UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WATER-RESOURCES APPRAISAL OF THE SOUTH-ARKANSAS LIGNITE AREA

Open File Report 79-924

Prepared in cooperation with the

ARKANSAS GEOLOGICAL COMMISSION

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By J. E. Terry, C. T. Bryant, A. H. Ludwig, and J. E. Reed

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ABBREVIATIONS

Btu/lb	British thermal unit per pound
Mgal/d	Million gallons per day
ft^3/s	cubic feet per second
mi^2	square miles
$(ft^3/s)/mi^2$	cubic feet per second per square mile
Jtu	Jackson turbidity unit
mg/L	milligrams per liter
mi	mile
µg/L	micrograms per liter
ft	feet
°C	degree Celsius
cm^{-1}	per centimeter (1/centimeter)
µmho	micromho
gal/min	gallons per minute
in.	inches
MW	megawatts
$(ft^3/s)/MWe$	cubic feet per second per megawatts electricity
scf	standard cubic feet

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ABSTRACT

The feasibility of developing lignite resources in south-central Arkansas is an important question at the present time (1978). Part of the concern is related to the possible impacts that mining and processing of lignite will have on water resources. Not only will the disturbance caused by excavating affect the quantity and quality of surface and ground water, but the mining, processing, and conversion processes will require the use and consumption of significant quantities of water.

In order to assess the magnitude of the effects of strip mining upon both surface and ground water, baseline conditions (hydrologic conditions in the area prior to mining) must be well defined. A thorough data file and literature search was made so that baseline conditions in the area could be defined. In addition, data-collection networks have been established for the collection of quantitative and qualitative information on streamflow and water levels in the aquifers. Data collected to date at these sites are included in the report. Collection of data at these sites will continue through at least September 1979.

Information presented in this report can be used to estimate the quantities of water available for use and the possible effects of mining and associated dewatering on water resources.

INTRODUCTION

Lignite in Arkansas

Lignite occurs in Arkansas principally in the deposits of Eocene age. These deposits are at the surface and in the subsurface southeast of a line approximately from Texarkana, northeastward through Arkadelphia, Little Rock, Bald Knob, and Pocahontas, to the Missouri State boundary. This line coincides roughly with the western boundary of the Coastal Plain in Arkansas (fig. 1). The area southeast of this line, which is almost one-half of the State, can be divided into three subareas with differing characteristics. The first subarea is a linear upland area called Crowleys Ridge which extends from the Missouri State boundary, north of Piggot, south to Helena. Deposits of Eocene age occur along this ridge. In many places, these deposits of Eocene age are covered by a substantial thickness of younger loess, silt, sand, or gravel. The second subarea is a part of the Mississippi Alluvial Plain, an area of flat terrain suited to agriculture. This area is of interest to lignite producers. However, in the Mississippi Alluvial Plain, the deposits of Eocene age are covered by 100 to 200 ft of alluvial deposits, which underlie the flood plains and terraces of the Arkansas, White, St. Francis, Mississippi, and other rivers. The sand and gravel in the lower part of the alluvial deposits constitute a productive aquifer that furnishes water to thousands of irrigation wells. Removing 100 ft or more of overburden, and pumping large quantities of water from strip mines, will increase the cost of producing lignite in the Mississippi Alluvial Plain. The third subarea includes all or parts of 20 counties in south-central Arkansas that contain outcrops of the deposits of Eocene age. Much exploration by several energy companies has taken place in this area, which contains several prospective lignite mining localities. These 20 counties constitute the most prospective area for development of the lignite resource at the present time.

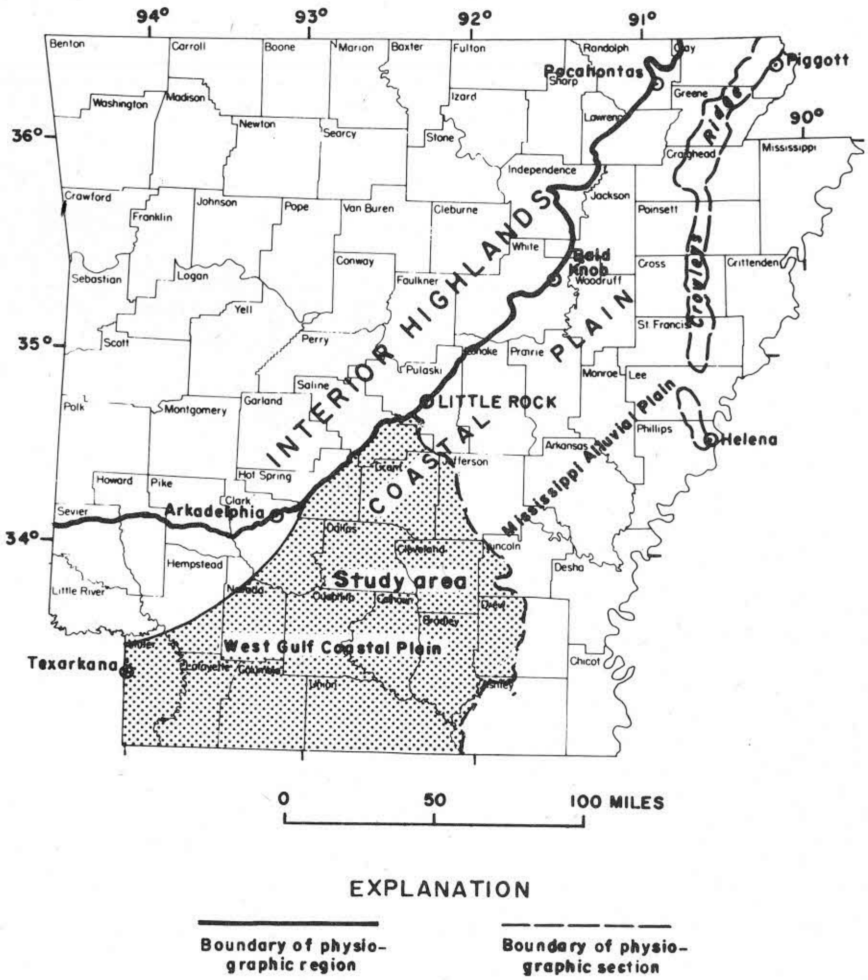


Figure 1.—Location of the project area.

Lignite found in Arkansas has a heating value of approximately 10,000 Btu/lb in dry form or 6,000 Btu/lb as mined. Lignite has a high moisture and volatile content. The high volatile content makes it readily convertible into gas or liquid form; however, the high moisture content and susceptibility to spontaneous combustion present problems in transportation and storage. Arkansas lignite is also low in sulfur content, ranging from 0.3 to 0.8 percent, making it desirable fuel for steam-electric generating plants.

Because it is not economically feasible to transport Arkansas lignite long distances, it will probably be utilized in near mine-mouth operations. Possible uses would include steam-electric generation, gasification, distillation of liquid hydrocarbons, and extraction of waxes.

Location of Project Area

The project area is all or parts of the above-mentioned 20 counties in south-central Arkansas. This area lies within and shares a common eastern boundary with the West Gulf Coastal Plain (fig. 1). East of this boundary, thick, highly saturated Quaternary deposits overlie the Eocene formations. To the northwest, the project boundary is the base of rocks of Eocene age (contact between Midway and Wilcox Groups on the geologic map of Arkansas). The southern and western boundaries are the State boundaries between Arkansas, Louisiana, and Texas.

Purpose and Scope of Investigation

The primary purpose of this investigation is to establish a data base defining hydrologic conditions in the project area prior to lignite mining.

Such an assessment is vital if the possible impacts of strip mining and lignite utilization upon water resources are to be evaluated.

Inevitably, environmental questions will be raised about the mining and utilization of lignite. Along with the more obvious effects on quality and quantity of surface water, strip mining of lignite could have an impact on ground water, both in the vicinity of the mine and at updip and downdip locations. Industries which use the lignite, either as a fuel or as a source for other products, will use and consume certain quantities of water. It is vital to have hydrologic information that can be used to answer both water use and environmental questions and to develop countermeasures to problems that may arise. Establishment of a data base defining predevelopment conditions in the project area is an important goal.

The information that must be contained in such a data base includes the following:

1. The availability and quality of ground and surface water.

2. The location and areal extent of the significant aquifers and their outcrops.

3. Water-level altitudes in the Tertiary aquifers.

4. Thickness of the Tertiary aquifers.

5. The areal extent and thickness of Quaternary deposits overlying the Tertiary beds.

This report presents the above-mentioned information for the project area.

Additional studies in the south-Arkansas lignite area will use the information presented in this report as indicators of the kinds of additional data needed to further define the hydrology in the area and as part of the input to a digital model which will be used to predict the impacts of mining upon the ground-water regime.

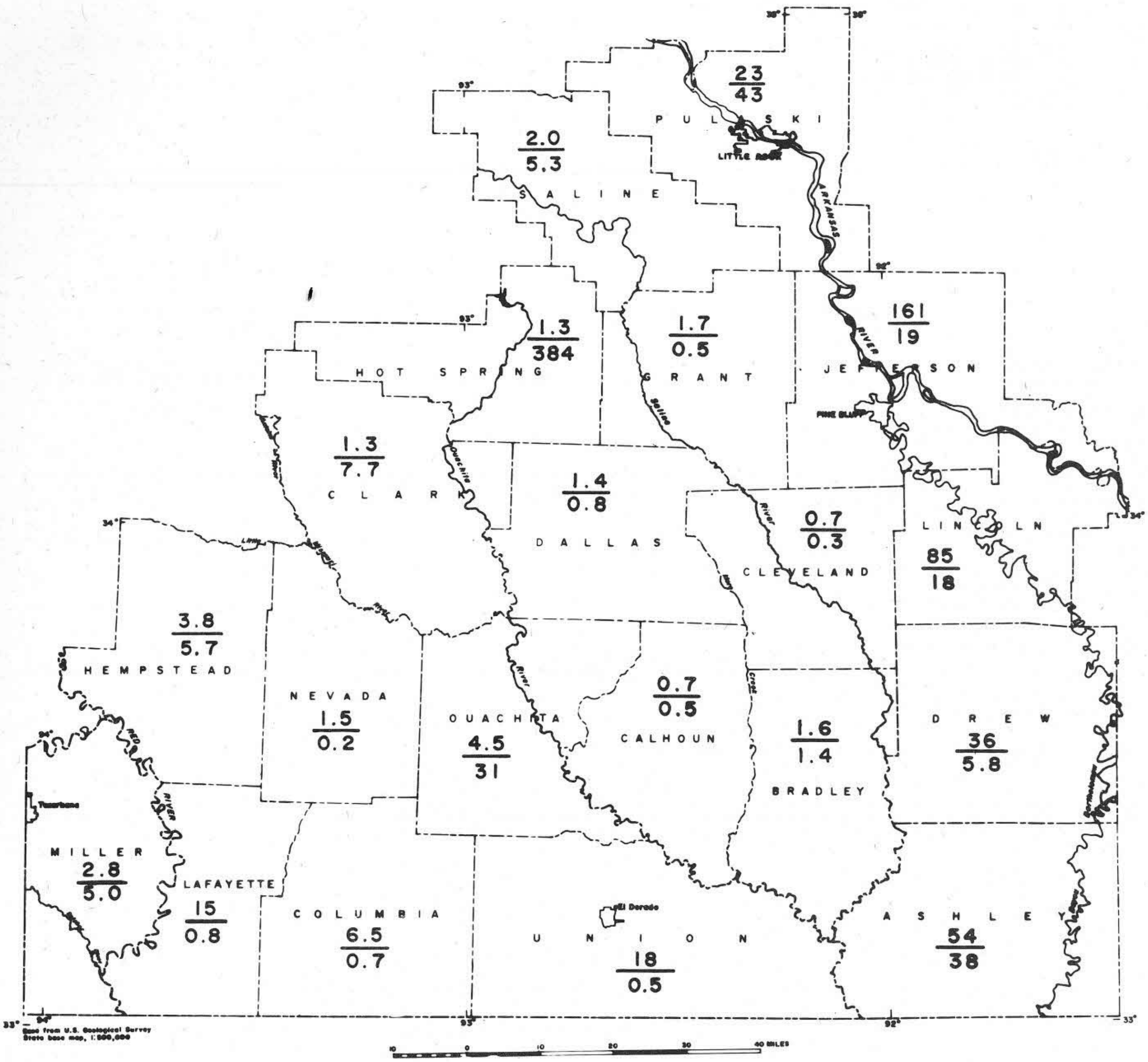
Previous Investigations

Many reports cover one or several facets of the water resources of part or all of the lignite area of south Arkansas. Reports dealing with surface water include reports on low flow (Hines, 1975), storage requirements (Patterson, 1967), and floods (Patterson, 1971). Ground-water investigations encompassing all of the south-Arkansas lignite area include reports on the aquifers of Tertiary age (Hosman and others, 1968), aquifers of Quaternary age (Boswell and others, 1968), aquifers of Cretaceous age (Boswell and others, 1965), and the base of freshwater (Cushing, 1966). Areal ground-water investigations within the project area include reports covering Ashley County (Hewitt and others, 1949), Bradley, Calhoun, and Ouachita Counties (Albin, 1964). Columbia County (Tait and others, 1953), Drew County (Onellion, 1956), the El Dorado area in Union County (Baker and others, 1948), Jefferson County (Klein and others, 1950), and Lincoln County (Bedinger and Reed, 1961). Water-resources investigations of areas within the project area include reports covering Clark, Cleveland, and Dallas Counties (Plebuch and Hines, 1969), Grant and Hot Spring Counties (Halberg and others, 1968), Hempstead, Lafayette, Little River, Miller, and Nevada Counties (Ludwig, 1972), and Pulaski and Saline Counties (Plebuch and Hines, 1967).

APPRAISAL OF THE WATER RESOURCES

Water Use

In 1975, the combined use of ground water and surface water in the 20 counties containing the project area was 991 Mgal/d (Halberg, 1977). Surface-water use was 569 Mgal/d and ground-water use was 422 Mgal/d. The use of ground water and surface water for 1975 for each of the counties is shown in figure 2. Of the surface-water use, 70 percent was for cooling at thermoelectric powerplants. Substantial amounts of surface water were used for public supply, self-supplied industry, irrigation, and fish farms. The largest use of surface water (384 Mgal/d) was in Hot Spring County, and the smallest use (0.2 Mgal/d) was in Nevada County (table 1). Most of the ground-water use (table 2) was from the deposits of Quaternary age (312 Mgal/d) and from the Sparta Sand (92 Mgal/d).



EXPLANATION

36	Ground water	(million gallon per day)
5.8	Surface water	

Figure 2.—Water used, by county, in the project area, 1975 (from Halberg, 1977).

Table 1.—*Use of surface water, by county, in the project area, 1975*

[Million gallons per day]

County	Public supply	Self-supplied industry	Live-stock	Irri-gation and fish farms	Wild-life impound-ments	Thermo-electric energy	County total
Ashley------	-----	35.71	0.14	2.53	----	------	38.38
Bradley-----	-----	-----	.08	1.30	----	------	1.38
Calhoun-----	-----	.38	.05	.08	----	------	.51
Clark-------	1.28	1.41	.23	4.80	----	------	7.72
Cleveland---	-----	-----	.06	.21	----	------	.27
Columbia----	-----	.12	.22	.37	----	------	.71
Dallas------	-----	-----	.05	.78	----	------	.83
Drew--------	-----	-----	.17	5.65	----	------	5.82
Grant-------	.05	.03	.07	.30	----	------	.45
Hempstead---	-----	.03	.38	1.76	3.57	------	5.74
Hot Spring--	1.09	3.84	.18	2.99	----	376.07	384.17
Jefferson---	-----	.51	.14	18.19	----	------	18.84
Lafayette---	-----	.05	.21	.51	----	------	.77
Lincoln-----	-----	----	.12	18.11	----	------	18.23
Miller------	2.08	.49	.37	2.10	----	------	5.04
Nevada------	-----	----	.23	-----	----	------	.23
Ouachita----	1.88	8.11	.08	.10	----	20.60	30.77
Pulaski-----	37.97	1.30	.28	3.45	----	------	43.00
Saline------	1.82	3.02	.17	.27	----	------	5.28
Union-------	-----	.35	.07	.06	----	-------	.48
Total--	46.17	55.35	3.30	63.56	3.57	396.67	568.62

Table 2.—*Withdrawals of ground water, by county, from aquifers in the project area, 1975*

[Million gallons per day]

County	Deposits of Quaternary age	Jackson Group	Cockfield Formation	Sparta Sand	Cane River Formation	Carrizo Sand	Wilcox Group	Clayton Formation	Tertiary System, undifferentiated	Nacatoch Sand	Older geologic units	Total for county
Ashley----------	53.27	----	0.50	----	----	----	----	----	----	----	----	53.77
Bradley---------	------	0.02	.27	1.34	----	----	----	----	----	----	----	1.63
Calhoun---------	------	----	.26	.47	----	----	----	----	----	----	----	.73
Clark-----------	.13	----	----	----	----	----	0.19	----	----	0.64	0.31	1.27
Cleveland-------	.02	.06	.44	.16	----	----	----	----	----	----	----	.68
Columbia--------	------	----	.34	6.02	0.10	----	----	----	----	----	----	6.46
Dallas----------	------	----	.07	1.19	.13	----	----	----	----	----	----	1.39
Drew------------	32.10	.26	.21	2.97	----	----	----	----	----	----	----	35.54
Grant-----------	.12	.01	.19	1.41	----	----	----	----	----	----	----	1.73
Hempstead-------	------	----	----	----	----	0.09	.08	----	----	1.44	2.15	3.76
Hot Spring------	.14	----	----	.15	.08	.06	.29	0.05	----	----	.53	1.30
Jefferson-------	106.79	.03	.17	53.82	----	----	----	----	----	----	----	160.81
Lafayette-------	12.19	----	----	.24	2.47	----	----	----	----	----	----	14.90
Lincoln---------	83.92	.07	.07	1.20	----	----	----	----	----	----	----	85.26
Miller----------	1.74	----	----	.35	.42	.08	.14	----	----	.04	----	2.77
Nevada----------	------	----	----	.13	.13	.04	.07	----	----	.55	.55	1.47
Ouachita--------	------	----	----	4.28	.15	.06	----	----	----	----	----	4.49
Pulaski---------	21.69	----	----	.20	----	----	.47	----	----	----	1.07	23.43
Saline----------	.12	----	----	.18	----	----	.18	.76	.12	----	.65	2.01
Union-----------	------	----	.67	17.40	----	----	----	----	----	----	----	18.07
Total----	312.23	.45	3.19	91.51	3.48	.33	1.42	.81	.12	2.67	5.26	421.57

Surface Water

The largest source of surface water in the project area is the Red River, which had an average flow at Fulton of 17,730 ft^3/s for the period 1927-76. The Ouachita River at Camden, where it has a drainage area of 5,391 mi^2, had an average flow of 7,562 ft^3/s for the period 1928-75. These and other mean flows for several streams in the lignite area are shown in table 3. Downstream, at the Arkansas-Louisiana State boundary, where the Ouachita River's drainage area is 10,835 mi^2, it has an estimated average flow of about 14,800 ft^3/s. The average flow in a stream is related to its drainage area. The relationship between average annual streamflow and drainage area for streams in Arkansas has been shown in map form by Patterson (1967, fig. 15). The part of his map that includes the lignite project area is shown in figure 3. The range for the lignite area is from $(0.9\ ft^3/s)/mi^2$ to $(1.3\ ft^3/s)/mi^2$.

