3, 1977	23.16	S	MAY Ø3, 1978	4.94	S	DEC 15, 1978	22.94	S
MAR 24, 1977	7.68	S	NOV Ø2	37.18	S	JUN Ø8		F	FEB Ø2, 1979	9.87	S
APR 25	1.41	S	DEC Ø6	39.ØØ	S	JUL Ø6	4.98	S	MAR Ø9	8.41	S
MAY 24	1.42	S	JAN Ø3, 1978	39.34	S	AUG Ø8	8.45	S	APR Ø5	1.68	S
JUN 23	7.8Ø	S	FEB Ø1	4Ø.77	S	SEP 11	1Ø.2Ø	S	MAY Ø4	1.98	S
JUL 26	9.27	S	MAR Ø6	1Ø.86	S	OCT Ø3	11.13	S			
AUG 25	11.Ø1	S	APR Ø5	8.Ø6	S	NOV Ø8	34.34	S			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, Ø2N-Ø5E-21 DCD 1.
LOCATION.--LAT 34 37'23", LONG Ø96 4Ø'5Ø", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: H.WINGARD.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 7 IN, DEPTH 13Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.Ø FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 59.93 FEET BELOW LAND SURFACE DATUM MAY 24,1977; LOWEST WATER LEVEL 1Ø2.Ø4 FEET BELOW LAND SURFACE DATUM DEC 15,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
OCT 27, 1976	76.52	S	OCT Ø3, 1977	69.44	S	MAY Ø3, 1978	81.32	S	DEC 15, 1978	1Ø2.Ø4	S
MAR 24, 1977	82.4Ø	S	NOV Ø2	73.Ø4	S	JUN Ø8	6Ø.85	S	FEB Ø2, 1979	86.59	S
APR 25	67.56	S	DEC Ø6	77.62	S	JUL Ø6	64.Ø5	S	MAR Ø9	86.26	S
MAY 24	59.93	S	JAN Ø3, 1978	8Ø.76	S	AUG Ø8	65.8Ø	S	APR Ø5	76.77	S
JUN 23	61.44	S	FEB Ø1	84.89	S	SEP 11	69.42	S	MAY Ø4	7Ø.96	S
JUL 26	61.89	S	MAR Ø6	84.53	S	OCT Ø3	72.15	S			
AUG 25	64.81	S	APR Ø6	83.16	S	NOV Ø8	76.98	S			

LOCAL NUMBER, Ø1S-Ø3E-22 BAC 1.
LOCATION.--LAT 34 27'34", LONG Ø96 58'49", HYDROLOGIC UNIT 1113Ø3Ø3, OWNER: G. GRIFFITTS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 8 IN, DEPTH 254 FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 38.77 FEET BELOW LAND SURFACE DATUM JUL Ø5,1978; LOWEST WATER LEVEL 47.77 FEET BELOW LAND SURFACE DATUM FEB Ø2,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB 1Ø, 1977	45.99	S	OCT Ø4, 1977	46.15	S	JUN Ø7, 1978	43.34	S	FEB Ø1, 1979	46.43	S
MAR 25	45.48	S	NOV Ø1	46.55	S	JUL Ø5	38.77	S	MAR Ø8	42.89	S
APR 27	41.76	S	DEC Ø7	47.16	S	AUG Ø7	4Ø.25	S	APR Ø5	4Ø.79	S
MAY 25	4Ø.8Ø	S	JAN Ø5, 1978	47.54	S	SEP Ø6	43.Ø3	S	MAY Ø3	39.Ø7	S
JUN 21	41.34	S	FEB Ø2	47.77	S	OCT Ø2	44.54	S			
JUL 22	43.63	S	APR Ø6	47.39	S	NOV Ø8	45.93	S			
AUG 26	44.33	S	MAY Ø3	46.74	S	DEC 14	46.27	S			

LOCAL NUMBER, Ø1S-Ø4E-12 ADA 1.
LOCATION.--LAT 34 29'17", LONG Ø96 49'43", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: J. SPARKS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 5 IN, DEPTH 11Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING AT PUMPHOUSE FLOOR, AT LAND SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 27.5Ø FEET BELOW LAND SURFACE DATUM JUL Ø5,1978; LOWEST WATER LEVEL 57.16 FEET BELOW LAND SURFACE DATUM FEB Ø1,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN 25, 1977	48.ØØ	S	OCT Ø3, 1977	38.45	S	MAY Ø2, 1978	45.95	SR	DEC 15, 1978	5Ø.72	S
MAR 24	55.Ø7	S	NOV Ø2	42.7Ø	S	JUN Ø8	34.74	S	FEB Ø1, 1979	57.16	S
APR 25	36.12	SR	DEC Ø5	47.Ø3	S	JUL Ø5	27.5Ø	S	MAR Ø8	56.87	S
MAY 24	29.89	S	JAN Ø3, 1978	53.11	SR	AUG Ø7	31.29	S	APR Ø5	44.17	S
JUN 22	28.67	S	FEB Ø2	57.86	SR	SEP Ø6	34.37	S	MAY Ø3	35.88	S
JUL 26	3Ø.17	S	MAR Ø7	59.ØØ	SR	OCT Ø2	38.77	S			
AUG 25	33.94	S	APR Ø5	5Ø.85	S	NOV Ø8	45.Ø8	S			