Flow Duration

Flow-duration data, as shown in table 4, for regular-gaging stations in the project area indicate for a particular stream the discharge that is equaled or exceeded for a given percentage of time. Flow duration ignores the characteristics of individual events but combines all events into one relationship for the stream. If the period for which the flow-duration data were collected is representative, the flow-duration relationship should apply in the future as long as hydrologic conditions do not change. Regulation of streamflow usually changes the flow-duration relationship. Some of the stations shown in table 4 have flow-duration data for both preregulated and regulated flow. Variation in flow, as reflected in flow duration, is a function of climate and the hydrologic characteristics of the drainage basin. Regulation of flow

Table 3.—*Drainage areas and mean flow for continuous-record gaging stations in the project area*

Station		Period of record (water years)	Drainage area (mi^2)	Mean flow (ft^3/s)
Number	Name			
07341500	Red River at Fulton-----------	1928-76	52,380	17,730
07349430	Bodcau Creek at Stamps--------	1959-70	234	207
07359500	Ouachita River near Malvern---	1925-26 1928-76	1,562	2,376
07360000	Ouachita River at Arkadelphia.	1905-6, 1929-75	2,311	3,558
07361600	Little Missouri River near Boughton.	1937-42, 1945-75	1,068	1,548
07362000	Ouachita River at Camden------	1929-75	5,391	7,562
07362100	Smackover Creek near Smackover.	1962-76	377	399
07362500	Moro Creek near Fordyce-------	1952-76	216	227
07363000	Saline River at Benton--------	1951-76	569	422
07363200	Saline River near Sheridan----	1971-76	1,129	1,813
07363300	Hurricane Creek near Sheridan.	1962-76	204	232
07363500	Saline River near Rye---------	1938-76	2,062	2,591
07365800	Cornie Bayou near Three Creeks.	1957-76	180	183
07365900	Three Creeks near Three Creeks.	1957-71	50.3	49.5

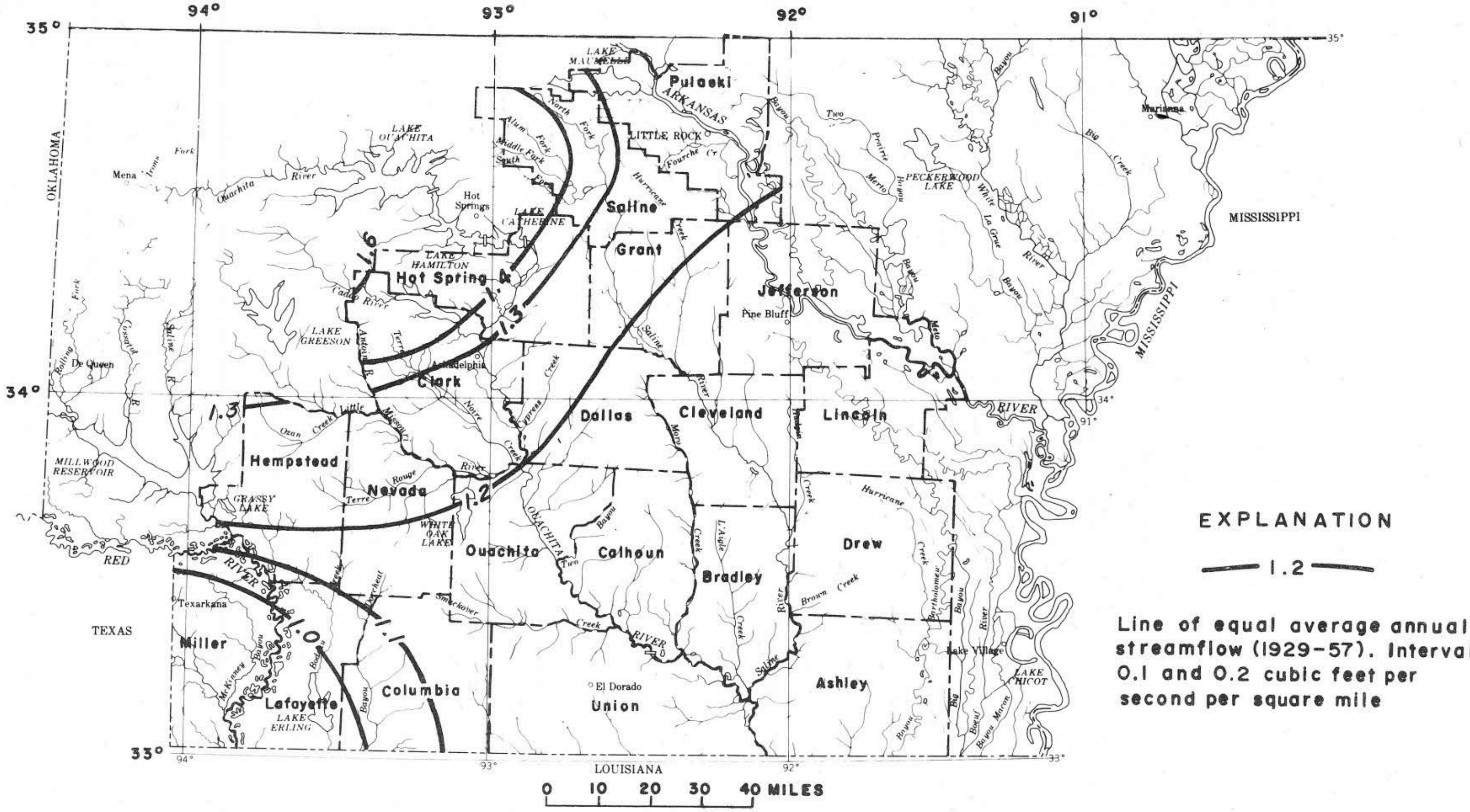


Figure 3.—Average annual streamflow per square mile in the project area (modified from Patterson, 1967).

Table 4.—*Flow duration at continuous-record gaging stations in the project area*

Station Number	Station Name	Period of record (water years)	Drainage area (mi^2)	Median flow	Flow, expressed as a ratio to medium flow, which was equaled or exceeded for percentage of time indicated in column subheads: 98	90	70	30	10	2
07337000	Red River at Index---	1937-43, 1945-70	48,030	5,450 5,200	0.10 .23	0.17 .44	0.51 .68	1.98 1.78	6.04 5.87	17.80 13.46
07341500	Red River at Fulton--	1928-43, 1945-70	52,380	7,700 7,200	.10 .21	.19 .40	.52 .63	1.96 2.18	6.04 6.36	13.38 13.61
07349430	Bodcau Creek at Stamps.	1961-70	234	52	.00	.01	.19	4.00	12.12	28.85
07359500	Ouachita River near Malvern.	1929-52, 1954-70	1,562	970 1,440	.09 .15	.14 .21	.39 .39	2.34 1.72	5.41 2.79	19.59 6.63
07360000	Ouachita River at Arkadelphia	1906, 1930-52, 1954-70	2,311	1,530 1,910	.10 .14	.16 .22	.38 .50	2.01 1.63	5.10 3.17	17.32 7.85
07361600	Little Missouri River near Boughton.	1938-42, 1946-49, 1951-70	1,068	405 520	.03 .09	.06 .19	.29 .54	2.99 1.81	9.93 6.12	27.90 18.27
07362000	Ouachita River at Camden.	1929-52, 1954-70	5,391	2,580 2,980	.09 .21	.16 .32	.40 .58	2.52 1.81	7.98 5.03	20.08 12.25
07362100	Smackover Creek near Smackover.	1962-70	377	63	.02	.08	.32	2.70	14.68	39.05
07362500	Moro Creek near Fordyce.	1952-70	216	9.6	.00	.00	.08	7.92	59.38	188.54
07363000	Saline River at Benton.	1951-70	569	192	.05	.15	.41	2.23	7.76	34.64
07363300	Hurricane Creek near Sheridan.	1962-70	204	26	.04	.12	.35	4.00	15.77	73.85

Table 4.—*Flow duration at continuous-record gaging station in the project area*—Continued

Station		Period of record (water years)	Drainage area (mi^2)	Median flow	Flow, expressed as a ratio to medium flow, which was equaled or exceeded for percentage of time indicated in column subheads					
Number	Name				98	90	70	30	10	2
07363500	Saline River near Rye.	1938-70	2,062	556	0.03	0.10	0.36	3.87	12.68	28.96
07365800	Cornie Bayou near Three Creeks.	1957-70	180	25	.00	.08	.38	3.12	14.92	53.60
07365900	Three Creeks near Three Creeks.	1957-70	50.3	5.5	.04	.13	.42	2.73	20.91	94.55

by reservoirs reduces flow variation. Flow-duration relationships at each station were defined by the percentage of time, during the period of record, that the daily mean flow was greater than a specified value. "The daily mean flow values for the period of record at each gaging station were sorted by computer into about 30 classes. Each class represents a range in daily-mean flow. These classes include the highest and lowest daily flows and are uniformly distributed throughout the range of daily flow. Each daily-mean flow for the period of record was included in its appropriate class. The number of days thus represented in each class were accumulated, beginning at the highest daily-mean flow class, and the percentage of days when the flow was greater than the lower limit of each class in the accumulation was computed" (Hines, 1975). Flow duration is a cumulative frequency obtained by summing the class frequencies beginning with the class of highest flow.

Flow duration was estimated at low-flow partial-record stations and the estimated flows at 99- and 90-percent duration are shown in table 5. These flows were estimated by correlation with flows at continuous-record gaging stations. They are not as accurate as data for continuous-record stations but do indicate hydrologic conditions existing at partial-record sites.

Flow-duration data can be plotted on logarithmic-probability paper if a graphical presentation is desired. The slope of the duration curve reflects variations in flow caused by the hydrologic and geologic characteristics of the river basin upstream from the station. The slopes of the curves for streams that have large low-flow yields are flatter than those for streams that have small low-flow yields. Thus, the flow-duration data are useful for comparing the flow characteristics of different streams.

Low-Flow Frequency

Low-flow frequency for regular-gaging stations was computed from annual events occurring during the period of record. The events were the

Table 5.—*Estimates of low-flow frequency and flow duration at partial-record stations*

Station Number	Station Name	Drainage area (mi²)	Period of record	Annual low flow, in cubic feet per second, for 7 consecutive days and recurrence intervals indicated in column heads: 2-year	10-year	Daily mean flow, in cubic feet per second, that will be equaled or exceeded the indicated percentage of time: 99	90
07341690	Bois D'Arc Creek near Hope--------------	36	1963-67, 1977	1.0	0.3	0.5	1.7
07342151	Maniece Bayou near Canfield-------------	109	1958-63	.6	----	---	1.4
07342350	McKinney Bayou near Garland City--------	169	1956-61, 1977	<.1	----	---	.3
07348600	Bayou Dorcheat at Buckner---------------	101	1958-63, 1977	.1	----	---	.4
07349420	Whetton Branch near Bodcaw--------------	[1]3.3	1963-67, 1977	.3	.2	.2	.4
	Prairie Bayou near Social Hill----------	28.0	1967, 1977	.16	[1].08	---	.22
	DeLisle Creek near Friendship-----------	27.0	1967, 1977	[1]<.1	0	---	0
	DeRoche Creek near Friendship-----------	39	1967-77	[1]<.1	0	---	.01
	Whiteoak Creek near Witherspoon---------	33	1967, 1977	[1].03	[1].01	---	[1].08
	Saline Bayou near Arkadelphia-----------	39	1967, 1977	.09	<.01	---	.22
07359590	Tenmile Creek near Donaldson------------	7.49	1964-67, 1977	<.1	<.1	<.1	<.1
07360100	L'Eau Frais Creek near Joan-------------	79.4	1958-67, 1977	2.6	.7	1.3	4.2
07360160	Cypress Creek at Manning----------------	59.6	1964-67, 1977	1.3	.1	.3	2.4
07360161	Cypress Creek near Sparkman-------------	82.4	1977	.71	.31	---	1.3
07361160	North Fork Ozan Creek near McCaskill----	72.3	1963-67	.1	----	---	.4
07361630	Terre Rouge Creek near Hope-------------	37.4	1964-67, 1977	.9	.2	.3	1.8
07361640	Little Terre Rouge Creek near Emmet-----	38	1963-67, 1977	.2	<.1	<.1	.6
07361650	Terre Rouge Creek near Prescott---------	231	1958-62, 1977	1.1	.2	.4	2.5
07361700	Caney Creek near Bluff City-------------	167	1958-62, 1977	.1	----	---	.5
07361800	Terre Noire Creek near Gurdon-----------	250	1958-66, 1977	.5	----	---	1.7

[1]Estimated.

Table 5.—*Estimates of low-flow frequency and flow duration at partial-record stations*—Continued

Station Number	Station Name	Drainage area (mi^2)	Period of record	Annual low flow, in cubic feet per second, for 7 consecutive days and recurrence intervals indicated in column heads: 2-year	10-year	Daily mean flow, in cubic feet per second, that will be equaled or exceeded the indicated percentage of time: 99	90
	Brushy Creek near Sparkman	[1]15	1968-77	<0.03	---	---	[1]0.1
	Tulip Creek near Manning	[1]40	1968, 1977	.8	---	---	1.6
	East Tulip Creek near Princeton	[1]20	1968, 1977	1.1	---	---	1.3
07361850	Tulip Creek near Pine Grove	152	1968, 1977	1.5	0.5	0.7	2.7
07361900	Bayou Freeo near Eagle Mills	94.8	1968, 1977	.4	<.1	.1	.8
07362060	Two Bayou at Camden	[1]110	1963-67, 1977	<.1	---	<.1	.4
07362070	Locust Bayou at Locust Bayou	[1]81	1963-67, 1977	0	0	0	0
07362080	Gum Creek near Stephens	[1]37	1959-67, 1977	.1	---	<.1	.3
07362090	Camp Creek near Smackover	46	1963-67, 1977	.2	---	.1	.7
07362300	Champagnolle Creek at Hampton	86	1958-61, 1977	0	0	0	0
07362540	Whitewater Creek near Tinsman	[1]25	1963-67, 1977	0	0	0	0
07362550	Moro Creek near Banks	374	1946-62, 1977	0	0	0	0
07362600	Alum Fork at Crows	123	1966, 1977	1.2	---	---	2.5
07362700	Middle Fork at Crows	109	1966, 1977	3.6	---	---	6.4
07362900	North Fork near Benton	132	1957-63, 1977	.6	<.1	.1	1.8
	South Fork near Nance	[1]115	1966, 1977	1.3	---	---	2.1
07363100	Francois Creek near Poyen	84.1	1958-63, 1977	.1	<.1	<.1	.1
07363110	Big Creek at Poyen	32.1	1964-67, 1977	.7	---	---	1.1
07363180	Lost Creek near Sheridan	68.2	1964-67	0	0	0	0
07363440	Derriesseaux Creek near Rison	144	1964-67, 1977	0	0	0	0

[1]Estimated.

Table 5.—*Estimates of low-flow frequency and flow duration at partial-record stations*—Continued

Station		Drainage area (mi^2)	Period of record	Annual low flow, in cubic feet per second, for 7 consecutive days and recurrence intervals indicated in column heads		Daily mean flow, in cubic feet per second, that will be equaled or exceeded the indicated percentage of time	
Number	Name			2-year	10-year	99	90
07363460	Big Creek near Pine Bluff---------------	14.8	1964-67	0	0	0	0
07363465	Big Creek near Pansy--------------------	157	1964-67, 1977	0	0	0	0
07363700	Hudgin Creek near Pansy-----------------	90.3	1958-66, 1977	<.1	<.1	<.1	<.1
07364010	Brown Creek near Lacey------------------	[1]14	1964-67, 1977	0	0	0	0
07364020	L'Aigle Creek at Hermitage--------------	167	1958-62, 1977	0	0	0	0
07364060	Bayou Lapile at Strong------------------	93.3	1958-63, 1977	.4	<.1	.1	.8
07364170	Cutoff Creek near Selma-----------------	88.4	1958-62, 1977	<.1	---	<.1	<.1
07364250	Chemin-a-Haut Creek near Berlin---------	216	1958-62, 1977	.2	---	<.1	.8
07364600	Bayou De Loutre near El Dorado-----------	78.4	1958-63, 1977	2.7	.8	1.4	4
07366100	Little Cornie Bayou near Junction City--	98.2	1958-63, 1977	1.1	---	.2	2

[1]Estimated.

lowest mean discharges for 1-, 7-, 14-, 30-, 60-, and 120-day periods during each year. The recurrence interval for these events was determined by either fitting a mathematical-frequency distribution to the data or by plotting the data on a graph and drawing a smooth curve through the data points (Hines, 1975). The resulting annual low flows for given recurrence intervals are shown in table 6 for streams in the project area.

Estimates of low-flow characteristics at partial-record stations were made by comparing measurements of low flow at the partial-record station with concurrent daily-mean discharge at a continuous-record gaging station. These continuous- and partial-record gaging stations are shown in figure 4. The criteria for selecting a continuous-record station for comparison were that it should have a long-term record, be near the partial-record station, and reflect similiar hydrologic conditions as the partial-record station. If a curve relating discharge at the two stations could be found, estimates of low flow at the partial-record station could be made based on corresponding frequency values, at the continuous-record station. Estimates of low-flow frequency obtained by the preceding method, for partial-record stations in the lignite area, are shown in table 5.

Low-flow frequency is important in determining the water-supply potential at a given site on a stream. Draft rates in excess of expected low flow must be supplied from storage. Storage requirements for streams in the lignite area are included in a report by Patterson (1967). Another use for low-flow data is in determining the waste-assimilation capacity of streams, such as the study by Jennings and Bryant (1974).

Many streams in south Arkansas would be classified as not having sustained base flow (Hines, 1975, fig. 7). The only part of the project area where streams have sustained base flow is the drainage of the Ouachita River upstream from Camden (Hines, 1975, fig. 7).

Table 6.—*Low-flow frequency at continuous-record gaging stations in the project area*

[This table includes data for both regulated and unregulated streams. From Hines, 1975]

Station Number	Station Name	Drainage area (mi^2)	Period of record (water years)	Consecutive days period	Annual low flow, in cubic feet per second, for recurrence interval, in years, indicated in column subheads: 2	5	10	20	50
07337000	Red River at Index-----	[1]48,030	1938-43,[2] 1946-70	1	1,750	1,210	917	695	482
				7	2,100	1,390	1,030	758	508
				14	2,390	1,600	1,160	839	542
				30	2,860	1,940	1,410	1,000	633
				60	3,400	2,230	1,600	1,140	640
				120	4,300	2,550	1,870	1,420	1,010
07341500	Red River at Fulton----	[1]52,380	1929-43	1	1,030	646	508	418	(336)
				7	1,140	696	539	437	(346)
				14	1,240	739	566	455	(358)
				30	1,380	808	615	494	(388)
				60	1,930	1,140	875	708	(550)
				120	4,140	2,310	1,670	1,270	(918)
			1946-70	1	2,190	1,440	1,060	777	520
				7	2,610	1,710	1,220	870	551
				14	2,910	1,940	1,380	962	590
				30	3,440	2,250	1,610	1,150	730
				60	4,000	2,620	1,950	1,460	1,020
				120	5,480	3,200	2,330	1,760	1,250
07349430	Bodcau Creek at Stamps.	234	1962-70	1	0	-----	-----	-----	-----
				7	<.1	-----	-----	-----	-----
				14	.3	0	-----	-----	-----
				30	.8	<.1	-----	-----	-----
				60	1.7	.2	(<.1)	-----	-----
				120	9.2	.9	(.2)	-----	-----

[1]5,936 mi^2 probably noncontributing.
[2]No frequency analysis for this period.

Note.— Values shown in parentheses were obtained by extrapolation

Table 6.—*Low-flow frequency at continuous-record gaging stations in the project area*—Continued

Station Number	Station Name	Drainage area (mi^2)	Period of record (water years)	Consecutive days period	Annual low flow, in cubic feet per second, for recurrence interval, in years, indicated in column subheads: 2	5	10	20	50
07359500	Ouachita River near Malvern.	1,562	1929-51	1	81	56	48	42	36
				7	133	90	73	62	52
				14	159	101	81	69	57
				30	200	128	100	81	64
				60	255	158	120	95	72
				120	400	216	160	125	94
			1955-70	1	203	134	104	83	(62)
				7	320	248	217	193	(169)
				14	355	266	230	203	(179)
				30	453	293	237	210	(188)
				60	646	370	282	227	(198)
				120	960	584	450	362	(283)
07360000	Ouachita River at Arkadelphia.	2,311	1930-51	1	150	106	88	76	66
				7	190	133	110	95	81
				14	227	152	124	105	88
				30	265	172	140	117	96
				60	332	220	178	150	124
				120	565	312	240	190	150
			1955-70	1	310	223	195	178	(160)
				7	420	280	237	208	(185)
				14	480	312	262	230	(200)
				30	640	385	308	260	(220)
				60	870	480	360	300	(255)
				120	1,120	600	450	370	(365)

Note.— Values shown in parentheses were obtained by extrapolation.

Table 6.—*Low-flow frequency at continuous-record gaging stations in the project area*—Continued

Station Number	Station Name	Drainage area (mi^2)	Period of record (water-years)	Consecutive days period	Annual low flow, in cubic feet per second, for recurrence interval, in years, indicated in column subheads: 2	5	10	20	50
07361600	Little Missouri River near Boughton.	1,068	1951-70	1	46	28	23	19	16
				7	74	38	27	20	17
				14	87	46	34	27	21
				30	131	71	51	38	28
				60	202	110	78	58	41
				120	302	175	126	94	65
07362000	Ouachita River at Camden.	5,391	1930-52	1	259	182	156	138	123
				7	312	212	175	151	129
				14	349	230	188	160	135
				30	413	260	206	171	138
				60	512	327	264	223	187
				120	768	458	362	302	251
			1955-70	1	719	545	471	418	(366)
				7	911	639	531	456	(385)
				14	994	683	564	483	(407)
				30	1,200	794	642	541	(447)
				60	1,510	992	798	668	(546)
				120	2,030	1,330	1,050	847	(658)
07362100	Smackover Creek near Smackover.	377	1963-70	1	1.7	.3	(<.1)	---	-----
				7	2.5	.5	(.1)	---	-----
				14	3.5	.6	(.2)	---	-----
				30	5.3	1.0	(.4)	---	-----
				60	9.6	2.9	(.9)	---	-----
				120	19	5.6	(2.5)	---	-----

Note.— Values shown in parentheses were obtained from extrapolation.

Table 6.—*Low-flow frequency at continuous-record gaging stations in the project area*—Continued

Station Number	Station Name	Drainage area (mi^2)	Period of record (water-years)	Consecutive days period	Annual low flow, in cubic feet per second, for recurrence interval, in years, indicated in column subheads: 2	5	10	20	50
07362500	Moro Creek near Fordyce.	216	1953-70	1	0	----	----	----	-----
				7	0	----	----	----	-----
				14	0	----	----	----	-----
				30	0	----	----	----	-----
				60	.1	0	----	----	-----
				120	.7	<.1	----	----	-----
07363000	Saline River at Benton.	569	1952-70	1	11	2.8	.7	<.1	0
				7	14	3.7	1.1	.2	0
				14	18	5.4	1.9	.6	(<.1)
				30	27	8.4	3.6	1.3	(.2)
				60	48	15	6.7	2.5	(.5)
				120	89	30	15	7.8	(3.3)
07363300	Hurricane Creek near Sheridan.	204	1963-70	1	1.6	.1	(0)	----	-----
				7	2.0	.5	(.1)	----	-----
				14	2.6	.7	(.2)	----	-----
				30	3.9	1.1	(.5)	----	-----
				60	7.6	1.9	(.7)	----	-----
				120	14	4.1	(1.8)	----	-----
07363500	Saline River near Rye.	2,062	1939-70	1	34	16	10	7.3	4.8
				7	37	17	11	7.9	5.3
				14	41	19	12	8.5	5.6
				30	50	21	14	9.6	6.3
				60	71	29	18	12	8.2
				120	151	67	45	32	22

Note.— Values shown in parentheses were obtained from extrapolation.

Table 6.—*Low-flow frequency at continuous-record gaging stations in the project area*—Continued

Station		Drainage area (mi^2)	Period of record (water-years)	Consecutive (water-years)	Annual low flow, in cubic feet per second, for recurrence interval, in years, indicated in column subheads				
Number	Name				2	5	10	20	50
07365800	Cornie Bayou near Three Creeks.	180	1957-69	1	0.6	0	---	---	------
				7	.9	<.1	---	---	------
				14	1.2	.1	---	---	------
				30	2.1	.3	0	---	------
				60	4.6	1.1	.5	0.2	(<0.1)
				120	8.9	2.0	.8	.3	(.1)
07365900	Three Creeks near Three Creeks.	50.3	1957-70	1	.2	0	---	---	------
				7	.3	<.1	---	---	------
				14	.5	.1	0	---	------
				30	.8	.2	.1	<.1	------
				60	1.4	.5	.3	.2	(<.1)
				120	2.6	1.0	.6	.4	(.3)

Note.— Values shown in parentheses were obtained from extrapolation.