LOCAL NUMBER, Ø1S-Ø4E-22 CDC 1.
LOCATION.--LAT 34 26'55", LONG Ø96 52'25", HYDROLOGIC UNIT 1114Ø3Ø4, OWNER: B. HANCOCK.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED DOMESTIC WELL, DIAMETER 6 IN, DEPTH 135 FT.
DATUM.--MEASURING POINT: TOP OF SANI-SEAL AT PUMPHOUSE FLOOR, 3.Ø FT ABOVE LAND SURFACE.
REMARKS.--WELL SUBJECT TO PUMPING.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 35.5Ø FEET BELOW LAND SURFACE DATUM JUN Ø8,1978; LOWEST WATER LEVEL 49.12 FEET BELOW LAND SURFACE DATUM NOV Ø8,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB Ø8, 1977	47.2Ø	S	OCT Ø3, 1977	48.53	S	MAY Ø2, 1978	45.Ø2	S	DEC 15, 1978	48.67	S
MAR 25	46.85	S	NOV Ø1	48.64	S	JUN Ø8	35.5Ø	S	FEB Ø1, 1979	48.32	S
APR 27	39.71	S	DEC Ø5	48.58	S	JUL Ø5	43.64	S	MAR Ø8	46.32	S
MAY 24	42.67	S	JAN Ø3, 1978	48.69	S	AUG Ø7	47.Ø1	S	APR Ø5	42.7Ø	S
JUN 24	45.83	S	FEB Ø2	48.81	S	SEP Ø6	48.35	S	MAY Ø3	42.98	S
JUL 25	46.93	S	MAR Ø7	47.84	S	OCT Ø2	48.62	S			
AUG 25	47.86	S	APR Ø5	44.44	S	NOV Ø8	49.12	S			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, Ø1S-Ø5E-27 AAB 1.
LOCATION.--LAT 34 26'54", LONG Ø96 45'4Ø", HYDROLOGIC UNIT 111303Ø4, OWNER: DAUBE CORP.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED DOMESTIC WELL, DIAMETER 6 IN, DEPTH 267 FT.
DATUM.--MEASURING POINT: TOP OF CASING AT PUMPHOUSE FLOOR, Ø.5 FT ABOVE LAND-SURFACE DATUM.
REMARKS.--WELL SUBJECT TO PUMPING.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 53.35 FEET BELOW LAND SURFACE DATUM JUN Ø7,1978; LOWEST WATER LEVEL 81.64 FEET BELOW LAND SURFACE DATUM FEB Ø2,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
MAY 24, 1977	55.79	S	DEC Ø5, 1977	75.58	S	JUN Ø7, 1978	53.35	S	DEC 14, 1978	77.9Ø	S
JUN 22	53.47	S	JAN Ø4, 1978	79.14	S	JUL Ø5	62.93	S	FEB Ø1, 1979	76.61	S
JUL 26	6Ø.18	S	FEB Ø2	81.64	S	AUG Ø7	76.2Ø	S	MAR Ø8	8Ø.45	S
AUG 28	7Ø.23	S	MAR Ø7	73.27	S	SEP Ø6	63.7Ø	S	APR Ø5	68.55	S
OCT Ø3	74.71	S	APR Ø5	64.Ø3	S	OCT Ø2	72.5Ø	S	MAY Ø3	6Ø.92	S
NOV Ø2	74.14	S	MAY Ø2	62.19	S	NOV Ø8	78.78	S			