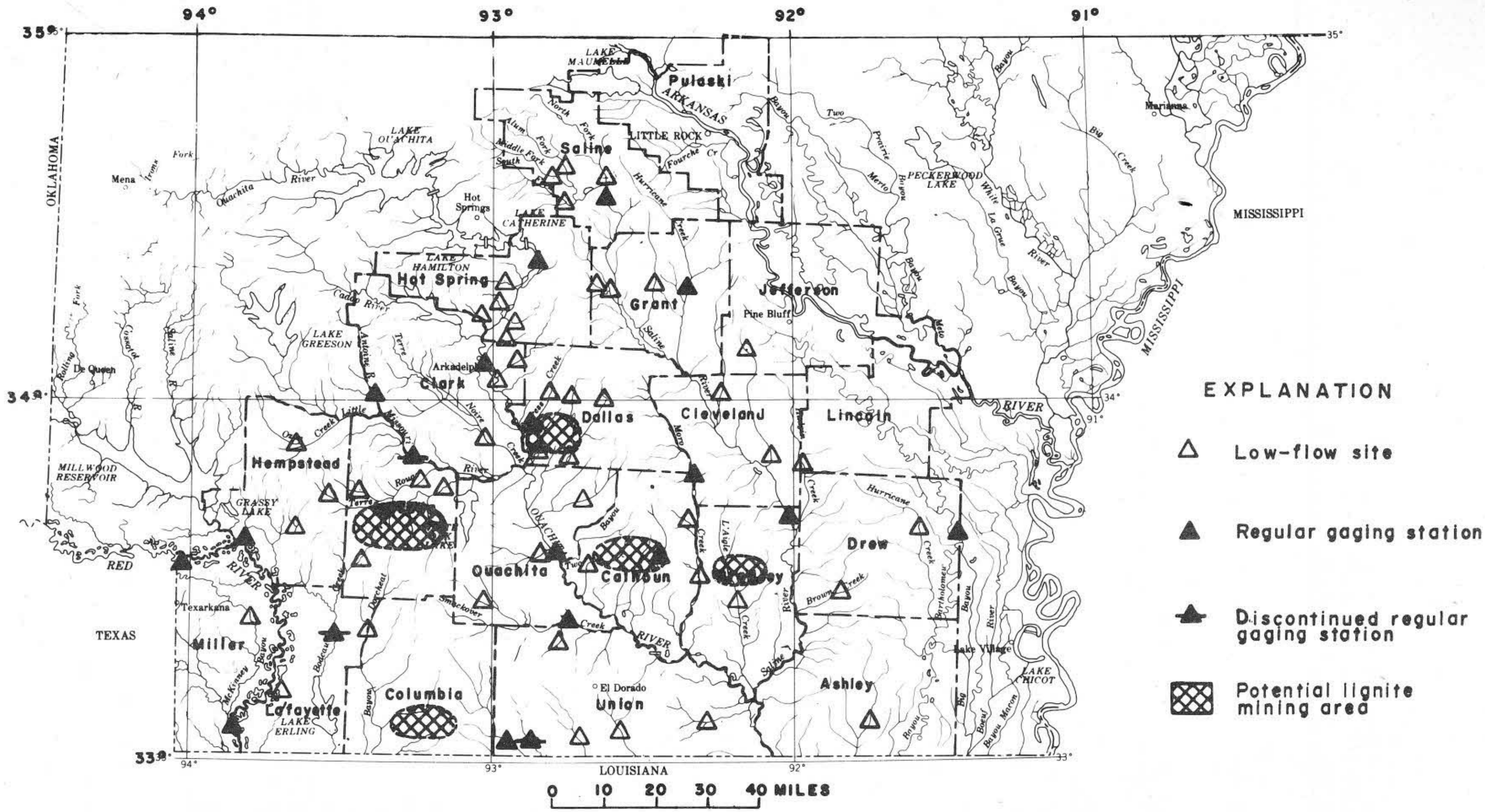


Figure 4.—Locations of regular-gaging stations and low-flow partial-record stations in the project area.

Flood Frequency

Flood frequency is often used as an indicator of the use that could be made of the flood plains of streams, the design characteristics of structures that must occupy the flood plain, and flood-insurance rates for developed areas of flood plains. The best method, at present, for estimating future flood events is by the analyses of past flood events. Flood frequency at points on a stream is determined from annual peak events for the period of record. The annual flood is the highest instantaneous discharge that has occurred during a year of record. A recurrence interval is determined from these annual floods, either by fitting them to a frequency distribution or by plotting the flood-data points and drawing a smooth curve through them.

An analysis of floods in Arkansas was made by Patterson (1971). His report (p. 3) has a description of methods for determining recurrence interval from gaging-station records by either the log-Pearson Type III frequency distribution or by graphical methods. Characteristics of annual floods, as determined by Patterson (1971), for sites in the project area are given in table 7.

The results of frequency analysis for gaging stations were expanded to include ungaged sites through the use of regression analysis (Patterson, 1971). Patterson related annual peak flow to hydrologic characteristics of the streams. Significant characteristics were found to be drainage area, main-channel slope, annual precipitation, and mean basin elevation for streams within the lignite area. Patterson's equations are given in table 8 for the parts of Arkansas that include the lignite area. The simplest equations require only information on the drainage area upstream from the site. However, the equation relating peak flow to drainage area also has the largest standard error. Better estimates of peak flow require more information on characteristics of the drainage basin. If increased accuracy is desired, one or more equation variables, in addition to drainage area, must be defined.

Table 7.—*Characteristics of annual floods for gaging stations in the project area*

[Type: P, partial-record station; D, continuous-record gaging station. Modified from Patterson, 1978]

Station			Peak discharge, in cubic feet per second, for indicated recurrence interval, in years				
Number	Type	Name	2	5	10	25	50
07344320	P	Mill Creek tributary near Fouke------	*270	*384	*460	--------	--------
07346800	P	East Fork Kelly Bayou tributary at Kiblah.	*17	*45	*68	--------	--------
07348630	P	Barlow Branch tributary near McNeil--	*32	*69	*93	--------	--------
07359500	D	Ouachita River near Malvern----------	54,600	88,700	111,000	138,000	157,000
07359520	P	Ouachita River tributary near Malvern.	*360	*860	*1,300	--------	--------
07360150	P	Pearson Creek tributary near Dalark--	*90	*146	*184	--------	--------
07362050	P	Ross Creek near Camden--------------	*570	*1,250	*1,750	--------	--------
07362100	D	Smackover Creek near Smackover-------	6,200	12,200	16,800	23,000	27,900
07362450	P	Cooks Creek near Fordyce------------	*750	*1,530	*2,050	--------	--------
07362500	D	Moro Creek near Fordyce-------------	4,680	8,770	12,300	17,700	22,600
07363000	D	Saline River at Benton--------------	*30,600	*47,600	*63,000	*84,000	*100,000
07363050	P	Holly Creek tributary near Benton----	*230	*420	*550	--------	--------
07363200	D	Saline River near Sheridan----------	*32,100	*44,200	*51,000	*61,000	*70,000
07363330	P	West Fork Big Creek at Sheridan------	*430	*970	*1,400	--------	--------

*Obtained from graphical frequency curve.

Table 7.—*Characteristics of annual floods for gaging stations in the project area*—Continued

Station			Peak discharge, in cubic feet per second, for indicated recurrence interval, in years				
Number	Type	Name	2	5	10	25	50
07363430	P	East Fork Derrieusseaux Creek near Pine Bluff.	*112	*205	*266	------	------
07363500	D	Saline River near Rye----------------	26,000	43,700	55,900	71,600	83,500
07364110	P	Nevins Creek tributary near Pine Bluff.	*125	*178	*215	------	------
07364550	P	Caney Creek tributary near El Dorado.	*60	*114	*150	------	------
07365800	D	Cornie Bayou near Three Creeks-------	3,960	8,000	11,600	17,200	22,300

*Obtained from graphical frequency curve.

Table 8.—*Regression equations applicable within the project area*

[Drainage area: 0.1 mi^2 to 3,000 mi^2. Model is $Y = aA^{b_1}S^{b_2}E^{b_3}P^{b_4}$; where S is greater than 30 ft/mi, use 30. From Patterson, 1971]

Equation number	Peak-flow characteristic, Y	Regression constant, a	Exponent of basin characteristic				Standard error of estimate, percent	
			Drainage area, A	Main channel slope, S	Mean basin elevation, E	Mean annual precipitation minus 30, P	Areas 25 mi^2 or more	Areas less than 25 mi^2
9(a)	Q_2	4.99	0.72	0.32	0.20	0.59	25	46
(b)	Q_2	58.1	.77	.46	----	----	30	45
(c)	Q_2	276	.68	----	----	----	41	50
10(a)	Q_5	11.8	.72	.35	.21	.43	22	40
(b)	Q_5	91.8	.78	.50	----	---	26	36
(c)	Q_5	498	.68	----	----	----	40	40
11(a)	Q_{10}	17.2	.73	.37	.21	.36	22	40
(b)	Q_{10}	112	.78	.52	----	----	26	36
(c)	Q_{10}	653	.68	----	----	----	40	40
*12(a)	Q_{25}	10.8	.62	.29	.36	.55	23	--
(b)	Q_{25}	65.6	.69	.45	.22	----	24	--
(c)	Q_{25}	117	.77	.63	----	----	26	--
(d)	Q_{25}	2,680	.48	----	----	----	40	--
*13(a)	Q_{50}	21.9	.62	.33	.31	.45	25	--
(b)	Q_{50}	96.4	.68	.46	.20	----	26	--
(c)	Q_{50}	164	.75	.63	----	----	27	--
(d)	Q_{50}	3,620	.46	----	----	----	41	--

*Not applicable for drainage areas less than 25 mi^2.

For small drainage areas, generally less than 25 mi^2, frequency relations are not defined for recurrence intervals of more than 10 years. Therefore, for drainage areas of this size, equations 12 and 13 in table 8 are invalid and should not be used. Patterson developed a method for estimating the Q_{25} and Q_{50} for drainage areas less than 25 mi^2. He determined values for the ratios Q_{25}/Q_{10} and Q_{50}/Q_{10} for long-term gaging stations throughout the State. These values were then related to basin parameters and a reasonably good correlation was obtained using main-channel slope as an independent variable. The relation curves shown in figure 5 reflect the results of this analysis. Peak flows for recurrence intervals of 25 and 50 years for small drainage areas in the project area can be estimated by first determining the 10-year flood and then multiplying by the appropriate value from the relation curves in figure 5.

Flood Stage

The elevation of the water surface, as well as the discharge, is important for planning purposes in the construction of structures or earthworks in the vicinity of streams. Methods requiring extensive field surveys are available to accurately determine the elevation and peak flow of design floods and should be used if extreme accuracy is required. However, the following procedure may be used in the absence, or in support, of other streamflow data to obtain an approximation of the elevation of the 50-year flood for any gaged or ungaged sites on streams in the project area. The procedure developed by Hines (1977) enables the determination of the elevation of the 50-year flood using a stage increment (ΔD) representing the surcharge produced by the 50-year flood discharge over the 50-percent-duration (median) flow.

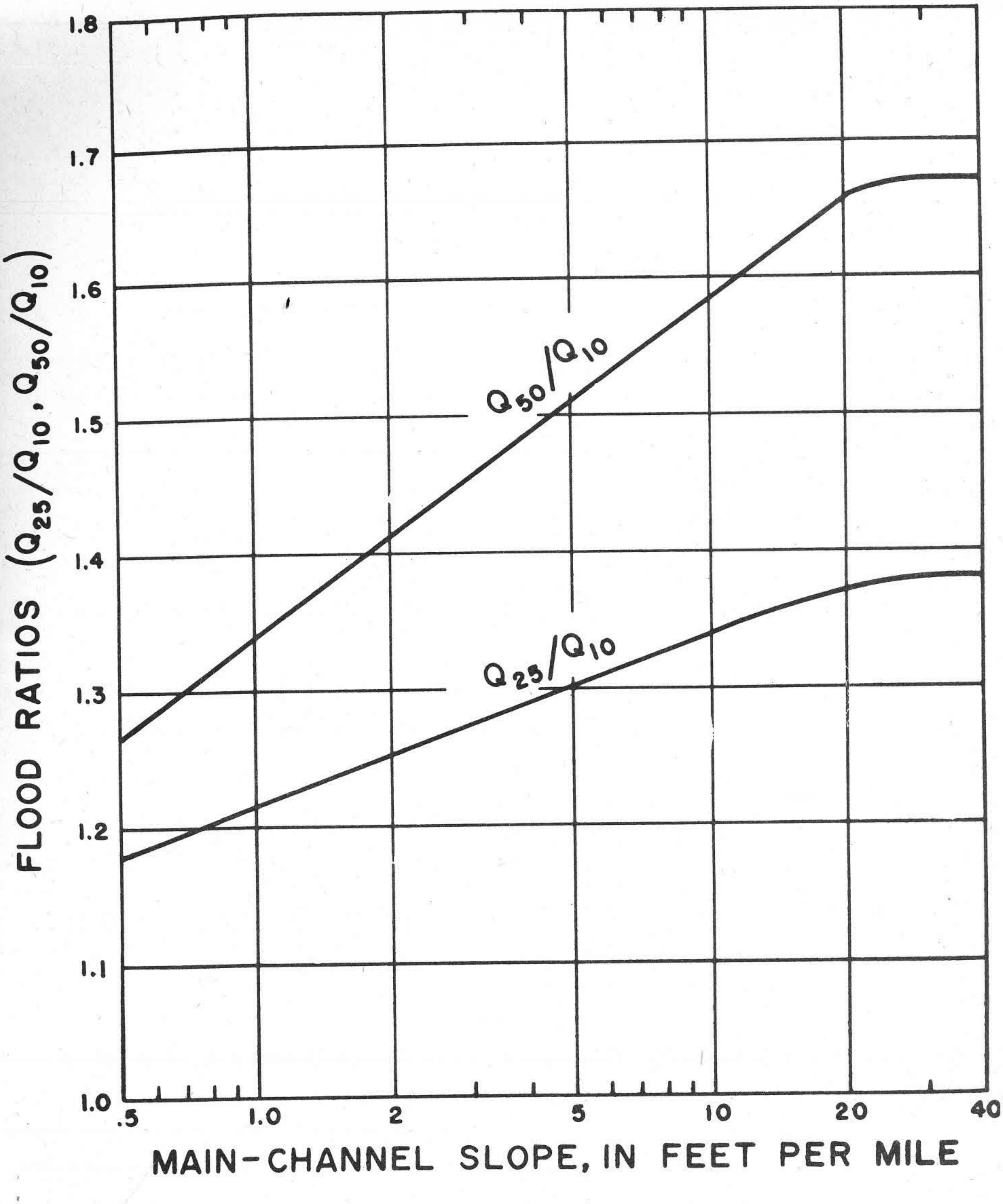


Figure 5.—Relation between flood ratios and main-channel slope.

For the project area, the increment of stage (ΔD) applicable to drainage areas of from 80 to 1,000 mi^2 is shown in figure 6. To use the graph, it is first necessary to determine the elevation of the median flow, either from topographic maps or from field observations, and second to add the ΔD value for the particular drainage area from the graph to that elevation. A reasonable assumption is that the contour "turnbacks" on streams (where the contour lines cross the streams) are at the elevation of the median flow.

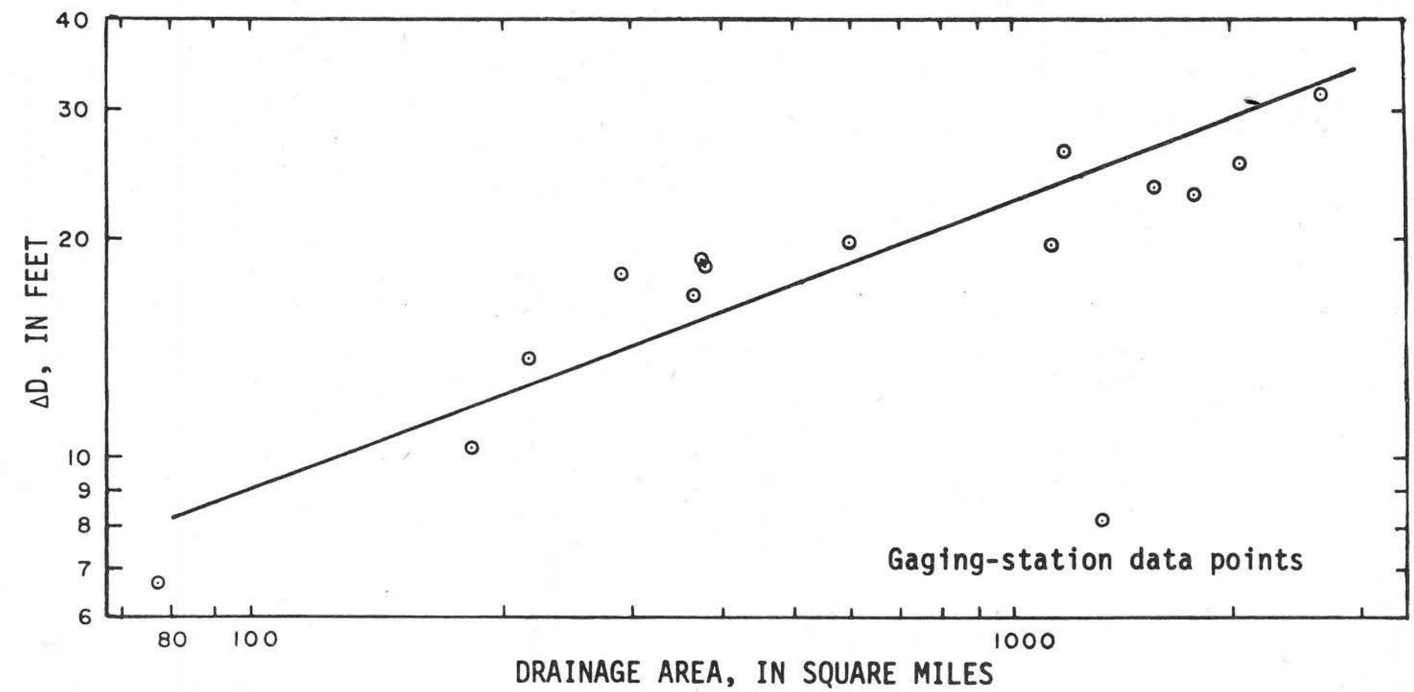


Figure 6.—Elevation of 50-year floodflow minus elevation of 50-percent duration flow (ΔD) versus drainage area for the project area (from Hines, 1977).

Quality of Surface Water

One of the concerns of large-scale strip mining is the potential degradation of environmental quality, especially surface-water quality. A part of this study is to determine water-quality conditions of streams in the south-central Arkansas lignite area prior to mining activities.

To determine background (present) water quality, data for a number of stations, which are located on selected streams in the study area, were evaluated (fig. 7). The data were collected by the Arkansas Department of Pollution Control and Ecology and by the U.S. Geological Survey in cooperation with the Arkansas Geological Commission. A few of the stations are inactive.

The results of statistical analysis of selected water-quality parameters for these stations are presented in tabular form. The results are for a period of 2 or more years and are based on data collected between 1967 and 1977.

In addition to current and historic water-quality stations, a number of sampling sites have been established downstream from probable mining areas (fig. 7). These sites include: 07348590, Bayou Dorcheat near Falcon; 07349415, Little Bodcau Creek at Bodcaw; 07360161, Cypress Creek near Sparkman; 07360182, Brushy Creek near Ouachita; 07361650, Terre Rouge Creek near Prescott; 07361660, Little Missouri River near Whelen Springs; 07361700, Caney Creek near Bluff City; 07361805, Terre Noire Creek at Vaden; 07361850, Tulip Creek near Pine Grove; and 07364035, L'Aigle Creek near Ingalls.

In addition, water-quality stations 07363300, Hurricane Creek near Sheridan, and 07363500, Saline River near Rye, have been reactivated for this study.