LOCAL NUMBER, Ø1S-Ø6E-Ø5 CCC 1.
LOCATION.--LAT 34 29'37", LONG Ø96 42'18", HYDROLOGIC UNIT 111401Ø2, OWNER: BURNETT.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 123 FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.Ø FT ABOVE LAND-SURFACE DATUM.
REMARKS.--WELL SUBJECT TO PUMPING.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 61.2Ø FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 77.33 FEET BELOW LAND SURFACE DATUM FEB Ø1,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
NOV Ø3, 1976	72.81	S	JUL 27, 1977	65.21	T	FEB Ø2, 1978	77.12	S	OCT Ø2, 1978	72.4Ø	SP
MAR 24, 1977	69.77	S	AUG 25	69.55	T	APR Ø6	7Ø.45	S	NOV Ø8	74.68	SP
APR 25	61.2Ø	T	NOV Ø2	73.Ø3	S	JUL Ø6	63.59	SP	FEB Ø1, 1979	77.33	S
MAY 23	62.1Ø	TP	DEC Ø7	75.44	TP	AUG Ø8	74.66	SP	MAR Ø8	74.99	S
JUN 22	64.79	T	JAN Ø4, 1978	78.5Ø	SP	SEP 11	7Ø.81	SP			

LOCAL NUMBER, Ø1S-Ø6E-35 BDB 1.
LOCATION.--LAT 34 25'48", LONG Ø96 38'53", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: S. SPEARS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 78 FT.
DATUM.--MEASURING POI5T: TOP OF SANITARY SEAL 1.4 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 4.24 FEET BELOW LAND SURFACE DATUM JUN Ø7,1978; LOWEST WATER LEVEL 14.85 FEET BELOW LAND SURFACE DATUM APR Ø5,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
NOV Ø4, 1976	4.59	S	AUG 25, 1977	8.85	SP	APR Ø6, 1978	4.57	S	OCT Ø2, 1978	1Ø.Ø2	SP
MAR 24, 1977	5.22	S	OCT Ø3	6.89	SP	MAY Ø2	5.43	S	DEC 15	5.98	S
APR 26	4.77	S	NOV Ø2	6.86	S	JUN Ø7	4.24	S	FEB Ø1, 1979	5.2Ø	S
MAY 24	5.Ø4	S	DEC Ø7	8.Ø6	S	JUL Ø5	6.25	S	MAR Ø8	4.48	S
JUN 22	6.7Ø	SR	JAN Ø4, 1978	9.38	S	AUG Ø8	7.67	SP	APR Ø5	14.85	S
JUL 27	7.49	SP	FEB Ø1	6.21	S	SEP Ø6	9.23	SP	MAY Ø3	5.24	S

LOCAL NUMBER, Ø1S-Ø7E-Ø2 CBB 1.
LOCATION.--LAT 34 29'22", LONG Ø96 32'55", HYDROLOGIC UNIT 1114Ø1Ø4, OWNER: C. LANDRUM.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 13Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING Ø.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 89.89 FEET BELOW LAND SURFACE DATUM APR Ø6,1978; LOWEST WATER LEVEL 99.7Ø FEET BELOW LAND SURFACE DATUM JAN Ø4,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB Ø9, 1977	91.98	S	OCT Ø3, 1977	96.Ø4	S	MAY Ø2, 1978	92.84	S	DEC 15, 1978	95.48	S
MAR 25	92.36	S	NOV Ø3	97.97	S	JUN Ø7	9Ø.62	S	FEB Ø2, 1979	94.55	S
APR 26	91.58	S	DEC Ø6	97.12	S	JUL Ø6	94.11	S	MAR Ø8	92.48	S
MAY 24	92.71	S	JAN Ø4, 1978	99.7Ø	S	AUG Ø8	95.64	S	APR Ø5	92.Ø3	S
JUN 22	94.74	S	FEB Ø2	98.19	S	SEP Ø7	96.8Ø	S	MAY Ø4	92.41	S
JUL 27	99.29	S	MAR Ø6	92.8Ø	S	OCT Ø2	96.83	S			
AUG 25	96.71	S	APR Ø6	89.89	S	NOV Ø8	97.63	S			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, 01S-07E-06 BBB 1.
LOCATION.--LAT 34 30'18", LONG 096 37'02", HYDROLOGIC UNIT 11140102, OWNER: TOM HARDEN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 6 IN, DEPTH 53 FT.
DATUM.--MEASURING POINT: TOP OF CASING AT PUMPHOUSE FLOOR 0.3 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 8.11 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 18.04 FEET BELOW LAND SURFACE DATUM FEB 02,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN 25, 1977	12.26	S	OCT 03, 1977	15.41	S	MAY 03, 1978	11.20	S	DEC 15, 1978	17.44	S
MAR 24	10.35	S	NOV 03	15.94	S	JUN 07	8.55	S	FEB 02, 1979	18.04	S
APR 25	8.11	S	DEC 06	16.44	S	JUL 05	11.29	S	MAR 08	16.04	S
MAY 23	10.36	S	JAN 04, 1978	16.65	S	AUG 08	13.46	S	APR 05	10.26	S
JUN 23	12.20	S	FEB 01	17.00	S	SEP 07	14.99	S	MAY 03	10.53	S
JUL 26	13.49	S	MAR 06	17.07	S	OCT 03	15.89	S			
AUG 25	13.30	S	APR 06	15.57	S	NOV 08	17.02	S			

LOCAL NUMBER, 01S-07E-08 BAA 1.
LOCATION.--LAT 34 29'32", LONG 096 35'37", HYDROLOGIC UNIT 11140104, OWNER: C. LANDRUM.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 200 FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.0 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 13.04 FEET BELOW LAND SURFACE DATUM JUN 08,1978; LOWEST WATER LEVEL 43.30 FEET BELOW LAND SURFACE DATUM NOV 08,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB 09, 1977	20.23	S	OCT 03, 1977	24.60	S	MAY 03, 1978	20.63	S	DEC 15, 1978	21.62	S
MAR 25	20.45	S	NOV 03	30.04	S	JUN 08	13.04	S	FEB 02, 1979	20.65	S
APR 26	18.82	S	DEC 06	35.26	S	JUL 05	20.94	S	MAR 08	18.00	S
MAY 24	20.68	S	JAN 04, 1978	41.85	S	AUG 08	25.00	S	APR 05	16.49	S
JUN 22	22.64	S	FEB 02	37.21	S	SEP 07	31.38	S	MAY 04	20.56	S
JUL 26	26.61	S	MAR 06	20.60	S	OCT 03	33.93	S			
AUG 25	32.62	S	APR 07	19.97	S	NOV 08	43.30	S			

LOCAL NUMBER, Ø1S-Ø7E-2Ø CAB 1.
LOCATION.--LAT 34 27'Ø7", LONG Ø96 35'47", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: D. BOWMAN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED DOMESTIC WELL, DIAMETER 6 IN, DEPTH 9Ø FT.
DATUM.--MEASURING POINT: TOP OF SANITARY SEAL 3.Ø FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 6.1Ø FEET BELOW LAND SURFACE DATUM DEC 15,1978; LOWEST WATER LEVEL 17.32 FEET BELOW LAND SURFACE DATUM NOV Ø8,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB Ø8, 1977	15.Ø7	S	OCT Ø3, 1977	15.Ø8	S	MAY Ø2, 1978	12.57	S	DEC 15, 1978	6.1Ø	S
MAR 25	11.21	S	NOV Ø2	15.34	S	JUN Ø8	1Ø.16	S	FEB Ø2, 1979	16.61	S
APR 26	7.74	S	DEC Ø6	16.23	S	JUL Ø6	1Ø.76	S	MAR Ø8	15.83	S
MAY 24	8.5Ø	S	JAN Ø4, 1978	15.11	S	AUG Ø8	13.52	S	APR Ø5	13.35	S
JUN 22	1Ø.64	S	FEB Ø2	16.Ø2	S	SEP 11	17.Ø4	S	MAY Ø4	13.46	S
JUL 27	13.19	S	MAR Ø3	16.46	S	OCT Ø3	15.52	S			
AUG 25	12.38	S	APR Ø6	14.26	S	NOV Ø8	17.32	S			

LOCAL NUMBER, Ø1S-Ø7E-23 DDD 1.
LOCATION.--LAT 34 26'57", LONG Ø96 36'27", HYDROLOGIC UNIT 1114Ø1Ø4, OWNER: C. LANDRUM.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 14Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING AT PUMPHOUSE FLOOR AT LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 47.21 FEET BELOW LAND SURFACE DATUM FEB Ø4,1977; LOWEST WATER LEVEL 95.44 FEET BELOW LAND SURFACE DATUM NOV Ø8,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB Ø4, 1977	47.21	S	OCT Ø3, 1977	83.12	S	JUN Ø8, 1978	61.72	S	FEB Ø2, 1979	78.67	S
MAR 25	59.15	S	NOV Ø2	85.29	S	JUL Ø6	9Ø.6Ø	SR	MAR Ø8	67.Ø3	S
APR 26	79.97	TR	DEC Ø6	87.69	S	AUG Ø8	8Ø.71	S	APR Ø5	72.13	S
MAY 24	73.Ø4	S	JAN Ø4, 1978	91.13	S	SEP 11	85.1Ø	S	MAY Ø4	66.84	S
JUN 22	76.3Ø	SR	FEB Ø2	79.79	S	OCT Ø2	87.7Ø	SP			
JUL 27	83.18	S	APR Ø8	64.Ø5	S	NOV Ø8	95.44	S			
AUG 25	81.98	S	MAY Ø3	66.32	S	DEC 15	82.54	S			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, Ø1S-Ø7E-25 CBC 1.
LOCATION.--LAT 34 26'17", LONG Ø96 36'17", HYDROLOGIC UNIT 1114Ø1Ø4, OWNER: UNKNOWN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 5 IN, DEPTH 287 FT.
DATUM.--MEASURING POINT: TOP OF CASING 2.Ø FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 51.Ø9 FEET BELOW LAND SURFACE DATUM JUN Ø8,1978; LOWEST WATER LEVEL 83.49 FEET BELOW LAND SURFACE DATUM NOV Ø8,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS
FEB Ø4, 1977	52.38 S	DEC Ø6, 1977	76.87 S	JUL Ø6, 1978	62.67 S	FEB Ø2, 1979	68.5Ø S
JUN 22	69.48 S	JAN Ø4, 1978	8Ø.Ø4 S	AUG Ø8	73.7Ø S	MAR Ø8	54.91 S
JUL 27	74.99 S	FEB Ø2	72.31 S	SEP 11	78.2Ø S	APR Ø5	52.24 S
AUG 25	78.63 S	APR Ø8	52.18 S	OCT Ø3	8Ø.42 S	MAY Ø4	55.33 S
OCT Ø3	77.1Ø S	MAY Ø3	55.8Ø S	NOV Ø8	83.49 S		
NOV Ø2	78.59 S	JUN Ø8	51.Ø9 S	DEC 15	76.69 S		