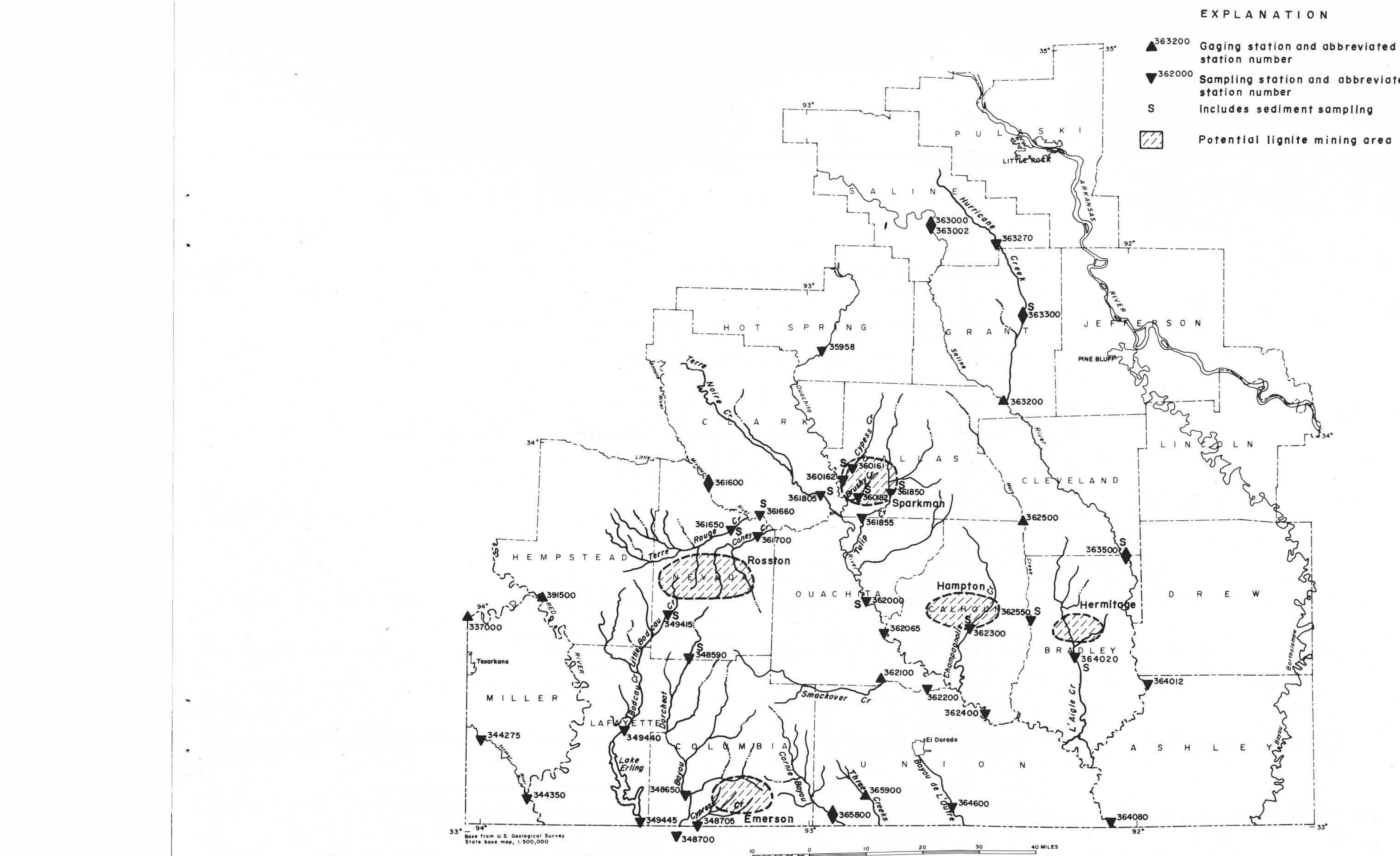


Figure 7.—Water-quality data-collection network in the project area.

Samples collected at all water-quality stations are analyzed for the common ions, organic carbon, suspended sediment, trace metals, dissolved oxygen, temperature, pH, conductivity, and benthic organisms. Organic carbon, sediment data, and benthic organisms are also being collected at continuous-record stream-gaging stations 07359500, Ouachita River near Malvern, and 07362550, Moro Creek near Banks.

Samples collected by the Geological Survey were analyzed using the techniques given in Brown, Skovgstad, and Fishman (1970). Analytical procedures used by the Arkansas Department of Pollution Control and Ecology include methods published by the American Public Health Association (1976), the American Society for Testing and Materials (1974), and the U.S. Environmental Protection Agency (1974).

Red River

Two water-quality sampling stations operated by the Arkansas Department of Pollution Control and Ecology are located on the Red River in Arkansas. One station, 07336860, is located near where the river enters Arkansas and the other station, 07344350, near where the river leaves Arkansas (fig. 7). Statistical summaries for these stations are shown in tables 9 and 10. The Red River is characterized by a very high concentration of suspended sediment, as evidenced by excessive turbidity concentrations and total nonfilterable residue (the suspended matter that will not pass through a 0.75-1.25 micrometer glass fiber filter) (table 9). Turbidity concentrations at times exceed the Arkansas State standard of 50 Jtu (Jackson turbidity unit). The annual sediment load of the Red River at a long-term monitoring station at Index, Ark., averages 520 tons per square mile of drainage area (U.S. Army Corps of Engineers, New Orleans District, 1966, p. I-23). Most of the sediment originates in the upper Red River basin where red, sandy soils are predominant and are subject to erosion. The iron-bearing, red soil probably accounts for the high total iron concentrations shown in table 9.

Table 9.—*Water-quality statistical summary for station 07336860, Red River near Foreman, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	25	915.59840820	286.99951172	1439.9975586
P00400	PH (UNITS)	25	7.94159149	6.72999287	8.3299913
P00010	TEMPERATURE (DEG C)	25	19.75997021	5.99999332	29.9999542
P00070	TURBIDITY (JTU)	25	88.11986992	9.99998569	599.9990234
P00300	DISSOLVED OXYGEN (MG/L)	25	8.78999035	5.99999332	11.7699852
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	25	2.50719700	0.95999902	5.2999945
P00915	DISSOLVED CALCIUM (CA) (MG/L)	7	67.99991499	40.99993896	83.9998932
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	7	20.28568459	8.99999046	24.9999695
P00929	TOTAL SODIUM (NA) (MG/L)	9	110.25539970	7.39999199	163.7997284
P00937	TOTAL POTASSIUM (K) (MG/L)	9	5.92221578	2.99999619	8.4999914
P00440	BICARBONATE (HCO3) (MG/L)	9	144.33312141	80.99989319	169.9997406
P00445	CARBONATE (CO3) (MG/L)	9	0.00000000	0.00000000	0.0000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	18	145.11089918	28.99995422	329.9995117
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	15	181.39973450	41.99993896	259.9995117
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	613.76835515	236.99969482	850.9987793
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	26	132.69211226	18.99996948	498.9992676
P00620	TOTAL NITRATE (N) (MG/L)	26	0.39999954	0.09999985	1.9499979
P00665	TOTAL PHOSPHORUS (P) (MG/L)	26	0.11461523	0.02999996	0.3499996
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	8.05881366	2.99999619	88.9998932
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	19	5.31578265	0.00000000	9.9999857
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	17	0.52941109	0.00000000	2.9999962
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	24	9.62498625	0.00000000	29.9999542
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	24	3286.91033427	189.99975586	15999.9648438
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	17	28.47054700	0.00000000	119.9997864
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	24	198.83303324	52.99993896	619.9990234
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	24	19.16664158	0.00000000	79.9999084

Table 10.—*Water-quality statistical summary for station 07344350, Red River near Spring Bank, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	43	507.27827170	150.99977112	1190.99780273
P00400	PH (UNITS)	42	7.82927745	7.41999245	8.19999123
P00010	TEMPERATURE (DEG C)	42	19.57140001	4.99999523	31.99995422
P00070	TURBIDITY (JTU)	42	132.23790369	14.99998093	699.99902344
P00300	DISSOLVED OXYGEN (MG/L)	43	8.25161881	4.86999512	11.00998497
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	42	1.84666422	0.91999906	4.39999485
P00915	DISSOLVED CALCIUM (CA) (MG/L)	11	42.81812494	20.99996948	72.99990845
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	11	12.27270993	3.99999523	29.99995422
P00929	TOTAL SODIUM (NA) (MG/L)	9	62.58880276	21.49996948	179.39973450
P00937	TOTAL POTASSIUM (K) (MG/L)	9	4.62221697	1.59999752	6.99999237
P00440	BICARBONATE (HCO3) (MG/L)	8	142.12478638	86.99989319	269.99951172
P00445	CARBONATE (CO3) (MG/L)	9	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	22	64.79536273	5.49999428	149.99978638
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	32	75.43739858	11.49998188	254.99967957
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	31	369.16072673	149.99978638	784.99877930
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	31	172.93523825	30.99995422	722.99902344
P00620	TOTAL NITRATE (N) (MG/L)	29	0.45758567	0.09999985	2.99999619
P00665	TOTAL PHOSPHORUS (P) (MG/L)	29	0.17931012	0.02999996	0.89999908
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	23	7.30433928	2.99999619	95.99989319
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	24	4.33332737	0.00000000	10.99998283
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	23	9.30433460	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	23	16.08693285	0.00000000	169.99974060
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	24	2567.95330811	325.99951172	5719.98828125
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	23	29.17387087	0.00000000	119.99978638
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	24	228.74967257	81.99990845	763.99902344
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	3	0.30666631	0.09999985	0.67999929
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	24	16.24997703	0.00000000	35.99995422

The stream is further characterized by the predominance of sodium, bicarbonate, sulfate, and chloride ions. These ions decrease in concentration from the upstream station (07336860) to the downstream station (07344350), probably due to dilution from tributaries between the stations. Chloride concentrations in the Red River sometimes exceed the U.S. Public Health Service standard of 250 mg/L (milligrams per liter) for drinking water (table 11).

Sulphur River

A sampling station on the Sulphur River (07344275) has been operated by the Arkansas Department of Pollution Control and Ecology since 1968. Water in the Sulphur River is a calcium bicarbonate type and occasionally contains high concentrations of iron (table 12) which often exceed U.S. Public Health Service standards. The stream is overloaded with wastes from municipal and industrial discharges resulting in dissolved-oxygen concentrations often in violation of the Arkansas standard of 5.0 mg/L (table 11).

Bayou Dorcheat

Statistical data are presented for two sampling stations on Bayou Dorcheat (tables 13 and 14). The stations are operated by the Arkansas Department of Pollution Control and Ecology. The station near Taylor (07348650) has been operated since April 1974. The other station (07348700) 10 mi downstream and located near Springhill, La., was operated from March 1968 to September 1974. Bayou Dorcheat receives municipal and industrial wastes through some of its tributaries and also receives some impact on its quality from oil-field brines (Arkansas Department of Pollution Control and Ecology, 1973, 1975).

Table 11.—*Water-quality standards and recommended water-quality limits*

Water-quality parameter	Arkansas standard	Public Health Service limit	National Academy of Science and National Academy of Engineering, 1974, recommended limits	
			Public water supply	Livestock
Arsenic----------	(1)	50 μg/L	100 μg/L	200 μg/L
Cadmium----------	(1)	10 μg/L	10 μg/L	50 μg/L
Chloride---------	(2)	250 mg/L	250 mg/L	----------
Chromium---------	(1 3)	50 μg/L	[3] 50 μg/L	1,000 μg/L
Copper-----------	(1)	1,000 μg/L	100 μg/L	500 μg/L
Dissolved solids--	(2)	500 mg/L	--------	----------
Dissolved oxygen--	[4] 5.0 mg/L	----------	--------	----------
Iron-------------	(1)	300 μg/L	300 μg/L	----------
Lead-------------	(1)	50 μg/L	50 μg/L	100 μg/L
Manganese--------	(1)	50 μg/L	50 μg/L	----------
Mercury----------	(1)	----------	2 μg/L	1,000 μg/L
pH---------------	6.0-9.0	----------	5.0-9.0	----------
Phosphorus-------	100 μg/L	100 μg/L	--------	----------
Sulfate----------	(2)	250 mg/L	250 mg/L	----------
Turbidity--------	[5] 50 JTU	----------	--------	----------
Zinc-------------	(1)	5,000 μg/L	500 μg/L	----------

[1]Standards are based on 96-hour Median Tolerance Limit. See "Arkansas Water Quality Standards, Regulation No. 2, as Amended," September 1975.
[2]Standards are set for individual streams. See "Arkansas Water-Quality Standards, Regulation No. 2, as Amended," September 1975.
[3]Hexavalent (Cr^{+6}).
[4]Minimum of 5.0 mg/L, except for natural conditions.
Minimum of 6.0 mg/L for trout and small-mouth bass streams.
[5]For trout or small-mouth bass streams, the standard is 10 Jtu.

Table 12.—*Water-quality statistical summary for station 07344275, Sulphur River south of Texarkana, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	255	199.89774810	59.99992371	899.99877930
P00400	PH (UNITS)	247	7.17914220	2.89999676	8.50999069
P00010	TEMPERATURE (DEG C)	267	16.92068692	1.22999763	33.49995422
P00070	TURBIDITY (JTU)	46	43.80646231	5.09999466	209.99971008
P00300	DISSOLVED OXYGEN (MG/L)	267	7.55665798	2.29999733	13.49998379
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	47	1.96957190	0.51999944	4.34999466
P00915	DISSOLVED CALCIUM (CA) (MG/L)	13	21.15381446	8.99999046	29.99995422
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	13	3.15384227	1.99999714	5.99999332
P00929	TOTAL SODIUM (NA) (MG/L)	8	12.94998133	4.99999523	20.99996948
P00937	TOTAL POTASSIUM (K) (MG/L)	9	7.05554718	1.79999733	38.99995422
P00440	BICARBONATE (HCO3) (MG/L)	9	67.33325026	25.99996948	98.99987793
P00445	CARBONATE (CO3) (MG/L)	9	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	26	19.46920355	7.99999142	59.99992371
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	35	20.08568709	6.49999332	61.99992371
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	1	24.99996948	24.99996948	24.99996948
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	34	145.76448957	62.99992371	266.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	35	57.65706280	3.99999523	275.99951172
P00620	TOTAL NITRATE (N) (MG/L)	36	0.90277663	0.09999985	15.99997902
P00665	TOTAL PHOSPHORUS (P) (MG/L)	35	0.11057127	0.01999998	0.21999973
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	1	9.99998569	9.99998569	9.99998569
P01002	TOTAL ARSENIC (AS) (UG/L)	25	4.71999344	2.99999619	26.99995422
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	24	3.41666226	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	1	19.99996948	19.99996948	19.99996948
P01034	TOTAL CHROMIUM (CR) (UG/L)	24	15.45831048	0.00000000	136.99978638
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	25	8.15998805	0.00000000	29.99995422
P01046	DISSOLVED IRON (FE) (UG/L)	3	489.99932353	241.99967957	677.99902344
P01045	TOTAL IRON (FE) (UG/L)	28	1684.96121270	239.99964905	4946.98828125
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	25	29.99996115	0.00000000	86.99989319
P01056	DISSOLVED MANGANESE (MN) (UG/L)	2	86.99987793	60.99992371	112.99983215
P01055	TOTAL MANGANESE (MN) (UG/L)	27	163.74049490	42.99993896	449.99926758
P71890	DISSOLVED MERCURY (HG) (UG/L)	2	0.34999961	0.29999965	0.39999956
P71900	TOTAL MERCURY (HG) (UG/L)	5	0.40999956	0.13999981	0.69999927
P01090	DISSOLVED ZINC (ZN) (UG/L)	3	18.66663965	9.99998569	29.99995422
P01092	TOTAL ZINC (ZN) (UG/L)	27	19.96293370	0.00000000	141.99978638

Table 13.—*Water-quality statistical summary for station 07348650, Bayou Dorcheat near Taylor, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	27	207.22190744	71.99990845	401.99926758
P00400	PH (UNITS)	27	6.53628929	5.97999382	6.99999237
P00010	TEMPERATURE (DEG C)	27	18.03701044	6.99999237	27.99995422
P00070	TURBIDITY (JTU)	27	16.40738487	5.99999332	39.99995422
P00300	DISSOLVED OXYGEN (MG/L)	27	6.46517824	3.19999599	9.69999027
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	26	1.21269063	0.24999976	3.19999599
P00915	DISSOLVED CALCIUM (CA) (MG/L)	7	7.57141931	4.99999523	10.99998283
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	7	3.57142421	1.99999714	6.99999237
P00929	TOTAL SODIUM (NA) (MG/L)	9	26.61107551	5.59999371	39.89994812
P00937	TOTAL POTASSIUM (K) (MG/L)	9	2.18888601	1.19999790	3.59999561
P00440	BICARBONATE (HCO3) (MG/L)	8	16.62497485	9.99998569	33.99995422
P00445	CARBONATE (CO3) (MG/L)	8	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	16	10.49998517	0.99999869	30.99995422
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	15	59.96658529	23.99995422	99.99983215
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	164.69205592	95.99989319	268.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	26	20.92304820	3.99999523	44.99993896
P00620	TOTAL NITRATE (N) (MG/L)	26	0.34923038	0.10999984	0.86999911
P00665	TOTAL PHOSPHORUS (P) (MG/L)	26	0.29538426	0.06999987	1.69999790
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	8.64704805	2.99999619	98.99987793
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	17	3.94117134	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	17	0.52941109	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	17	7.76469517	0.00000000	19.99996948
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	17	2087.70229205	819.99877930	4577.99218750
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	17	36.58818391	0.00000000	109.99981689
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	17	416.35227158	69.99992371	1799.99658203
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	17	18.29409050	0.00000000	39.99995422

Table 14.—*Water-quality statistical summary for station 07348700, Bayou Dorcheat near Springhill, La.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	61	744.44264847	74.99990845	4229.99609375
P00400	PH (UNITS)	60	6.32066507	1.19999790	7.70000362
P00010	TEMPERATURE (DEG C)	61	17.39179925	3.99999905	31.00003052
P00070	TURBIDITY (JTU)	17	18.11174146	5.39999390	54.99992371
P00300	DISSOLVED OXYGEN (MG/L)	15	6.30532633	2.49999714	10.89998436
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	17	1.28058656	0.72999924	2.79999638
P00915	DISSOLVED CALCIUM (CA) (MG/L)	47	28.22554260	3.09999943	139.99998474
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	47	7.11915159	0.00000050	33.00003052
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	43	33.65120273	0.00000000	144.00047302
P00445	CARBONATE (CO3) (MG/L)	43	0.00000019	0.00000000	0.00000050
P00945	DISSOLVED SULFATE (SO4) (MG/L)	49	8.40816590	0.60000038	34.00003052
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	58	211.23292326	14.99999714	1329.99951172
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	34	367.44111588	78.99998474	2469.99975586
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	6	173.83310699	93.99989319	375.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	6	19.99997282	8.99999046	47.99993896
P00620	TOTAL NITRATE (N) (MG/L)	9	0.25111082	0.01999998	0.79999918
P00665	TOTAL PHOSPHORUS (P) (MG/L)	6	0.35499950	0.04999995	1.68999767
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	6	4.49999475	2.99999619	8.99999046
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	6	4.16666142	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	6	32.33328692	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	6	12.83331474	5.99999332	19.99996948
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	6	854.33190918	389.99926758	1609.99682617
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	6	41.49994040	0.00000000	99.99983215
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	6	244.83295186	0.00000000	634.99902344
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	2	0.21999976	0.18999976	0.24999976
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	6	32.16662280	11.99998093	71.99990845

Water in Bayou Dorcheat, at the upstream site near Taylor, 07348650, does not meet State water-quality standards (table 11). Dissolved oxygen concentrations are often less than the minimum recommended 5.0 mg/L. Iron and manganese concentrations are generally high at this location and exceed recommended maximums for drinking water. Lead concentration, at times, also exceeds standards.

Data for the downstream site near Springhill, 07348700, show some additional degradation in quality occurring between the two sites. For example, the average chloride concentration increased almost fourfold, probably because of oil-field brines.

No sediment data are available for this stream. Benthic organisms were collected at the station near Taylor, 07348650, in 1973, and the findings were published by the Arkansas Department of Pollution Control and Ecology (1976). A good benthic population was found.

Cypress Creek

Cypress Creek is a tributary to Bayou Dorcheat and drains a potential mining area in the vicinity of Emerson. A water-quality station, 07348705, was operated by the Arkansas Department of Pollution Control and Ecology at the Arkansas-Louisiana State line from March 1968 to April 1974. This stream is in a low, marshy area and has infrequent flow and low velocity, that makes it difficult to interpret its water quality. Chromium, lead, iron, and manganese concentrations have exceeded water-quality standards (table 15). In 17 samples, the maximum chloride concentration was 1,330 mg/L which indicates oil-field pollution. The dissolved-oxygen concentration has been less than the State's standard of 5.0 mg/L. No benthic or sediment data are available for this stream.

Table 15.—*Water-quality statistical summary for station 07348705, Cypress Creek at Arkansas-Louisiana State line*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	17	168.29387440	70.99990845	299.99951172
P00400	PH (UNITS)	17	6.26999322	5.79999352	6.92999268
P00010	TEMPERATURE (DEG C)	17	16.05880143	4.99999523	24.99996948
P00070	TURBIDITY (JTU)	17	25.05878830	10.99998283	54.99992371
P00300	DISSOLVED OXYGEN (MG/L)	17	6.92881584	3.59999561	10.20998383
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	17	1.74705649	0.75999922	2.64999676
P00915	DISSOLVED CALCIUM (CA) (MG/L)	3	6.99999237	6.99999237	6.99999237
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	3	3.33332920	2.99999619	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	0	.	.	.
P00445	CARBONATE (CO3) (MG/L)	0	.	.	.
P00945	DISSOLVED SULFATE (SO4) (MG/L)	5	6.39999294	1.99999714	8.99999046
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	17	43.61759130	13.99998283	82.99990845
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	5	128.39981995	88.99989319	153.99978638
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	5	38.99994812	22.99996948	82.99990845
P00620	TOTAL NITRATE (N) (MG/L)	5	0.39199957	0.19999975	0.59999937
P00665	TOTAL PHOSPHORUS (P) (MG/L)	5	0.06199992	0.02999996	0.09999985
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	5	3.59999561	2.99999619	5.99999332
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	5	2.59999695	0.00000000	6.99999237
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	5	18.79997787	0.00000000	79.99990845
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	5	17.19997768	0.00000000	39.99995422
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	5	1248.19765625	659.99902344	1849.99633789
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	5	27.59996490	0.00000000	56.99992371
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	5	180.59972229	0.00000000	289.99951172
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	2	0.51999944	0.25999969	0.77999920
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	5	17.59997711	6.99999237	25.99996948

Bodcau Creek

Statistical data are presented for two stations on Bodcau Creek (tables 16 and 17). The station near Lewisville (07349440) drains a low, marshy area resulting in a summertime stratification of the water. Dissolved-oxygen concentrations range from 0.0 mg/L near the bottom of the stream to 5.0 mg/L near the surface.

As with other streams in the area, iron, manganese, and lead concentrations are high at times, exceeding standards for drinking water (table 16). In 1973, upstream from this station and 5 miles downstream from where the Stamps sewage-treatment plant effluent enters the stream, the Arkansas Department of Pollution Control and Ecology found a good benthic community in the stream with a diversity index of 2.5947, an indication that the stream is in good condition, with the exceptions noted previously.

The station near Taylor (07349445) is downstream from Lake Erling, and water quality at this site shows some improvement after the water moves through the lake. The dissolved-oxygen concentration remains above 5.0 mg/L (table 17). Iron concentration is less, but lead and manganese concentrations are a little higher than concentrations upstream from the lake. Chromium concentration is noticeably higher downstream from Lake Erling and exceeds drinking-water standards. The source of the chromium is not known.

No recent benthic sampling has been done at either site. However, as mentioned above, in 1973, a good benthic population was found 5 miles downstream from where the Stamps waste effluent enters the stream. No sediment data are available for Bodcau Creek.

Ouachita River

Statistical data are presented for seven water-quality sampling sites on the Ouachita River (tables 18 through 24). These sites are: Station 07359500,

Table 16.—*Water-quality statistical summary for station 07349440, Bodcau Creek near Lewisville, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	28	158.35692378	60.99992371	435.99926758
P00400	PH (UNITS)	28	6.39356504	5.78999424	6.99999237
P00010	TEMPERATURE (DEG C)	28	18.46426109	5.99999332	27.99995422
P00070	TURBIDITY (JTU)	27	16.11108949	5.99999332	84.99989319
P00300	DISSOLVED OXYGEN (MG/L)	28	5.86142254	3.49999619	9.47999001
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	27	1.36444260	0.53999943	3.19999599
P00915	DISSOLVED CALCIUM (CA) (MG/L)	8	6.76249337	4.99999523	9.99998569
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	8	3.01249719	1.99999714	5.99999332
P00929	TOTAL SODIUM (NA) (MG/L)	9	19.43330563	8.29999161	42.99993896
P00937	TOTAL POTASSIUM (K) (MG/L)	9	1.93333085	1.19999790	3.49999619
P00440	BICARBONATE (HCO3) (MG/L)	9	13.66664738	9.99998569	27.99995422
P00445	CARBONATE (CO3) (MG/L)	10	0.00000005	0.00000000	0.00000050
P00945	DISSOLVED SULFATE (SO4) (MG/L)	18	6.26110380	0.99999869	15.99997902
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	16	43.87494755	18.49996948	98.99987793
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	1	138.00047302	138.00047302	138.00047302
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	128.99980927	39.99995422	264.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	26	17.99997464	0.99999869	45.99993896
P00620	TOTAL NITRATE (N) (MG/L)	26	0.31153811	0.09999985	0.94999903
P00665	TOTAL PHOSPHORUS (P) (MG/L)	26	0.13692290	0.03999996	0.31999964
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	4.05881814	2.99999619	20.99996948
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	17	3.82352403	0.00000000	19.99996948
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	17	0.52941109	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	17	8.64704744	0.00000000	59.99992371
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	17	1852.64375574	349.99951172	3286.99414063
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	17	17.05879991	0.00000000	59.99992371
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	18	249.88855998	78.99990845	543.99926758
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	17	10.94116108	0.00000000	19.99996948

Table 17.—*Water-quality statistical summary for station 07349445, Bodcau Creek near Taylor, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	16	103.43736839	43.99993896	247.99964905
P00400	PH (UNITS)	16	6.68311787	6.29999352	7.09999275
P00010	TEMPERATURE (DEG C)	17	17.17644534	4.99999523	28.99995422
P00070	TURBIDITY (JTU)	17	15.61762726	3.29999638	32.99995422
P00300	DISSOLVED OXYGEN (MG/L)	17	8.88234217	6.07999325	10.99998283
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	17	1.44352744	0.64999932	3.38999653
P00915	DISSOLVED CALCIUM (CA) (MG/L)	3	5.66666063	3.99999523	7.99999142
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	4	2.74999657	0.99999869	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	0	.	.	.
P00445	CARBONATE (CO3) (MG/L)	0	.	.	.
P00945	DISSOLVED SULFATE (SO4) (MG/L)	7	5.32856546	2.99999619	9.29998970
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	17	23.36467524	10.99998283	58.99992371
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	7	78.14275687	42.99993896	149.99978638
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	5	26.59996700	7.99999142	51.99993896
P00620	TOTAL NITRATE (N) (MG/L)	5	0.19199976	0.09999985	0.39999956
P00665	TOTAL PHOSPHORUS (P) (MG/L)	6	0.04166661	0.00999999	0.07999986
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	7	4.14285224	2.99999619	6.99999237
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	7	1.28571251	0.00000000	2.99999619
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	7	18.71425615	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	6	9.16665395	0.00000000	14.99998093
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	7	711.42735073	299.99951172	1245.99780273
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	7	22.71425547	1.99999714	63.99992371
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	7	264.71387591	0.00000000	839.99877930
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	4	0.26999968	0.09999985	0.53999943
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	7	5.57142162	0.00000000	11.99998093

Table 18.— *Water-quality statistical summary for station 073599500, Ouachita River near Malvern, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	50	113.55224207	6.61999226	346.99951172
P00400	PH (UNITS)	49	6.94019670	6.49999332	7.98999119
P00010	TEMPERATURE (DEG C)	63	17.45235596	2.99999619	29.99995422
P00070	TURBIDITY (JTU)	49	12.69386194	1.69999790	59.99992371
P00300	DISSOLVED OXYGEN (MG/L)	50	8.51038940	3.69999504	11.97998428
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	50	1.44579813	0.02999996	4.29999447
P00915	DISSOLVED CALCIUM (CA) (MG/L)	8	9.12498891	5.99999332	13.99998283
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	8	2.49999712	0.99999869	4.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	4	9.17498779	2.29999733	19.99996948
P00937	TOTAL POTASSIUM (K) (MG/L)	4	4.07499504	1.99999714	7.99999142
P00440	BICARBONATE (HCO3) (MG/L)	5	50.19992676	20.99996948	159.99977112
P00445	CARBONATE (CO3) (MG/L)	5	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	19	15.84208488	4.99999523	49.99993896
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	49	14.14691995	2.99999619	43.99993896
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	20	90.84987488	42.99993896	180.99977112
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	20	16.09997921	1.99999714	47.99993896
P00620	TOTAL NITRATE (N) (MG/L)	20	0.45199945	0.09999985	0.95999661
P00665	TOTAL PHOSPHORUS (P) (MG/L)	20	0.16879980	0.00599999	2.29999733
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	38	8.23683711	2.99999619	9.99999619
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	40	1.97499746	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	12	4.24999452	0.00000000	14.99998093
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	19	21.73681184	0.00000000	157.99978638
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	18	189.22194163	31.99995422	539.99926758
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	40	25.97496639	0.00000000	749.99902344
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	17	229.23495932	74.99990845	789.99877930
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	16	0.50249951	0.09999985	0.79999918
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	46	13.49998522	0.00000000	79.99990845

Table 19.—*Water-quality statistical summary for station 07359580, Ouachita River near Donaldson, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	26	120.92291377	62.99992371	484.99926758
P00400	PH (UNITS)	25	6.90279255	6.49999332	7.19999218
P00010	TEMPERATURE (DEG C)	26	19.26920355	8.99999046	28.99995422
P00070	TURBIDITY (JTU)	25	14.08398052	3.99999523	99.99983215
P00300	DISSOLVED OXYGEN (MG/L)	25	7.98719112	3.29999638	11.11998558
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	24	0.94291529	0.26999968	1.99999714
P00915	DISSOLVED CALCIUM (CA) (MG/L)	7	8.85713264	5.99999332	12.99998474
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	7	2.14285432	0.99999869	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	9	6.49999163	1.89999771	11.99998093
P00937	TOTAL POTASSIUM (K) (MG/L)	9	2.55555254	0.59999937	7.99999142
P00440	BICARBONATE (HCO3) (MG/L)	9	18.88886049	10.99998283	23.99995422
P00445	CARBONATE (CO3) (MG/L)	9	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	17	16.47056495	5.99999332	54.99992371
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	14	21.85710934	6.99999237	119.99978638
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	90.38448862	45.99993896	286.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	26	20.38458769	3.99999523	162.99978638
P00620	TOTAL NITRATE (N) (MG/L)	26	0.52884551	0.12999982	1.19999790
P00665	TOTAL PHOSPHORUS (P) (MG/L)	26	0.03923072	0.00999999	0.11999983
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	2.99999619	2.99999619	2.99999619
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	19	4.57894133	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	20	0.44999943	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	20	4.64999374	0.00000000	14.99998093
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	20	444.04927597	219.99969482	1299.99780273
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	19	56.57886887	0.00000000	185.99975586
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	19	257.31537267	38.99995422	1499.99731445
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	19	12.84208754	0.00000000	39.99995422

Table 20.—*Water-quality statistical summary for station 07360162, Ouachita River near Sparkman, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	27	110.88873574	49.99993896	477.99926758
P00400	PH (UNITS)	27	6.88814078	5.89999390	7.19999218
P00010	TEMPERATURE (DEG C)	27	19.14812056	6.99999237	27.99995422
P00070	TURBIDITY (JTU)	27	18.51479061	4.99999523	89.99989319
P00300	DISSOLVED OXYGEN (MG/L)	27	8.46850918	6.68999290	11.69998550
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	26	1.07692168	0.34999961	1.99999714
P00915	DISSOLVED CALCIUM (CA) (MG/L)	7	7.85713305	5.99999332	10.99998283
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	7	1.99999739	0.99999869	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	9	6.79999118	1.69999790	11.99998093
P00937	TOTAL POTASSIUM (K) (MG/L)	9	1.82221970	0.99999869	2.99999619
P00440	BICARBONATE (HCO3) (MG/L)	9	18.99996991	12.99998474	23.99995422
P00445	CARBONATE (CO3) (MG/L)	9	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	18	13.11109347	4.99999523	30.99995422
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	15	20.49996808	7.49999237	109.99981689
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	84.26911574	35.99995422	292.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	26	30.34611155	5.99999332	173.99974060
P00620	TOTAL NITRATE (N) (MG/L)	27	0.53740674	0.11999983	1.20999813
P00665	TOTAL PHOSPHORUS (P) (MG/L)	27	0.03962958	0.00999999	0.10999984
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	16	3.37499583	2.99999619	7.99999142
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	16	4.49999434	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	17	0.52941109	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	17	6.17646238	0.00000000	19.99996948
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	17	711.76362430	216.99967957	1299.99780273
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	16	47.06243799	0.99999869	170.99972534
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	16	153.68727970	85.99989319	259.99951172
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	16	10.18748523	0.00000000	19.99996948

Table 21.—*Water-quality statistical summary for station 07362000, Ouachita River at Camden, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	33	97.69696230	61.99992371	149.00000000
P00400	PH (UNITS)	33	6.99393868	6.00000000	7.89999962
P00010	TEMPERATURE (DEG C)	32	17.09374851	5.00000000	28.50000000
P00070	TURBIDITY (JTU)	32	18.09374905	2.00000000	50.00000000
P00300	DISSOLVED OXYGEN (MG/L)	16	8.88124865	6.79999256	11.79999924
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	2	0.39999998	0.39999956	0.40000039
P00915	DISSOLVED CALCIUM (CA) (MG/L)	32	8.36875212	5.20000172	11.00000000
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	32	1.57500028	0.90000039	2.10000038
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	33	20.12121212	11.00000000	32.00000000
P00445	CARBONATE (CO3) (MG/L)	32	0.00000002	0.00000000	0.00000050
P00945	DISSOLVED SULFATE (SO4) (MG/L)	33	9.82424557	5.20000172	21.00000000
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	33	10.59091146	5.50000191	20.00000000
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	31	60.61289141	40.00000000	91.00000000
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	0	.	.	.
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	1	13.00004768	13.00004768	13.00004768
P00620	TOTAL NITRATE (N) (MG/L)	0	.	.	.
P00665	TOTAL PHOSPHORUS (P) (MG/L)	33	0.05454552	0.00000000	0.29000026
P00600	TOTAL NITROGEN (N) (MG/L)	31	0.77193598	0.30000025	1.70000076
P01000	DISSOLVED ARSENIC (AS) (UG/L)	12	0.33333309	0.00000000	1.99999714
P01002	TOTAL ARSENIC (AS) (UG/L)	12	0.91666643	0.00000000	2.00000000
P01025	DISSOLVED CADMIUM (CD) (UG/L)	12	0.66666656	0.00000000	2.00000000
P01027	TOTAL CADMIUM (CD) (UG/L)	11	9.09090779	0.00000000	10.00000000
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	12	0.83333333	0.00000000	10.00000000
P01034	TOTAL CHROMIUM (CR) (UG/L)	11	18.18181818	0.00000000	160.00000000
P01040	DISSOLVED COPPER (CU) (UG/L)	12	5.91666603	0.00000000	25.00000000
P01042	TOTAL COPPER (CU) (UG/L)	11	16.36363229	0.00000000	55.00000000
P01046	DISSOLVED IRON (FE) (UG/L)	12	183.33323161	50.00000000	869.99877930
P01045	TOTAL IRON (FE) (UG/L)	11	1989.99978083	149.99978638	7200.00000000
P01049	DISSOLVED LEAD (PB) (UG/L)	12	0.99999968	0.00000000	3.00000000
P01051	TOTAL LEAD (PB) (UG/L)	11	99.99998474	99.99983215	100.00000000
P01056	DISSOLVED MANGANESE (MN) (UG/L)	12	79.99998093	10.00000000	170.00000000
P01055	TOTAL MANGANESE (MN) (UG/L)	11	196.36360862	80.00000000	610.00000000
P71890	DISSOLVED MERCURY (HG) (UG/L)	12	0.02500001	0.00000000	0.20000005
P71900	TOTAL MERCURY (HG) (UG/L)	10	0.02999998	0.00000000	0.19999975
P01090	DISSOLVED ZINC (ZN) (UG/L)	12	18.33333214	0.00000000	40.00000000
P01092	TOTAL ZINC (ZN) (UG/L)	11	71.81817211	10.00000000	400.00000000

Table 22.—*Water-quality statistical summary for station 07362065, Ouachita River below Camden, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	82	129.06096761	63.99992371	236.99998474
P00400	PH (UNITS)	87	6.99425155	6.29999924	7.99999142
P00010	TEMPERATURE (DEG C)	46	19.10868842	3.99999905	32.99998474
P00070	TURBIDITY (JTU)	0	.	.	.
P00300	DISSOLVED OXYGEN (MG/L)	46	7.39130354	3.29999924	11.49999428
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	44	3.28636658	0.19999975	16.00004578
P00915	DISSOLVED CALCIUM (CA) (MG/L)	0	.	.	.
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	0	.	.	.
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	88	24.14771940	14.00004768	36.00003052
P00445	CARBONATE (CO3) (MG/L)	88	0.00000011	0.00000000	0.00000050
P00945	DISSOLVED SULFATE (SO4) (MG/L)	47	13.67020723	4.20000362	39.99998474
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	47	15.29361445	3.69999504	30.99998474
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	0	.	.	.
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	46	46.58913429	0.99999964	633.00024414
P00620	TOTAL NITRATE (N) (MG/L)	0	.	.	.
P00665	TOTAL PHOSPHORUS (P) (MG/L)	47	0.10382984	0.00000000	0.67000037
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	3	9.99998919	9.99998569	9.99999619
P01002	TOTAL ARSENIC (AS) (UG/L)	0	.	.	.
P01025	DISSOLVED CADMIUM (CD) (UG/L)	8	0.12499996	0.00000000	0.99999964
P01027	TOTAL CADMIUM (CD) (UG/L)	0	.	.	.
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	4	6.99999833	0.00000000	10.99999523
P01034	TOTAL CHROMIUM (CR) (UG/L)	0	.	.	.
P01040	DISSOLVED COPPER (CU) (UG/L)	8	4.12499829	0.99999869	11.99999428
P01042	TOTAL COPPER (CU) (UG/L)	0	.	.	.
P01046	DISSOLVED IRON (FE) (UG/L)	8	213.74982977	9.99999619	489.99926758
P01045	TOTAL IRON (FE) (UG/L)	0	.	.	.
P01049	DISSOLVED LEAD (PB) (UG/L)	8	2.37499931	0.00000000	7.99999905
P01051	TOTAL LEAD (PB) (UG/L)	0	.	.	.
P01056	DISSOLVED MANGANESE (MN) (UG/L)	8	126.24990463	29.99998474	269.99975586
P01055	TOTAL MANGANESE (MN) (UG/L)	0	.	.	.
P71890	DISSOLVED MERCURY (HG) (UG/L)	6	0.43333309	0.10000044	0.50000000
P71900	TOTAL MERCURY (HG) (UG/L)	3	5.33333238	0.50000000	14.99999714
P01090	DISSOLVED ZINC (ZN) (UG/L)	8	17.49998951	0.00000000	50.00000000
P01092	TOTAL ZINC (ZN) (UG/L)	0	.	.	.

Table 23.—*Water-quality statistical summary for station 07362400, Ouachita River at Lock and Dam 8, near Calion, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	37	284.54009845	119.99978638	738.99902344
P00400	PH (UNITS)	37	6.59837140	5.56999397	7.09999275
P00010	TEMPERATURE (DEG C)	37	19.81078156	8.99999046	33.99995422
P00070	TURBIDITY (JTU)	37	17.13511312	5.99999332	39.99995422
P00300	DISSOLVED OXYGEN (MG/L)	37	7.18701901	1.32999802	10.59998322
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	37	1.81729490	0.38999957	3.99999523
P00915	DISSOLVED CALCIUM (CA) (MG/L)	10	12.59998226	9.99998569	16.99996948
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	10	3.19999615	0.99999869	4.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	7	45.51422555	17.99996948	84.19989014
P00937	TOTAL POTASSIUM (K) (MG/L)	7	2.51428236	1.89999771	3.09999561
P00440	BICARBONATE (HCO3) (MG/L)	7	17.85711779	9.99998569	31.99995422
P00445	CARBONATE (CO3) (MG/L)	7	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	21	10.03808183	0.99999869	29.99995422
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	32	73.81239796	18.99996948	239.99964905
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	25	217.95965820	99.99983215	439.99926758
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	25	24.39996399	8.99999046	132.99978638
P00620	TOTAL NITRATE (N) (MG/L)	25	0.47439946	0.09999985	2.49999714
P00665	TOTAL PHOSPHORUS (P) (MG/L)	25	0.04919993	0.00999999	0.17999977
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	6.17646240	2.99999619	22.99996948
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	19	7.73683101	0.00000000	16.99996948
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	19	9.26314404	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	24	9.54165370	0.00000000	39.99995422
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	25	1079.43815308	64.99992371	1992.99658203
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	24	66.08323508	0.00000000	417.99926758
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	24	294.66623052	89.99989319	699.99902344
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	3	0.97666530	0.09999985	2.42999649
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	23	19.30432216	0.00000000	69.99992371

Table 24.—*Water-quality statistical summary for station 07364080, Ouachita River near Felsenthal, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	41	227.90233072	82.00000000	879.99975586
P00400	PH (UNITS)	25	6.95479595	6.36999321	8.49999142
P00010	TEMPERATURE (DEG C)	24	20.20831792	5.99999332	29.99995422
P00070	TURBIDITY (JTU)	18	19.77775680	2.00000000	44.99993896
P00300	DISSOLVED OXYGEN (MG/L)	20	7.36399455	4.47999477	11.19998646
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	12	1.38166477	0.59999937	2.39999576
P00915	DISSOLVED CALCIUM (CA) (MG/L)	27	9.62963097	5.20000172	31.00000000
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	27	1.98518541	0.90000039	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	2	4.79999495	4.09999561	5.49999428
P00937	TOTAL POTASSIUM (K) (MG/L)	2	1.64999771	1.19999790	2.09999752
P00440	BICARBONATE (HCO3) (MG/L)	21	19.33332493	3.99999523	37.99998474
P00445	CARBONATE (CO3) (MG/L)	15	0.00000010	0.00000000	0.00000050
P00945	DISSOLVED SULFATE (SO4) (MG/L)	39	10.92563556	4.39999962	36.99995422
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	39	44.26921756	4.49999523	229.99995422
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	24	107.83336830	65.00000000	193.99969482
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	12	131.49979782	73.99990845	273.99951172
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	12	20.66663699	0.99999869	42.99993896
P00620	TOTAL NITRATE (N) (MG/L)	12	0.29166633	0.09999985	0.60999936
P00665	TOTAL PHOSPHORUS (P) (MG/L)	14	0.04785708	0.00000000	0.08999985
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	4	10.49999309	9.99998569	11.99999428
P01002	TOTAL ARSENIC (AS) (UG/L)	4	2.99999619	2.99999619	2.99999619
P01025	DISSOLVED CADMIUM (CD) (UG/L)	9	0.33333319	0.00000000	1.99999905
P01027	TOTAL CADMIUM (CD) (UG/L)	4	9.24998736	6.99999237	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	4	8.24999571	0.00000000	19.99998474
P01034	TOTAL CHROMIUM (CR) (UG/L)	4	1.49999809	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	9	3.77777651	1.99999905	6.99999905
P01042	TOTAL COPPER (CU) (UG/L)	12	12.74998267	2.99999619	49.99993896
P01046	DISSOLVED IRON (FE) (UG/L)	9	258.88876004	79.99998474	739.99975586
P01045	TOTAL IRON (FE) (UG/L)	12	1168.08119456	179.99972534	1899.99682617
P01049	DISSOLVED LEAD (PB) (UG/L)	9	1.44444387	0.00000000	9.99999619
P01051	TOTAL LEAD (PB) (UG/L)	12	28.58329288	9.99998569	59.99992371
P01056	DISSOLVED MANGANESE (MN) (UG/L)	9	139.99991692	19.99998474	329.99975586
P01055	TOTAL MANGANESE (MN) (UG/L)	15	214.06642253	40.00003052	680.99902344
P71890	DISSOLVED MERCURY (HG) (UG/L)	6	0.61666642	0.49999952	0.89999998
P71900	TOTAL MERCURY (HG) (UG/L)	2	1.34999943	0.50000000	2.19999886
P01090	DISSOLVED ZINC (ZN) (UG/L)	9	11.22221533	0.00000000	29.99998474
P01092	TOTAL ZINC (ZN) (UG/L)	12	26.58329360	8.99999046	169.99974060

near Malvern, upstream from potential mining areas; station 07359580, near Donaldson; station 07360162, near Sparkman; station 07362000, at Camden and downstream from the confluence of the Little Missouri River; station 07362065, "below" Camden; station 07362400 at Lock and Dam 8, near Calion, and downstream from the confluence of Smackover Creek; and station 07364080, near Felsenthal and near the Arkansas-Louisiana State boundary, downstream from the confluences of Moro Creek and the Saline River.