LOCAL NUMBER, Ø2S-Ø3E-13 CCD 1.
LOCATION.--LAT 34 23'35", LONG Ø96 56'53", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: W. WILLIAMS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 5 IN, DEPTH 79 FT.
DATUM.--MEASURING POINT: TOP OF CASING IN CONCRETE SLAB, Ø.2 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 9.1Ø FEET BELOW LAND SURFACE DATUM JUN Ø7,1978; LOWEST WATER LEVEL 23.23 FEET BELOW LAND SURFACE DATUM FEB Ø2,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS
MAR 17, 1977	17.21 S	OCT Ø4, 1977	22.51 S	JUN Ø7, 1978	9.1Ø S	FEB Ø1, 1979	17.7Ø S
25	17.66 S	NOV Ø1	22.78 S	JUL Ø5	18.4Ø S	MAR Ø8	14.24 S
APR 27	14.46 S	DEC Ø7	22.88 S	AUG Ø7	21.Ø7 S	APR Ø5	13.73 S
MAY 25	18.69 S	JAN Ø5, 1978	23.Ø6 S	SEP Ø6	22.Ø5 S	MAY Ø3	16.94 S
JUN 21	2Ø.58 S	FEB Ø2	23.23 S	OCT Ø2	22.34 S		
JUL 27	21.44 S	APR Ø6	17.15 S	NOV Ø8	22.86 S		
AUG 26	22.16 S	MAY Ø3	18.5Ø S	DEC 14	2Ø.7Ø S		