The stations "at" and "below" Camden, 07362000, and 07362065, are U.S. Geological Survey stations. The station "below" Camden (07362065) is inactive. The rest of the stations on the Ouachita River are operated by the Arkansas Department of Pollution Control and Ecology.

Water quality of the Ouachita River at the three upstream stations near Malvern, Donaldson, and Sparkman is similar. However, there is an increase in iron and lead concentrations from the station near Malvern (07359500) to the station near Sparkman (07360162). Iron, lead, and manganese concentrations at all stations on the Ouachita River sometimes exceed standards for drinking water. The sources of these metals may be the mining activities near Hot Springs.

Data for stations on the Ouachita River at and downstream from Camden show some dilutional effect of the Little Missouri River whose confluence is several miles upstream from these stations. Most noticeable are reductions in specific conductance, sulfate, and chloride.

The station at Lock and Dam 8 near Calion (07362400), reflects the influence of Smackover Creek (table 23). Of particular note are increases in specific conductance, sodium, chloride, and total filterable residue (see discussion of Smackover Creek). Those same parameters continue to increase, as shown by data for the station near Felsenthal, despite some dilution by Moro Creek and Saline River. Like Smackover Creek, the lower part of the Ouachita River receives oil-field brines high in sodium chloride.

The Ouachita River shows a general deterioration in quality from the station near Malvern (07359500) to the Arkansas-Louisiana State line. Some of the deterioration results from mining activities upstream from the study area. In addition, there is a large number of municipal and industrial waste discharges, both on the main stem of the Ouachita River and on a number of tributary streams (Arkansas Department of Pollution Control and Ecology, 1977). As a result of these wastes, dissolved-oxygen concentrations are sometimes suppressed to less than the State standard of 5.0 mg/L. The Ouachita River water quality is further deteriorated downstream from Smackover Creek which carries oil-field brines into the river.

No benthic or sediment data are published for the Ouachita River. However, benthic and sediment data are being collected at the stations near Malvern and at Camden and will be published in a subsequent report.

Little Missouri River

The Arkansas Department of Pollution Control and Ecology has operated a sampling station on the Little Missouri River near Boughton (07361600) since April 1974. Statistical data for this station (table 25) show the stream to be of good quality except for occasional high concentrations of iron, lead, manganese, and unfilterable residues.

There are no waste sources directly on the main stem of the river, but a few effluents are located on tributary streams (Arkansas Department of Pollution Control and Ecology, 1977).

Benthic and sediment data are not available at this site. Both types of data are being collected at station 07361660, near Whelen Springs, and will be published in a subsequent report.

Table 25.—*Water-quality statistical summary for station 07381600, Little Missouri River near Boughton, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	38	68.97362478	27.99995422	129.00000000
P00400	PH (UNITS)	38	7.12367831	6.39999962	7.59999180
P00010	TEMPERATURE (DEG C)	38	18.88155854	6.99999237	27.99995422
P00070	TURBIDITY (JTU)	37	22.54051564	3.00000000	69.99992371
P00300	DISSOLVED OXYGEN (MG/L)	37	8.57756001	5.79999352	11.59998703
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	36	1.17416509	0.37999958	3.19999599
P00915	DISSOLVED CALCIUM (CA) (MG/L)	10	9.13999252	2.99999619	19.00000000
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	10	1.70999831	0.99999869	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	9	2.57777458	1.69999790	3.39999580
P00937	TOTAL POTASSIUM (K) (MG/L)	9	1.21110951	0.09999985	1.79999733
P00440	BICARBONATE (HCO3) (MG/L)	19	28.73682419	1.99999714	66.00000000
P00445	CARBONATE (CO3) (MG/L)	20	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	20	8.65499071	0.99999869	25.00000000
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	18	5.24443960	2.10000038	8.49999142
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	3	67.66666667	53.00000000	95.00000000
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	27	60.51844053	25.99996948	104.99981689
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	27	35.62958082	3.99999523	120.99983215
P00620	TOTAL NITRATE (N) (MG/L)	38	0.31342074	0.00000000	2.96999645
P00665	TOTAL PHOSPHORUS (P) (MG/L)	38	0.09421045	0.00999999	0.89999908
P00600	TOTAL NITROGEN (N) (MG/L)	11	0.55727305	0.24000019	1.30000019
P01000	DISSOLVED ARSENIC (AS) (UG/L)	1	0.00000000	0.00000000	0.00000000
P01002	TOTAL ARSENIC (AS) (UG/L)	17	3.35293703	2.99999619	8.99999046
P01025	DISSOLVED CADMIUM (CD) (UG/L)	1	6.00000000	6.00000000	6.00000000
P01027	TOTAL CADMIUM (CD) (UG/L)	17	4.52940580	0.00000000	13.99998283
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	1	0.00000000	0.00000000	0.00000000
P01034	TOTAL CHROMIUM (CR) (UG/L)	17	0.52941109	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	1	4.00000000	4.00000000	4.00000000
P01042	TOTAL COPPER (CU) (UG/L)	16	5.37499273	0.00000000	10.99998283
P01046	DISSOLVED IRON (FE) (UG/L)	1	320.00000000	320.00000000	320.00000000
P01045	TOTAL IRON (FE) (UG/L)	17	1113.58642578	438.99926758	3004.99487305
P01049	DISSOLVED LEAD (PB) (UG/L)	1	2.99999619	2.99999619	2.99999619
P01051	TOTAL LEAD (PB) (UG/L)	17	15.76468625	0.00000000	59.99992371
P01056	DISSOLVED MANGANESE (MN) (UG/L)	1	120.00000000	120.00000000	120.00000000
P01055	TOTAL MANGANESE (MN) (UG/L)	17	115.47042577	24.99996948	223.99969482
P71890	DISSOLVED MERCURY (HG) (UG/L)	1	0.00000000	0.00000000	0.00000000
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	1	30.00000000	30.00000000	30.00000000
P01092	TOTAL ZINC (ZN) (UG/L)	17	6.99999063	0.00000000	22.99996948

Smackover Creek

Data are given for two stations on Smackover Creek (tables 26 and 27). Station 07362110, north of Smackover, Ark., has been operated by the Arkansas Department of Pollution Control and Ecology since April 1974. The other station, 07362200, was operated by the Geological Survey from 1959 to 1972. Water in Smackover Creek is of very poor quality. A number of refineries, chemical plants, and municipalities discharge their waste water into Smackover Creek or into one of its tributaries. In addition, oil-field brines are flushed into the creek during surface runoff. The results of these wastes can be seen in the high concentrations of sodium, chloride, dissolved solids, and total filterable residue.

Benthic data were collected at several locations on Smackover Creek during summer surveys in 1974 and 1975 by the Arkansas Department of Pollution Control and Ecology (1977). Population densities of benthic organisms generally decreased downstream. No sediment data are available for this stream.

Moro Creek

Data for one station near Banks (07362550) are given in table 28. This station has been operated by the Arkansas Department of Pollution Control and Ecology since April 1974. Like most streams in the study area, high concentrations of iron, lead, and manganese are present which sometimes exceed standards (table 11). This stream usually does not flow during late summer and fall. When streamflow becomes low, dissolved oxygen is sometimes reduced to less than 5.0 mg/L.

No waste sources are discharged directly into Moro Creek, but three municipal and two industrial waste sources discharge into tributaries of Moro

Table 26.—*Water-quality statistical summary for station 07362110, Smackover Creek north of Smackover, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	27	635.40641050	210.99969482	1629.99731445
P00400	PH (UNITS)	26	6.26845485	5.89999390	6.70999241
P00010	TEMPERATURE (DEG C)	27	18.07404780	4.99999523	27.99995422
P00070	TURBIDITY (JTU)	27	17.37034678	5.99999332	39.99995422
P00300	DISSOLVED OXYGEN (MG/L)	27	6.64332595	3.19999599	11.09998226
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	27	1.10222080	0.51999944	1.74999714
P00915	DISSOLVED CALCIUM (CA) (MG/L)	7	22.57139751	10.99998283	39.99995422
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	7	7.28570543	3.99999523	12.99998474
P00929	TOTAL SODIUM (NA) (MG/L)	9	90.36654663	21.49996948	229.99966431
P00937	TOTAL POTASSIUM (K) (MG/L)	9	3.05555174	1.79999733	4.49999523
P00440	BICARBONATE (HCO3) (MG/L)	9	11.33331839	6.99999237	19.99996948
P00445	CARBONATE (CO3) (MG/L)	9	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	18	7.61110169	0.99999869	18.99996948
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	15	249.09964396	109.99981689	529.99926758
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	429.57626108	187.99972534	969.99877930
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	26	25.96150281	1.99999714	90.99989319
P00620	TOTAL NITRATE (N) (MG/L)	27	0.21370344	0.09999985	0.71999925
P00665	TOTAL PHOSPHORUS (P) (MG/L)	27	0.06851844	0.00999999	0.89999908
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	3.47058375	2.99999619	9.99998569
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	18	7.77776792	0.00000000	13.99998283
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	17	0.52941109	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	23	6.84055571	0.00000000	16.99996948
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	23	1759.08385700	739.99902344	3297.99414063
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	16	57.31242377	0.00000000	321.99951172
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	22	499.31736131	235.99964905	1399.99755859
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	22	17.72724633	0.00000000	35.99995422

Table 27.—*Water-quality statistical summary for station 07362200, Smackover Creek near Norphlet, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	106	4004.19589061	292.00024414	19099.9960938
P00400	PH (UNITS)	11	5.13636442	3.69999886	6.0000038
P00010	TEMPERATURE (DEG C)	104	18.14229858	5.00000000	31.9999847
P00070	TURBIDITY (JTU)	0	.	.	.
P00300	DISSOLVED OXYGEN (MG/L)	7	6.32857323	4.40000343	8.4000034
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	0	.	.	.
P00915	DISSOLVED CALCIUM (CA) (MG/L)	4	90.25008821	11.00004768	260.0002441
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	4	20.47502136	2.20000362	60.0000305
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	10	5.00000005	0.00000000	11.9999943
P00445	CARBONATE (CO3) (MG/L)	10	0.00000020	0.00000000	0.0000005
P00945	DISSOLVED SULFATE (SO4) (MG/L)	7	12.61429569	4.00000381	23.9999847
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	7	971.42919922	82.00003052	2900.0043945
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	4	1703.50133514	177.00045776	5080.0000000
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	0	.	.	.
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	0	.	.	.
P00620	TOTAL NITRATE (N) (MG/L)	0	.	.	.
P00665	TOTAL PHOSPHORUS (P) (MG/L)	0	.	.	.
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	2	9.99999619	9.99999619	9.9999962
P01002	TOTAL ARSENIC (AS) (UG/L)	0	.	.	.
P01025	DISSOLVED CADMIUM (CD) (UG/L)	8	0.37499984	0.00000000	1.9999990
P01027	TOTAL CADMIUM (CD) (UG/L)	0	.	.	.
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	4	10.74999332	0.00000000	18.9999847
P01034	TOTAL CHROMIUM (CR) (UG/L)	0	.	.	.
P01040	DISSOLVED COPPER (CU) (UG/L)	8	5.49999805	0.99999964	10.9999952
P01042	TOTAL COPPER (CU) (UG/L)	0	.	.	.
P01046	DISSOLVED IRON (FE) (UG/L)	8	568.74975395	199.99998474	1599.9995117
P01045	TOTAL IRON (FE) (UG/L)	0	.	.	.
P01049	DISSOLVED LEAD (PB) (UG/L)	8	5.99999666	0.00000000	19.9999847
P01051	TOTAL LEAD (PB) (UG/L)	0	.	.	.
P01056	DISSOLVED MANGANESE (MN) (UG/L)	8	872.49948120	389.99975586	1399.9997559
P01055	TOTAL MANGANESE (MN) (UG/L)	4	870.00139236	140.00047302	2500.0043945
P71890	DISSOLVED MERCURY (HG) (UG/L)	4	0.64999950	0.49999952	1.0999994
P71900	TOTAL MERCURY (HG) (UG/L)	2	2.04999971	0.50000000	3.5999994
P01090	DISSOLVED ZINC (ZN) (UG/L)	8	62.49995375	9.99999619	309.9997559
P01092	TOTAL ZINC (ZN) (UG/L)	0	.	.	.

Table 28.—*Water-quality statistical summary for station 07362550, Moro Creek near Banks, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	22	56.13629289	29.99995422	115.99984741
P00400	PH (UNITS)	23	6.50825397	5.99999332	6.99999237
P00010	TEMPERATURE (DEG C)	22	18.31815607	7.99999142	25.99996948
P00070	TURBIDITY (JTU)	23	23.26083805	9.99998569	54.99992371
P00300	DISSOLVED OXYGEN (MG/L)	22	6.68953792	3.79999542	10.79998589
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	23	1.56217177	0.84999913	2.99999619
P00915	DISSOLVED CALCIUM (CA) (MG/L)	5	4.59999485	1.99999714	6.99999237
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	5	1.79999769	0.99999869	3.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	7	4.81428024	2.09999752	9.19999027
P00937	TOTAL POTASSIUM (K) (MG/L)	7	1.98571159	0.99999869	3.59999561
P00440	BICARBONATE (HCO3) (MG/L)	7	17.42854718	8.99999046	32.99995422
P00445	CARBONATE (CO3) (MG/L)	7	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	15	7.19999003	0.99999869	14.99998093
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	12	9.33332229	5.99999332	14.99998093
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	22	83.77261769	56.99992371	116.99983215
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	22	21.13633572	2.99999619	62.99992371
P00620	TOTAL NITRATE (N) (MG/L)	23	0.25130405	0.09999985	0.74999928
P00665	TOTAL PHOSPHORUS (P) (MG/L)	23	0.08391292	0.01999998	0.19999975
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	14	3.49999544	2.99999619	9.99998569
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	14	4.42856514	0.00000000	16.99996948
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	14	0.21428544	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	14	5.07142217	0.00000000	13.99998283
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	14	1362.06903948	496.99926758	2796.99536133
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	13	43.84609516	0.00000000	153.99978638
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	13	188.84588036	50.99993896	619.99902344
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	13	15.76920773	0.00000000	40.99993896

Creek (Arkansas Department of Pollution Control and Ecology, 1970). Probable cause of low dissolved-oxygen concentration in the stream is forest litter in combination with low velocities.

Benthic organisms were collected in 1974 and 1975 at two locations upstream from the station near Banks (07362550), in the vicinity of Fordyce, by the Arkansas Department of Pollution Control and Ecology (1977). Sediment data are being collected at the station near Banks but are not available for publication.

Saline River

Data are given for four stations on the Saline River (tables 29 through 32). Two of these, operated by the Arkansas Department of Pollution Control and Ecology, are 07363002, west of Benton, and 07364012, near Fountain Hill (fig. 7). The other two stations, 07363080, near Tull, and 07363500, near Rye, were operated by the Geological Survey. The station near Rye has been reactivated for the present study.

The Saline River water is of good quality except for certain trace metals, which at times exceed levels recommended for drinking water. Metals exceeding recommended limits include copper, iron, lead, manganese, and zinc (tables 29 through 32).

No sediment or benthic data are available for publication, but both are being collected at station 07363500, near Rye. These data will be published in a subsequent report.

Hurricane Creek

Hurricane Creek is a tributary to the Saline River (fig. 7) and drains an area of bauxite mining. The Arkansas Department of Pollution Control and

Table 29.—*Water-quality statistical summary for station 07363002, Saline River west of Benton, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	25	110.95983887	64.99992371	149.99978638
P00400	PH (UNITS)	26	7.53845365	7.04999256	7.79999161
P00010	TEMPERATURE (DEG C)	26	21.11535450	6.99999237	30.99995422
P00070	TURBIDITY (JTU)	26	13.81536671	3.99999523	49.99993896
P00300	DISSOLVED OXYGEN (MG/L)	26	8.25845220	6.15999317	11.89998245
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	25	1.03799861	0.02999996	2.58999634
P00915	DISSOLVED CALCIUM (CA) (MG/L)	6	15.99997600	9.99998569	19.99996948
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	6	3.16666295	0.99999869	4.99999523
P00929	TOTAL SODIUM (NA) (MG/L)	8	2.47499681	1.49999809	3.79999542
P00937	TOTAL POTASSIUM (K) (MG/L)	8	0.73749906	0.09999985	1.39999771
P00440	BICARBONATE (HCO3) (MG/L)	8	64.24991989	45.99993896	76.99990845
P00445	CARBONATE (CO3) (MG/L)	8	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	17	4.88234723	0.99999869	9.99998569
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	14	4.39285231	3.49999619	5.99999332
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	26	77.46413745	0.06999987	120.99983215
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	25	13.31998215	2.99999619	58.99992371
P00620	TOTAL NITRATE (N) (MG/L)	26	0.20153821	0.09999985	0.82999915
P00665	TOTAL PHOSPHORUS (P) (MG/L)	26	0.02730766	0.00999999	0.14999980
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	17	2.99999619	2.99999619	2.99999619
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	19	2.94736425	0.00000000	9.99998569
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	19	0.47368361	0.00000000	2.99999619
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	26	131.49979107	0.00000000	999.99804688
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	26	526.92225295	200.99972534	1899.99682617
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	19	34.42100048	0.00000000	269.99951172
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	26	38.15379370	15.99997902	67.99990845
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	26	216.15351749	0.99999869	3799.99389648

Table 30.—*Water-quality statistical summary for station 07363080, Saline River near Tull, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	20	116.19998169	56.00000000	151.00000000
P00400	PH (UNITS)	19	7.33157790	6.69999981	7.89999962
P00010	TEMPERATURE (DEG C)	19	18.57894576	8.00000000	28.00000000
P00070	TURBIDITY (JTU)	15	11.53333238	3.00000000	38.00000000
P00300	DISSOLVED OXYGEN (MG/L)	19	7.92105062	5.09999943	10.29999924
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	19	1.39999808	0.29999965	5.39999390
P00915	DISSOLVED CALCIUM (CA) (MG/L)	4	15.75000000	14.00000000	17.00000000
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	4	3.42500138	2.70000076	4.00000191
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	16	54.93748760	16.00000000	83.99989319
P00445	CARBONATE (CO3) (MG/L)	15	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	4	10.12500048	5.50000191	14.00000000
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	4	2.90000105	2.50000095	3.40000153
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	4	78.75000000	60.00000000	92.00000000
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	0	.	.	.
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	0	.	.	.
P00620	TOTAL NITRATE (N) (MG/L)	15	0.12533341	0.01000001	0.32000029
P00665	TOTAL PHOSPHORUS (P) (MG/L)	20	0.09150005	0.01000001	0.18000013
P00600	TOTAL NITROGEN (N) (MG/L)	20	0.51650032	0.25000018	0.90000081
P01000	DISSOLVED ARSENIC (AS) (UG/L)	1	1.00000000	1.00000000	1.00000000
P01002	TOTAL ARSENIC (AS) (UG/L)	0	.	.	.
P01025	DISSOLVED CADMIUM (CD) (UG/L)	1	1.00000000	1.00000000	1.00000000
P01027	TOTAL CADMIUM (CD) (UG/L)	0	.	.	.
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	1	0.00000000	0.00000000	0.00000000
P01034	TOTAL CHROMIUM (CR) (UG/L)	0	.	.	.
P01040	DISSOLVED COPPER (CU) (UG/L)	1	4.00000000	4.00000000	4.00000000
P01042	TOTAL COPPER (CU) (UG/L)	0	.	.	.
P01046	DISSOLVED IRON (FE) (UG/L)	1	130.00000000	130.00000000	130.00000000
P01045	TOTAL IRON (FE) (UG/L)	0	.	.	.
P01049	DISSOLVED LEAD (PB) (UG/L)	1	4.00000000	4.00000000	4.00000000
P01051	TOTAL LEAD (PB) (UG/L)	0	.	.	.
P01056	DISSOLVED MANGANESE (MN) (UG/L)	1	80.00000000	80.00000000	80.00000000
P01055	TOTAL MANGANESE (MN) (UG/L)	0	.	.	.
P71890	DISSOLVED MERCURY (HG) (UG/L)	1	0.00000000	0.00000000	0.00000000
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	1	20.00000000	20.00000000	20.00000000
P01092	TOTAL ZINC (ZN) (UG/L)	0	.	.	.

Table 31.—*Water-quality statistical summary for station 07363500, Saline River near Rye, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	51	104.58836095	41.00003052	239.99993896
P00400	PH (UNITS)	51	7.13921711	6.10000324	7.80000305
P00010	TEMPERATURE (DEG C)	57	17.19999749	0.99999964	32.00003052
P00070	TURBIDITY (JTU)	0	.	.	.
P00300	DISSOLVED OXYGEN (MG/L)	31	8.59678296	4.69999886	12.99999905
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	0	.	.	.
P00915	DISSOLVED CALCIUM (CA) (MG/L)	31	8.33871952	3.80000401	14.00004768
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	31	2.28064715	0.90000033	3.50000381
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	50	27.86001268	9.99999619	52.00003052
P00445	CARBONATE (CO3) (MG/L)	52	0.00000027	0.00000000	0.00000050
P00945	DISSOLVED SULFATE (SO4) (MG/L)	31	19.13550042	5.80000401	70.99998474
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	31	2.97419561	0.89999998	4.20000362
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	31	71.32259000	25.00000000	153.99996948
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	0	.	.	.
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	0	.	.	.
P00620	TOTAL NITRATE (N) (MG/L)	0	.	.	.
P00665	TOTAL PHOSPHORUS (P) (MG/L)	11	0.02636362	0.00000000	0.08999991
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	0	.	.	.
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	0	.	.	.
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	5	2.59999943	0.00000000	6.99999905
P01034	TOTAL CHROMIUM (CR) (UG/L)	2	4.99999571	2.99999905	6.99999237
P01040	DISSOLVED COPPER (CU) (UG/L)	5	3.19999886	0.00000000	5.99999905
P01042	TOTAL COPPER (CU) (UG/L)	0	.	.	.
P01046	DISSOLVED IRON (FE) (UG/L)	13	390.15368740	0.00000000	909.99975586
P01045	TOTAL IRON (FE) (UG/L)	0	.	.	.
P01049	DISSOLVED LEAD (PB) (UG/L)	5	2.79999936	0.00000000	6.99999905
P01051	TOTAL LEAD (PB) (UG/L)	0	.	.	.
P01056	DISSOLVED MANGANESE (MN) (UG/L)	15	80.33331267	4.99999523	169.99995422
P01055	TOTAL MANGANESE (MN) (UG/L)	10	68.00011149	0.00000050	210.00045776
P71890	DISSOLVED MERCURY (HG) (UG/L)	1	0.50000000	0.50000000	0.50000000
P71900	TOTAL MERCURY (HG) (UG/L)	3	1.36666640	0.50000000	2.79999924
P01090	DISSOLVED ZINC (ZN) (UG/L)	4	11.74999595	9.99999619	15.99999619
P01092	TOTAL ZINC (ZN) (UG/L)	0	.	.	.

Table 32.—*Water-quality statistical summary for station 07364012, Saline River near Fountain Hill, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	52	112.90375137	34.99995422	544.00000000
P00400	PH (UNITS)	53	6.97565500	5.79999352	7.70000362
P00010	TEMPERATURE (DEG C)	51	18.09801919	0.00000000	34.00000000
P00070	TURBIDITY (JTU)	43	20.04648457	7.99999142	74.99990845
P00300	DISSOLVED OXYGEN (MG/L)	52	7.90480148	4.19999504	12.00000572
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	51	1.37921431	0.27999967	3.19999981
P00915	DISSOLVED CALCIUM (CA) (MG/L)	12	9.41665888	2.99999619	22.00000000
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	12	3.33333049	0.99999869	6.99999237
P00929	TOTAL SODIUM (NA) (MG/L)	9	14.63332950	1.39999771	80.00000000
P00937	TOTAL POTASSIUM (K) (MG/L)	9	1.82222070	1.09999847	3.00000000
P00440	BICARBONATE (HCO3) (MG/L)	9	28.11108292	8.99999046	45.00000000
P00445	CARBONATE (CO3) (MG/L)	8	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	31	15.79353305	3.99999523	47.99993896
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	43	14.38371583	2.49999714	140.00000000
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	40	100.12492294	51.99993896	325.00000000
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	39	20.66664478	4.00000000	88.99989319
P00620	TOTAL NITRATE (N) (MG/L)	38	0.28578921	0.00999999	1.09999847
P00665	TOTAL PHOSPHORUS (P) (MG/L)	39	0.05333329	0.00999999	0.14999980
P01002	TOTAL ARSENIC (AS) (UG/L)	24	4.29166106	2.99999619	18.99996948
P01027	TOTAL CADMIUM (CD) (UG/L)	27	9.18517323	0.00000000	110.99960164
P01034	TOTAL CHROMIUM (CR) (UG/L)	24	7.87499768	0.00000000	99.99983215
P01042	TOTAL COPPER (CU) (UG/L)	36	21.19443369	0.00000000	390.00000000
P01045	TOTAL IRON (FE) (UG/L)	39	1064.17800356	20.00000000	3300.00000000
P01051	TOTAL LEAD (PB) (UG/L)	38	66.57865986	0.00000000	269.99951172
P01055	TOTAL MANGANESE (MN) (UG/L)	39	225.66640961	64.99992371	510.00000000
P71900	TOTAL MERCURY (HG) (UG/L)	4	0.59999974	0.09999985	1.50000000
P01092	TOTAL ZINC (ZN) (UG/L)	36	18.24998429	0.00000000	90.00000000

Ecology has operated a water-quality station (07363270) near Sardis since 1974. The Geological Survey operated a water-quality station (07363300) near Sheridan from October 1949 to September 1954 and from October 1967 to September 1972. This station has been reactivated for this study.

As might be expected of a stream draining a mining area, high concentrations of some trace metals have been reported (tables 33 and 34). Metals in excess of recommended limits include cadmium, iron, lead, and manganese. Sulfates sometime exceed standards (table 33).

No sediment and benthic data are available for publication. However, both sediment and benthic data are being collected at the station near Sheridan. Early indications are that benthic communities are very small (E.E. Morris, oral commun., 1978), probably as a result of upstream mining activities. Both sediment and benthic data will be published in a subsequent report.

Bayou de Loutre

Statistical data are given for a water-quality station (07364600) on Bayou de Loutre near El Dorado (table 35). The station has been operated by the Arkansas Department of Pollution Control and Ecology since October 1970. This stream drains an area of oil-field activities, and the water quality of the stream reflects those activities. High chloride concentrations resulting from oil-field brines exceed limits for human consumption. Of metals present, chromium, iron, lead, and manganese exceed limits. Dissolved oxygen is sometimes less than the State standard of 5.0 mg/L, probably as a result of low flows, municipal and industrial wastes (Arkansas Department of Pollution Control and Ecology, 1975), respiration of aquatic plants, and oxygen demand of the breakdown of organic detritus from forest litter. No sediment or benthic data are available for this stream.

Table 33.—*Water-quality statistical summary for station 07363270, Hurricane Creek near Sardis, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	22	500.99745269	2.95999622	952.9987793
P00400	PH (UNITS)	23	5.34999408	3.02999592	8.8299904
P00010	TEMPERATURE (DEG C)	23	19.08692837	7.99999142	27.9999542
P00070	TURBIDITY (JTU)	23	29.76517661	3.99999523	189.9997559
P00300	DISSOLVED OXYGEN (MG/L)	23	8.93564162	6.01999378	17.9999695
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	22	1.01499875	0.38999957	2.1799974
P00915	DISSOLVED CALCIUM (CA) (MG/L)	5	22.59997025	8.99999046	45.9999390
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	5	7.99999123	4.99999523	13.9999828
P00929	TOTAL SODIUM (NA) (MG/L)	7	38.62852015	13.99998283	57.8999329
P00937	TOTAL POTASSIUM (K) (MG/L)	7	2.74285385	1.49999809	3.9999952
P00440	BICARBONATE (HCO3) (MG/L)	7	22.99996649	0.00000000	116.9998322
P00445	CARBONATE (CO3) (MG/L)	7	1.42856938	0.00000000	9.9999857
P00945	DISSOLVED SULFATE (SO4) (MG/L)	15	235.59963385	9.99998569	499.9992676
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	12	5.70832713	3.99999523	6.9999924
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	22	397.04485807	40.99993896	988.9985352
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	22	51.09083674	6.99999237	302.9995117
P00620	TOTAL NITRATE (N) (MG/L)	23	0.37869520	0.09999985	1.2099981
P00665	TOTAL PHOSPHORUS (P) (MG/L)	23	0.03347822	0.00999999	0.1199998
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	15	2.99999619	2.99999619	2.9999962
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	22	15.04543390	0.00000000	59.9999237
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	16	0.37499952	0.00000000	2.9999962
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	23	11.08694042	0.00000000	28.9999542
P01046	DISSOLVED IRON (FE) (UG/L)	0	.	.	.
P01045	TOTAL IRON (FE) (UG/L)	23	5267.12026579	519.99926758	24049.9492188
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	16	102.37484086	0.00000000	398.9992676
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	22	2144.63238248	109.99981689	6019.9882813
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	0	.	.	.
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	22	137.99980311	9.99998569	609.9990234

Table 34.—*Water-quality statistical summary for station 07363300, Hurricane Creek near Sheridan, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	64	530.35959411	90.99989319	1719.9997559
P00400	PH (UNITS)	58	6.49655298	4.29999924	8.2000036
P00010	TEMPERATURE (DEG C)	54	16.03148100	2.49999714	29.9999847
P00070	TURBIDITY (JTU)	0	.	.	.
P00300	DISSOLVED OXYGEN (MG/L)	34	8.07941821	5.00000000	13.0000477
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	10	1.38999971	0.00000000	5.0000000
P00915	DISSOLVED CALCIUM (CA) (MG/L)	32	25.18751186	6.20000362	86.9999847
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	32	4.99687630	1.10000420	16.9999847
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	55	32.81821555	0.00000000	156.0004578
P00445	CARBONATE (CO3) (MG/L)	55	0.00000023	0.00000000	0.0000005
P00945	DISSOLVED SULFATE (SO4) (MG/L)	36	207.94449192	22.00003052	859.9997559
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	36	5.60555975	1.19999886	14.0000477
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	32	360.43759394	62.00003052	1239.9995117
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	0	.	.	.
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	0	.	.	.
P00620	TOTAL NITRATE (N) (MG/L)	0	.	.	.
P00665	TOTAL PHOSPHORUS (P) (MG/L)	10	0.01899999	0.00000000	0.0699999
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	3	9.99999619	9.99999619	9.9999962
P01002	TOTAL ARSENIC (AS) (UG/L)	0	.	.	.
P01025	DISSOLVED CADMIUM (CD) (UG/L)	7	0.71428512	0.00000000	1.9999990
P01027	TOTAL CADMIUM (CD) (UG/L)	0	.	.	.
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	5	5.19999886	0.00000000	9.9999962
P01034	TOTAL CHROMIUM (CR) (UG/L)	0	.	.	.
P01040	DISSOLVED COPPER (CU) (UG/L)	9	5.77777534	1.99999905	19.9999847
P01042	TOTAL COPPER (CU) (UG/L)	0	.	.	.
P01046	DISSOLVED IRON (FE) (UG/L)	19	90.57892227	0.00000000	205.9999695
P01045	TOTAL IRON (FE) (UG/L)	0	.	.	.
P01049	DISSOLVED LEAD (PB) (UG/L)	10	3.59999905	0.00000000	9.9999962
P01051	TOTAL LEAD (PB) (UG/L)	0	.	.	.
P01056	DISSOLVED MANGANESE (MN) (UG/L)	19	2893.15667885	0.00000000	15999.9960938
P01055	TOTAL MANGANESE (MN) (UG/L)	20	181.18521919	0.00000050	610.0002441
P71890	DISSOLVED MERCURY (HG) (UG/L)	6	1.18333284	0.49999952	3.9999990
P71900	TOTAL MERCURY (HG) (UG/L)	1	0.50000000	0.50000000	0.5000000
P01090	DISSOLVED ZINC (ZN) (UG/L)	10	51.71998888	0.00000000	250.0000000
P01092	TOTAL ZINC (ZN) (UG/L)	0	.	.	.

Table 35.—*Water-quality statistical summary for station 07364600, Bayou de Loutre near El Dorado, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	46	2963.42935313	406.99926758	7499.98828125
P00400	PH (UNITS)	47	7.03892870	6.13999367	8.09999084
P00010	TEMPERATURE (DEG C)	46	19.74997029	4.99999523	30.99995422
P00070	TURBIDITY (JTU)	47	12.34253737	2.69999695	29.99995422
P00300	DISSOLVED OXYGEN (MG/L)	46	6.46042745	2.34999657	13.69998169
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	47	2.95829431	0.82999915	12.99998474
P00915	DISSOLVED CALCIUM (CA) (MG/L)	11	93.81804171	18.99996948	269.99951172
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	11	18.09088343	4.99999523	38.99995422
P00929	TOTAL SODIUM (NA) (MG/L)	8	330.46198845	64.49992371	609.99902344
P00937	TOTAL POTASSIUM (K) (MG/L)	8	14.61248326	1.49999809	52.99993896
P00440	BICARBONATE (HCO3) (MG/L)	8	57.37491584	13.99998283	109.99981689
P00445	CARBONATE (CO3) (MG/L)	8	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	24	38.06661459	8.59999084	99.99983215
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	35	1051.55539987	18.99996948	2499.99609375
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	34	1830.14382037	280.99951172	4549.99218750
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	34	49.47051954	9.99998569	335.99951172
P00620	TOTAL NITRATE (N) (MG/L)	34	0.61588161	0.00999999	1.39999771
P00665	TOTAL PHOSPHORUS (P) (MG/L)	34	0.17117625	0.02999996	0.77999872
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	24	5.70832618	2.99999619	44.99993896
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	32	11.21873467	0.00000000	25.99996948
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	25	5.47999104	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	32	10.65623479	0.00000000	42.99993896
P01046	DISSOLVED IRON (FE) (UG/L)	1	374.99951172	374.99951172	374.99951172
P01045	TOTAL IRON (FE) (UG/L)	33	1052.93764796	264.99951172	2814.99536133
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	33	58.72719476	0.00000000	255.99966431
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	34	1008.29238712	129.99983215	2659.99536133
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	4	0.40749955	0.09999985	0.70999926
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	34	24.61761208	0.00000000	49.99993896

Cornie Bayou

Station 07365800 (fig. 7), Cornie Bayou near the town of Three Creeks, was operated by the Arkansas Department of Pollution Control and Ecology from February 1968 to April 1974. Table 36 gives the statistical data for this station. Part of the drainage area of this stream is comprised of oil fields and is subject to degradation by oil-field wastes. Data for station 07365800 reflect some degradation from oil fields. The maximum chloride concentration of 240 mg/L (table 36), which is near the recommended maximum allowed for drinking water, probably resulted from oil-field brine. Arsenic, chromium, iron, lead, and manganese concentrations have exceeded standards. Dissolved-oxygen concentration is sometimes less than the 5.0 mg/L minimum recommended by State water-quality standards. No benthic or sediment data are available for this stream.

Three Creeks

Table 37 gives statistical data for a water-quality station (07365900), on Three Creeks, near the town of Three Creeks. This station was operated by the Arkansas Department of Pollution Control and Ecology from February 1968 to April 1974, and data show the stream to be degraded by oil-field wastes (Arkansas Department of Pollution Control and Ecology, 1975). However, two samples collected during the summer of 1974, at the Arkansas-Louisiana State boundary, indicate some improvement in water quality (Arkansas Department of Pollution Control and Ecology, 1975).

At the station near Three Creeks, dissolved oxygen, chloride, chromium, iron, lead, manganese, and zinc concentrations (table 37) are in violation of one or more of the standards shown in table 11.

A varied benthic community was reported for this stream at the Arkansas-Louisiana State boundary for the summer of 1974 (Arkansas Department of Pollution Control and Ecology, 1975). No sediment data are available.

Table 36.—*Water-quality statistical summary for station 07365800, Cornie Bayou near Three Creeks, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	19	456.10460141	154.99977112	759.99902344
P00400	PH (UNITS)	14	5.75570822	4.77999496	6.69999313
P00010	TEMPERATURE (DEG C)	35	15.64283412	2.49999714	26.99995422
P00070	TURBIDITY (JTU)	14	17.69283356	3.79999542	39.99995422
P00300	DISSOLVED OXYGEN (MG/L)	14	7.05356353	3.39999580	10.29998684
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	13	1.68999786	0.50999945	8.35999107
P00915	DISSOLVED CALCIUM (CA) (MG/L)	4	24.24996495	1.99999714	37.99995422
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	4	5.74999356	1.99999714	6.99999237
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	0	.	.	.
P00445	CARBONATE (CO3) (MG/L)	0	.	.	.
P00945	DISSOLVED SULFATE (SO4) (MG/L)	6	5.98332707	3.89999580	7.99999142
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	19	145.68400734	33.99995422	239.99964905
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	0	.	.	.
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	6	370.83274587	91.99989319	582.99902344
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	6	31.66662312	10.99998283	50.99993896
P00620	TOTAL NITRATE (N) (MG/L)	6	0.52666604	0.09999985	2.29999733
P00665	TOTAL PHOSPHORUS (P) (MG/L)	6	0.03999995	0.00999999	0.06999987
P00600	TOTAL NITROGEN (N) (MG/L)	0	.	.	.
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	6	10.16665252	2.99999619	28.99995422
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	6	4.66666158	0.00000000	7.99999142
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	6	25.83329217	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	6	13.99998124	0.00000000	32.99995422
P01046	DISSOLVED IRON (FE) (UG/L)	1	374.99951172	374.99951172	374.99951172
P01045	TOTAL IRON (FE) (UG/L)	6	1118.49808757	609.99902344	1699.99682617
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	6	116.33316215	3.99999523	214.99971008
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	6	704.99902344	399.99926758	909.99877930
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	2	0.24499971	0.17999977	0.30999964
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	5	24.59996643	19.99996948	28.99995422

Table 37.—*Water-quality statistical summary for station 07365900, Three Creeks near Three Creeks, Ark.*

VARIABLE	LABEL	N	MEAN	MINIMUM VALUE	MAXIMUM VALUE
P00095	SPECIFIC CONDUCTANCE (MICROMHOS)	21	551.47534688	154.99977112	1073.99755859
P00400	PH (UNITS)	16	6.11686891	5.29999447	8.09999943
P00010	TEMPERATURE (DEG C)	21	15.85711970	3.99999523	29.49995422
P00070	TURBIDITY (JTU)	16	19.24372327	4.69999504	44.99993896
P00300	DISSOLVED OXYGEN (MG/L)	16	7.30374110	3.64999580	10.59998322
P00310	BIOCHEMICAL OXYGEN DEMAND 5 DAY (MG/L)	16	1.57187315	0.19999975	6.29999352
P00915	DISSOLVED CALCIUM (CA) (MG/L)	5	37.39996490	6.99999237	53.00000000
P00925	DISSOLVED MAGNESIUM (MG) (MG/L)	5	9.99999084	2.99999619	17.00000000
P00929	TOTAL SODIUM (NA) (MG/L)	0	.	.	.
P00937	TOTAL POTASSIUM (K) (MG/L)	0	.	.	.
P00440	BICARBONATE (HCO3) (MG/L)	2	237.49983978	211.99967957	263.00000000
P00445	CARBONATE (CO3) (MG/L)	2	0.00000000	0.00000000	0.00000000
P00945	DISSOLVED SULFATE (SO4) (MG/L)	7	8.68570764	4.99999523	17.00000000
P00940	DISSOLVED CHLORIDE (CL) (MG/L)	20	322.79948959	17.00000000	3399.99438477
P70300	DISSOLVED SOLIDS (RESIDUE AT 180 C) (MG/L)	1	266.00000000	266.00000000	266.00000000
P00515	TOTAL FILTRABLE RESIDUE (MG/L)	6	431.33266703	70.99990845	642.99902344
P00530	TOTAL NONFILTRABLE RESIDUE (MG/L)	6	42.33327230	6.99999237	109.99981689
P00620	TOTAL NITRATE (N) (MG/L)	6	0.17666644	0.09999985	0.29999965
P00665	TOTAL PHOSPHORUS (P) (MG/L)	7	0.06285711	0.01999998	0.18000013
P00600	TOTAL NITROGEN (N) (MG/L)	1	1.30000019	1.30000019	1.30000019
P01000	DISSOLVED ARSENIC (AS) (UG/L)	0	.	.	.
P01002	TOTAL ARSENIC (AS) (UG/L)	6	3.66666222	2.99999619	6.99999237
P01025	DISSOLVED CADMIUM (CD) (UG/L)	0	.	.	.
P01027	TOTAL CADMIUM (CD) (UG/L)	6	6.16665999	0.00000000	8.99999046
P01030	DISSOLVED CHROMIUM (CR) (UG/L)	0	.	.	.
P01034	TOTAL CHROMIUM (CR) (UG/L)	6	25.83329217	0.00000000	99.99983215
P01040	DISSOLVED COPPER (CU) (UG/L)	0	.	.	.
P01042	TOTAL COPPER (CU) (UG/L)	6	7.83332364	0.00000000	12.99998474
P01046	DISSOLVED IRON (FE) (UG/L)	1	449.99926758	449.99926758	449.99926758
P01045	TOTAL IRON (FE) (UG/L)	6	973.16499837	399.99926758	1919.99658203
P01049	DISSOLVED LEAD (PB) (UG/L)	0	.	.	.
P01051	TOTAL LEAD (PB) (UG/L)	6	131.33311717	0.00000000	391.99926758
P01056	DISSOLVED MANGANESE (MN) (UG/L)	0	.	.	.
P01055	TOTAL MANGANESE (MN) (UG/L)	6	966.83164978	229.99966431	1969.99658203
P71890	DISSOLVED MERCURY (HG) (UG/L)	0	.	.	.
P71900	TOTAL MERCURY (HG) (UG/L)	4	0.28499967	0.09999985	0.47999948
P01090	DISSOLVED ZINC (ZN) (UG/L)	0	.	.	.
P01092	TOTAL ZINC (ZN) (UG/L)	6	224.33289083	16.99996948	1199.99755859

Ground-Water Occurrence and Quality

The geologic column in south Arkansas is summarized in table 38. Lignite occurs in Tertiary deposits of Eocene age. "Arkansas lignite is found principally in strata of Eocene age. It is most abundant in strata of the Wilcox Group and successively less abundant in the overlying Claiborne and Jackson Groups" (Stroud and others, 1969). The Eocene deposits also contain aquifers that are important sources of water supply both locally and regionally. Total ground-water usage in the study area was 422 Mgal/d in 1975 (Halberg, 1975).

Much of the definition of the geologic units in the subsurface is based on interpretation of electric logs of test holes drilled for oil and gas exploration. An example of such an electric log is shown in figure 8. The geologic units have been correlated throughout the Coastal Plain of Arkansas and in parts of adjacent States in regional hydrologic studies such as U.S. Geological Survey Professional Papers 448 and 569.

The stratigraphic relationships of the Tertiary units in the project area are shown by five geologic cross sections located as shown in figure 9. The cross sections are shown in figure 10, sheets 1 through 4. Table 39 contains information on the test holes and wells used to define the cross sections.

Most of the aquifers that yield freshwater in the study area are part of, or lie above, the Eocene Series. The exceptions are the Clayton Formation of Paleocene age and the Nacatoch Sand of Cretaceous age. These two aquifers yield freshwater within small areas in the project area. The geologic units below the Nacatoch Sand do not contain freshwater in the project area.