LOCAL NUMBER, Ø2S-Ø4E-26 CBA 1.
LOCATION.--LAT 34 21'13", LONG Ø96 51'32", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: J. THORNTON.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--UNUSED CORE HOLE, DIAMETER 5 IN, DEPTH 145 FT.
DATUM.--MEASURING POINT: FLOOR OF RECORDER SHELTER 3.2 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 19.74 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 37.67 FEET BELOW LAND SURFACE DATUM JAN 1Ø,1979; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
FEB Ø7, 1977	29.3Ø	S	SEP 3Ø, 1977	33.26	M	APR 2Ø, 1978	22.93	M	NOV 1Ø, 1978	37.27	M
MAR 25	28.Ø9	S	OCT Ø5	33.85	M	25	24.Ø5	M	15	37.44	M
APR 13	21.43	S	1Ø	34.18	M	3Ø	24.74	M	2Ø	37.47	M
15	21.86	M	15	34.53	M	MAY Ø3	25.22	S	25	37.46	M
2Ø	21.5Ø	M	2Ø	34.76	M	Ø5	25.62	M	DEC 15	36.95	M
25	19.74	M	NOV 2Ø	35.42	M	1Ø	26.2Ø	M	2Ø	37.11	M
3Ø	2Ø.7Ø	M	25	35.56	M	12	26.49	S	25	37.27	M
MAY 24	22.94	M	3Ø	35.62	M	JUN Ø7	24.ØØ	S	3Ø	37.47	M
25	23.ØØ	M	DEC Ø5	35.87	M	JUL Ø5	26.71	M	JAN Ø5, 1979	37.6Ø	M
31	23.89	M	1Ø	36.ØØ	M	15	28.49	M	1Ø	37.67	M
JUN Ø5	24.71	M	15	36.Ø1	M	2Ø	29.37	M	14	35.54	M
Ø9	25.34	M	2Ø	36.27	M	25	3Ø.Ø5	M	FEB Ø5	35.5Ø	M
1Ø	25.63	M	25	36.41	M	31	3Ø.79	M	1Ø	35.51	M
15	26.49	M	31	36.58	M	AUG Ø5	31.35	M	2Ø	35.42	M
2Ø	27.31	M	JAN Ø5, 1978	36.68	M	1Ø	31.73	M	25	35.58	M
25	28.Ø3	M	25	37.19	M	15	32.42	M	MAR Ø8	29.28	M
JUL Ø5	29.Ø2	M	31	37.3Ø	M	SEP Ø6	34.32	S	15	29.95	M
21	3Ø.77	M	FEB Ø5	37.36	M	1Ø	34.51	M	APR Ø5	22.94	M
AUG 12	33.Ø3	M	1Ø	37.26	M	15	34.79	M	1Ø	23.8Ø	M
23	33.72	M	MAR 1Ø	28.58	M	25	35.37	M	15	24.56	M
25	33.88	M	15	27.9Ø	M	3Ø	35.64	M	3Ø	25.21	M
31	32.21	M	2Ø	28.Ø5	M	OCT Ø5	35.93	M	MAY Ø3	25.54	M
SEP Ø5	32.4Ø	M	25	26.ØØ	M	1Ø	36.13	M	Ø5	25.91	M
1Ø	32.86	M	31	24.16	M	15	36.39	M	Ø8	26.19	M
15	32.65	M	APR Ø5	24.65	M	2Ø	36.59	M	15	27.Ø9	M
2Ø	32.7Ø	M	1Ø	25.16	M	25	36.71	M	JUN 27	27.85	M
25	33.Ø1	M	15	22.18	M	31	37.Ø2	M			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, Ø2S-Ø5E-Ø3 CBC 1.
LOCATION.--LAT 34 24'32", LONG Ø96 46'22", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: R.GRAY.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 18Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.Ø FT ABOVE LAND-SURFACE DATUM.
REMARKS.--WELL SUBJECT TO PUMPING.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 93.9Ø FEET BELOW LAND SURFACE DATUM MAY Ø3,1979; LOWEST WATER LEVEL 1Ø3.39 FEET BELOW LAND SURFACE DATUM JAN Ø4,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN 31, 1977	1ØØ.Ø5	S	OCT Ø3, 1977	1Ø2.76	S	JUN Ø7, 1978	94.47	S	FEB Ø1, 1979	1Ø3.12	S
MAR 25	98.98	S	NOV Ø1	1Ø3.Ø3	SR	JUL Ø5	97.5Ø	SP	MAR Ø8	1Ø1.35	S
APR 25	95.54	S	DEC Ø5	1Ø3.22	SR	AUG Ø7	99.29	SP	APR Ø5	95.7Ø	S
MAY 24	96.8Ø	SR	JAN Ø4, 1978	1Ø3.39	S	SEP Ø6	1Ø1.66	S	MAY Ø3	93.9Ø	S
JUN 22	98.16	SR	FEB Ø2	1Ø3.69	SP	OCT Ø2	1Ø2.62	SP			
JUL 26	1ØØ.21	SR	APR Ø5	97.16	SR	NOV Ø8	1Ø3.28	SP			
AUG 25	1Ø1.55	SR	MAY Ø2	97.39	SR	DEC 14	1Ø3.Ø5	S			

LOCAL NUMBER, Ø2S-Ø6E-Ø4 CAB 1.
LOCATION.--LAT 34 24'43", LONG Ø96 4Ø'57", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: W. CORBIN.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED STOCK WELL, DIAMETER 6 IN, DEPTH 143 FT.
DATUM.--MEASURING POINT: TOP OF CASING Ø.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 83.52 FEET BELOW LAND SURFACE DATUM JUN Ø7,1978; LOWEST WATER LEVEL 132.92 FEET BELOW LAND SURFACE DATUM FEB Ø2,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
NOV Ø4, 1976	123.78	S	OCT Ø3, 1977	111.35	S	JUN Ø7, 1978	83.52	S	FEB Ø1, 1979	129.96	S
MAR 24, 1977	11Ø.5Ø	T	NOV Ø2	123.53	S	JUL Ø5	88.51	S	MAR Ø8	123.93	S
APR 26	85.61	T	DEC Ø6	129.Ø8	S	AUG Ø8	1Ø1.88	S	APR Ø5	98.45	S
MAY 24	9Ø.33	S	JAN Ø4, 1978	131.6Ø	S	SEP Ø6	111.35	S	MAY Ø3	1Ø1.7Ø	S
JUN 22	98.84	S	FEB Ø2	132.92	T	OCT Ø2	118.83	S			
JUL 27	1Ø5.72	S	APR Ø6	1Ø6.18	T	NOV Ø8	125.12	S			
AUG 25	115.73	S	MAY Ø2	95.78	S	DEC 14	127.26	S			

LOCAL NUMBER, 02S-06E-12 CCB 1.
LOCATION.--LAT 34 23'37", LONG 096 38'08", HYDROLOGIC UNIT 11140102, OWNER: P. FERRIS.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 4 IN, DEPTH 75 FT.
DATUM.--MEASURING POINT: BOTTOM OF RECORDER SHELTER FLOOR 3.0 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1976 TO 1979; HIGHEST WATER LEVEL 14.75 FEET BELOW LAND SURFACE DATUM APR 25,1977; LOWEST WATER LEVEL 39.53 FEET BELOW LAND SURFACE DATUM FEB 05,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
NOV 11, 1976	34.91	S	JUN 09, 1977	19.34	S	SEP 30, 1977	32.70	M	FEB 20, 1978	34.77	M
FEB 08, 1977	26.35	S	10	19.70	M	OCT 05	33.20	M	MAR 09	31.90	S
MAR 28	20.90	S	15	20.54	M	06	33.36	S	APR 06	23.61	S
31	18.70	M	20	21.34	M	10	33.69	M	MAY 05	18.47	M
APR 05	15.90	M	25	22.19	M	15	34.16	M	10	17.58	M
10	15.18	M	30	22.52	M	25	35.22	M	15	17.32	M
15	15.28	M	JUL 05	23.20	M	NOV 09	35.77	S	20	16.95	M
20	15.38	M	10	23.92	M	10	35.81	M	25	17.14	M
25	14.75	M	15	24.82	M	15	35.90	M	JUL 06	16.10	S
30	14.91	M	20	25.46	M	20	36.21	M	15	17.94	M
MAY 05	15.09	M	31	26.78	M	DEC 10	37.28	M	20	19.05	M
10	15.65	M	AUG 05	27.46	M	15	37.48	M	25	19.88	M
12	15.90	S	18	29.36	S	20	38.34	M	31	20.93	M
15	16.27	M	20	29.56	M	JAN 25, 1978	39.50	M	AUG 05	21.82	M
20	16.78	M	25	29.87	M	31	39.51	M	SEP 06	27.20	S
25	17.18	M	SEP 16	31.84	S	FEB 05	39.53	M	30	30.08	M
31	18.05	M	20	31.95	M	10	39.50	M			
JUN 05	18.78	M	25	32.33	M	15	35.89	M			

Appendix 8.--*Water levels in observation wells*--Continued

LOCAL NUMBER, Ø2S-Ø7E-Ø7 AAA 1.
LOCATION.--LAT 34 24'14", LONG Ø96 36'12", HYDROLOGIC UNIT 1114Ø1Ø2, OWNER: P. TEAFATELLER.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED DOMESTIC WELL, DIAMETER 6 IN, DEPTH 16Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.Ø FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 38.44 FEET BELOW LAND SURFACE DATUM JUN Ø8,1978; LOWEST WATER LEVEL 57.2Ø FEET BELOW LAND SURFACE DATUM MAR Ø3,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN Ø5, 1977	53.84	S	OCT Ø3, 1977	54.3Ø	S	MAY Ø3, 1978	47.45	S	DEC 15, 1978	53.23	S
MAR 25	5Ø.6Ø	S	NOV Ø2	56.65	S	JUN Ø8	38.44	S	FEB Ø2, 1979	52.Ø1	S
APR 26	42.9Ø	S	DEC Ø7	53.66	S	JUL Ø6	47.51	S	MAR Ø8	46.28	S
MAY 24	47.43	S	JAN Ø4, 1978	54.16	S	AUG Ø8	5Ø.66	S	APR Ø5	44.2Ø	S
JUN 22	51.94	S	FEB Ø2	54.41	S	SEP 11	52.15	S	MAY Ø4	47.11	S
JUL 27	51.64	S	MAR Ø3	57.2Ø	S	OCT Ø3	52.71	S			
AUG 25	52.61	S	APR Ø4	55.38	S	NOV Ø8	53.43	S			

LOCAL NUMBER, Ø3S-Ø4E-Ø6 CCA 1.
LOCATION.--LAT 34 19'14", LONG Ø96 55'46", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: P. HOWE.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 8 IN, DEPTH 7Ø FT.
DATUM.--MEASURING POINT: TOP OF CASING 3.3 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 15.54 FEET BELOW LAND SURFACE DATUM JUN Ø7,1978; LOWEST WATER LEVEL 27.11 FEET BELOW LAND SURFACE DATUM NOV Ø8,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS	DATE	WATER LEVEL	MS
JAN Ø8, 1977	27.1Ø	S	AUG 26, 1977	26.73	S	MAY Ø3, 1978	16.88	S	NOV Ø8, 1978	27.11	S
MAR 25	2Ø.87	S	OCT Ø4	27.Ø1	S	JUN Ø7	15.54	S	DEC 14	26.78	S
APR 27	15.78	S	NOV Ø1	27.ØØ	S	JUL Ø5	18.2Ø	S	FEB Ø1, 1979	26.Ø4	S
MAY 25	17.7Ø	S	DEC Ø7	26.99	S	AUG Ø7	23.48	S	MAR Ø8	19.94	S
JUN 21	21.78	S	FEB Ø2, 1978	26.72	S	SEP Ø6	27.ØØ	S	APR Ø5	15.84	S
JUL 27	26.55	S	APR Ø6	17.69	S	OCT Ø2	27.Ø2	S	MAY Ø3	16.45	S

LOCAL NUMBER, Ø3S-Ø4E-Ø6 CCD 1.
LOCATION.--LAT 34 19'12", LONG Ø96 55'47", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: P. HOWE.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 6 IN, DEPTH 1Ø5 FT.
DATUM.--MEASURING POINT: TOP OF CASING Ø.5 FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 13.ØØ FEET BELOW LAND SURFACE DATUM JUN Ø7,1978; LOWEST WATER LEVEL 2Ø.78 FEET BELOW LAND SURFACE DATUM FEB Ø2,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS
MAR 25, 1977	15.35 S	OCT Ø4, 1977	18.29 S	MAY Ø3, 1978	14.91 S	NOV Ø8, 1978	18.25 S
APR 27	14.84 S	NOV Ø1	18.93 S	JUN Ø7	13.ØØ S	DEC 14	18.86 S
MAY 25	15.37 S	DEC Ø7	19.58 S	JUL Ø5	15.Ø8 S	FEB Ø1, 1979	2Ø.24 S
JUN 21	15.82 S	JAN Ø5, 1978	2Ø.23 S	AUG Ø7	15.83 S	MAR Ø8	16.56 S
JUL 27	16.62 S	FEB Ø2	2Ø.78 S	SEP Ø6	16.64 S	APR Ø5	14.22 S
AUG 26	17.36 S	APR Ø6	14.87 S	OCT Ø2	17.25 S	MAY Ø3	14.96 S

LOCAL NUMBER, Ø3S-Ø4E-23 ABB 1.
LOCATION.--LAT 34 17'17", LONG Ø96 51'13", HYDROLOGIC UNIT 1113Ø3Ø4, OWNER: DAUBE CORP.
AQUIFER.--ARBUCKLE-SIMPSON.
WELL CHARACTERISTICS.--DRILLED UNUSED WELL, DIAMETER 9 IN, DEPTH 221 FT.
DATUM.--MEASURING POINT: TOP OF CASING 1.Ø FT ABOVE LAND-SURFACE DATUM.

PERIOD OF RECORD.--1977 TO 1979; HIGHEST WATER LEVEL 18.66 FEET BELOW LAND SURFACE DATUM APR 26,1977; LOWEST WATER LEVEL 35.25 FEET BELOW LAND SURFACE DATUM FEB Ø2,1978; WATER LEVELS IN FEET BELOW LAND SURFACE DATUM

DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS	DATE	WATER LEVEL MS
MAR 15, 1977	3Ø.45 S	OCT Ø4, 1977	32.39 S	JUN Ø7, 1978	25.Ø5 S	FEB Ø1, 1979	33.22 S
25	3Ø.66 S	NOV Ø1	32.91 S	JUL Ø5	31.23 S	MAR Ø8	25.69 S
APR 26	18.66 S	DEC Ø7	33.61 S	AUG Ø7	31.57 S	APR Ø5	2Ø.ØØ S
MAY 24	3Ø.57 S	JAN Ø3, 1978	34.47 S	SEP Ø6	31.97 S	MAY Ø3	29.67 S
JUN 21	31.Ø1 S	FEB Ø2	35.25 S	OCT Ø2	32.11 S		
JUL 25	31.42 S	APR Ø5	25.59 S	NOV Ø8	33.Ø1 S		
AUG 25	31.93 S	MAY Ø3	29.38 S	DEC 14	32.91 S		

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