Table 38.—*Generalized geologic column in the lignite area of southern Arkansas*

<table>
<tr><th>System</th><th>Series</th><th>Group</th><th>Formation</th><th>Lignite occurrence</th></tr>
<tr><td rowspan="2">Quaternary</td><td>Holocene</td><td rowspan="2"></td><td rowspan="2">Terrace and stream deposits</td><td rowspan="2">Lignite beds absent</td></tr>
<tr><td>Pleistocene</td></tr>
<tr><td rowspan="4">Tertiary</td><td rowspan="3">Eocene</td><td>Jackson</td><td>Undifferentiated</td><td rowspan="3">Contains lignite beds</td></tr>
<tr><td>Claiborne</td><td>Cockfield Formation
Cook Mountain Formation
Sparta Sand
Cane River Formation
Carrizo Sand</td></tr>
<tr><td>Wilcox</td><td>Undifferentiated</td></tr>
<tr><td>Paleocene</td><td>Midway</td><td>Porters Creek Clay
Clayton Formation</td><td>Lignite beds absent</td></tr>
<tr><td>Cretaceous</td><td>Upper Cretaceous</td><td></td><td>Arkadelphia Marl
Nacatoch Sand
Saratoga Chalk
Marlbrook Marl
Annona Chalk
Ozan Formation
Brownstown Marl
Tokio Formation
Woodbine Formation</td><td>Lignite beds in Tokio Formation only</td></tr>
</table>

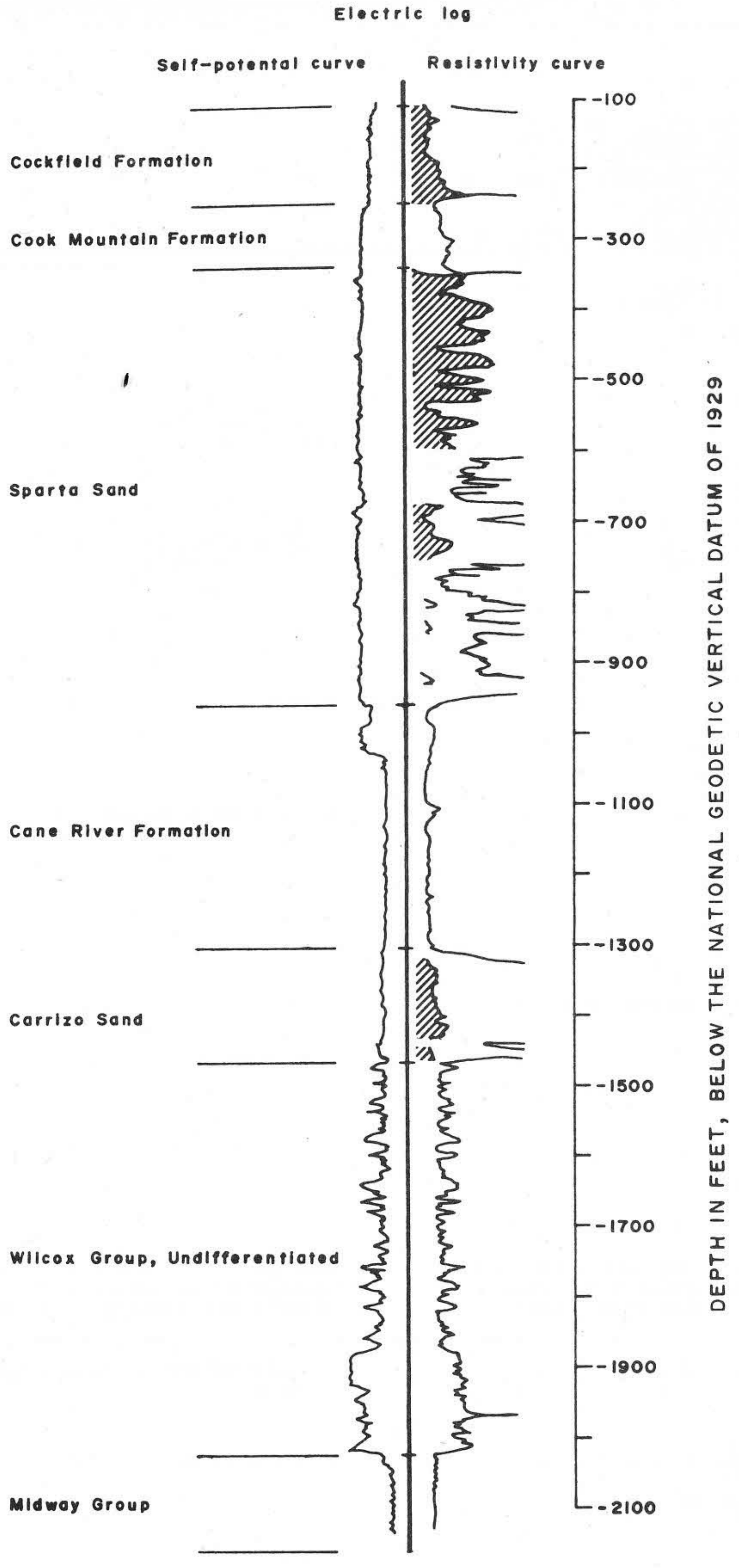


Figure 8.—Composite example of an electric log.

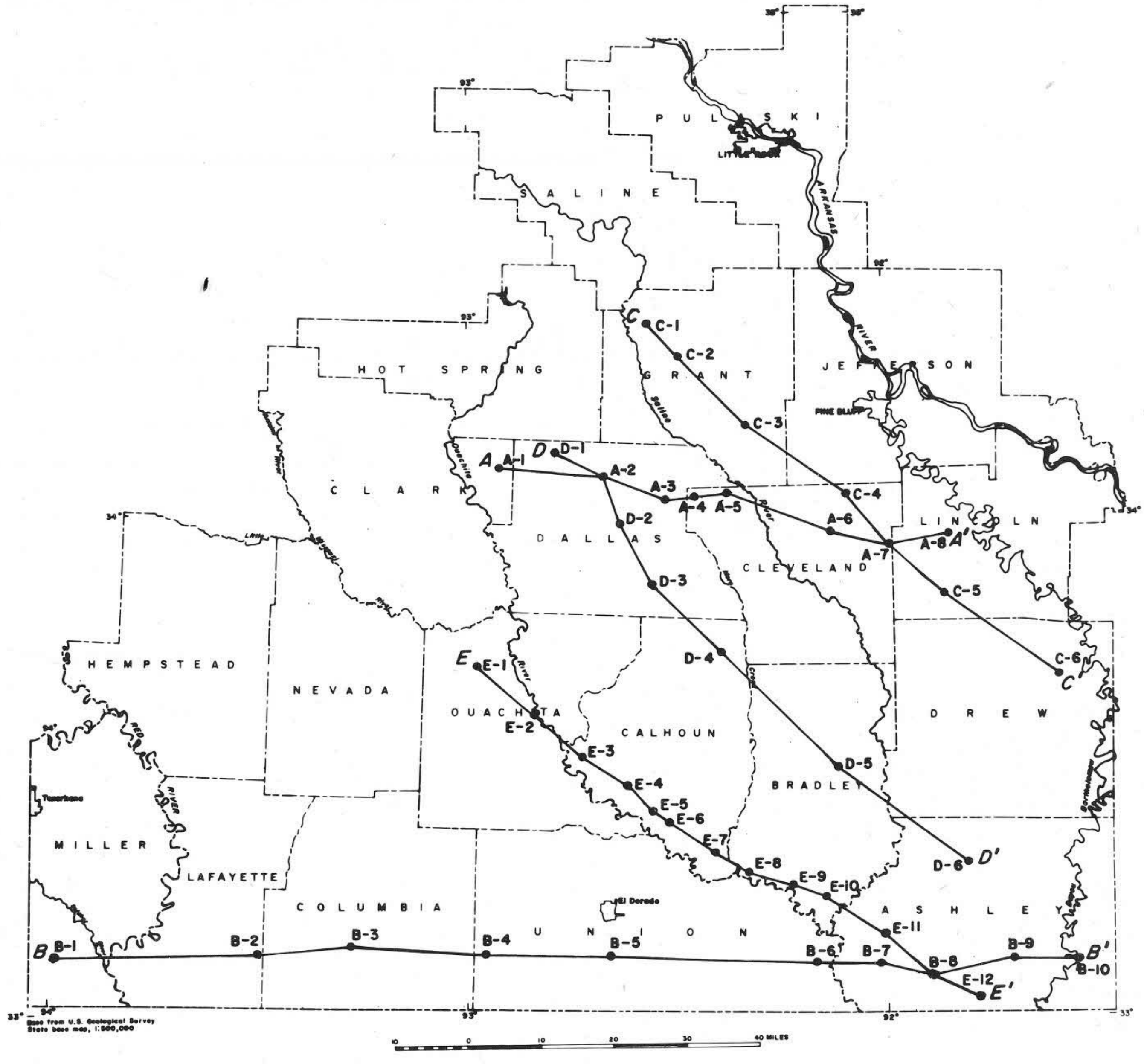


Figure 9. —Locations of geologic cross sections.

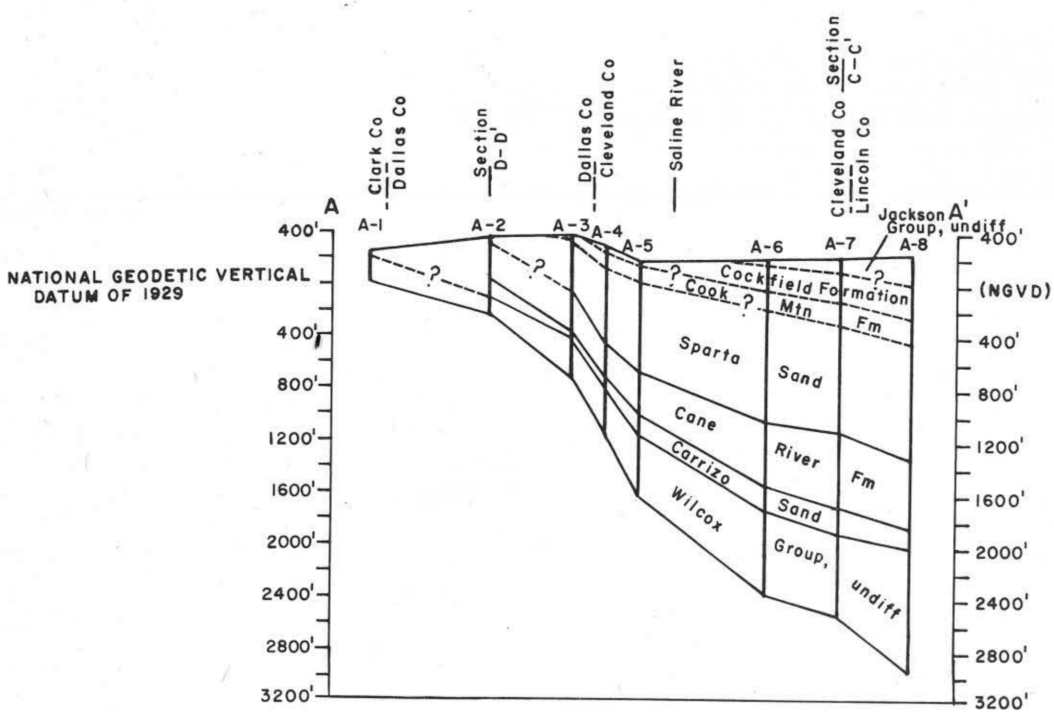


Figure 10, sheet 1 of 4.—Geologic cross sections in the project area.

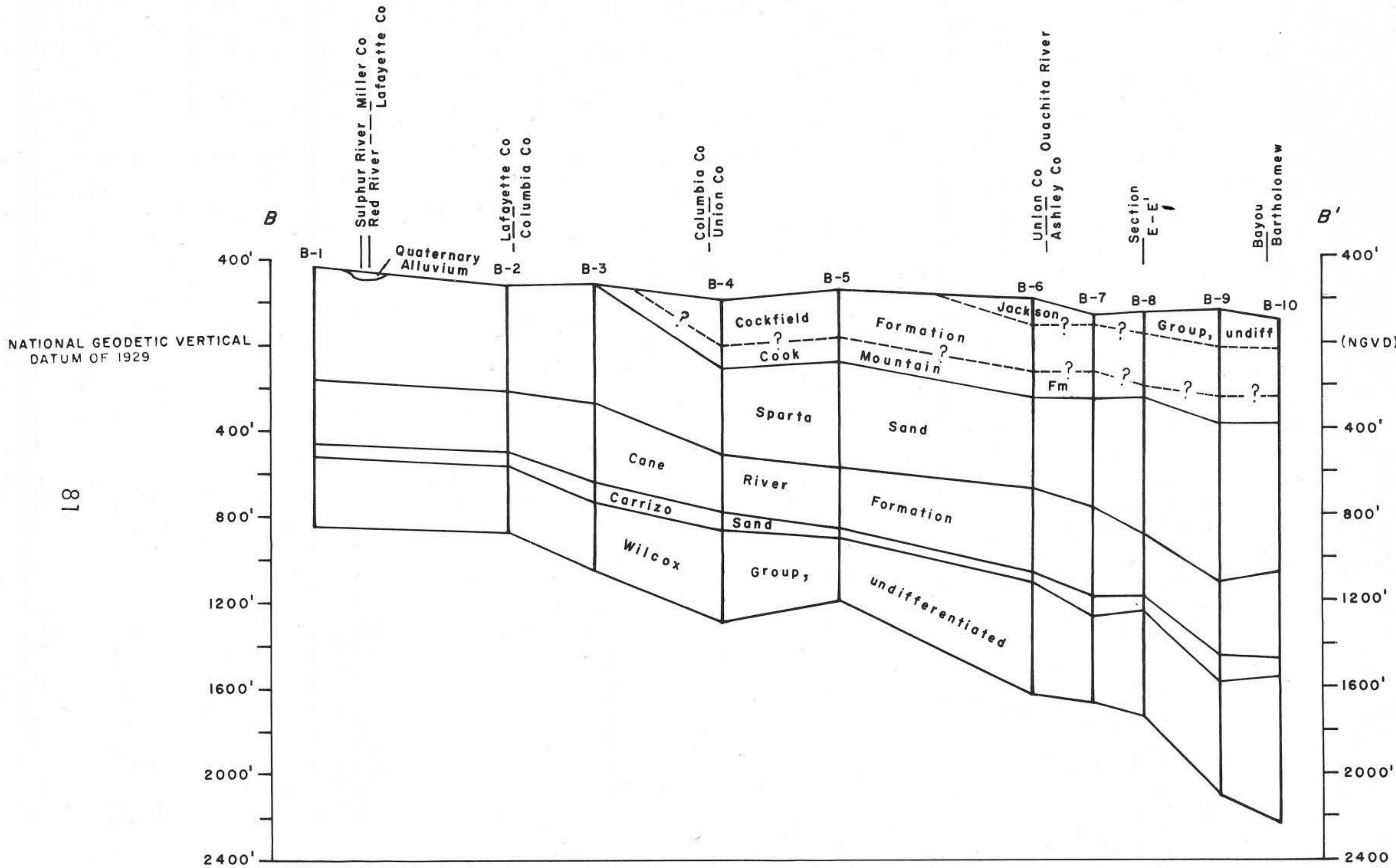


Figure 10, sheet 2 of 4.—Geologic cross sections in the project area.

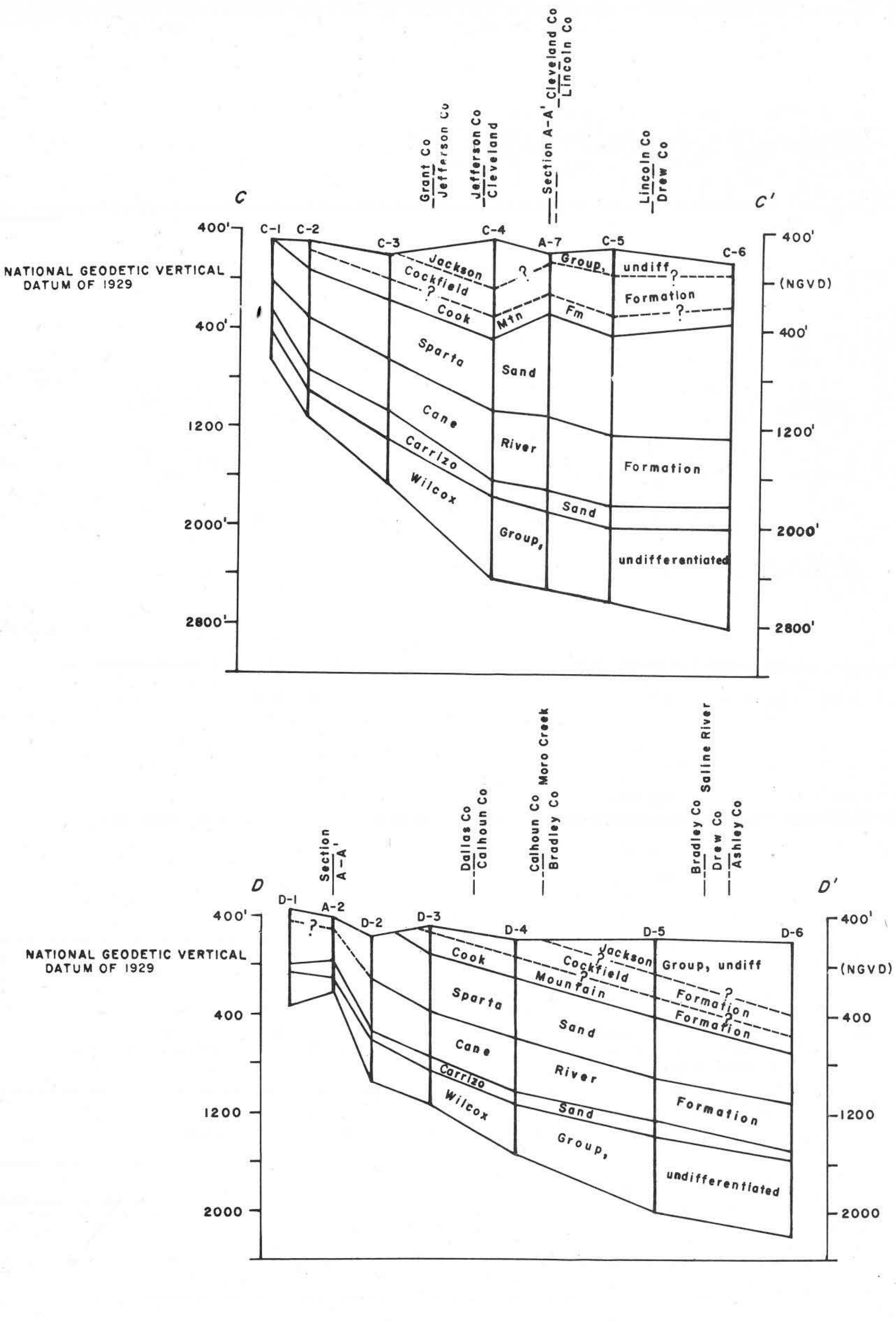


Figure 10, sheet 3 of 4.—Geologic cross sections in the project area.

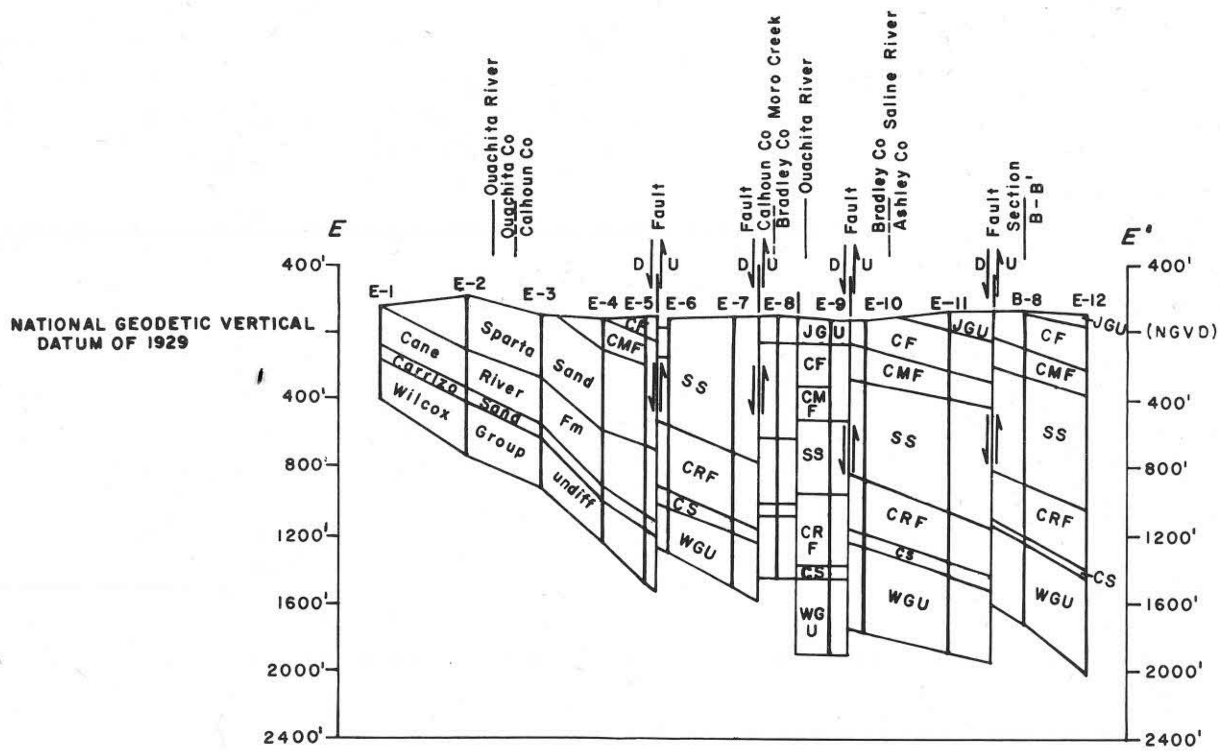


Figure 10, sheet 4 of 4.—Geologic cross sections in the project area.

Table 39.—*Test holes and wells used in defining cross sections*

Control point	Location	Owner	Lease
	Cross section A		
A-1	Clark County, sec. 27, T. 7 S., R. 18 W.	J. F. Stone	Hunnicut No. 1.
A-2	Dallas County, sec. 34, T. 7 S., R. 17 W.	Lion Oil Co.	Core Hole No. 12-PW-7.
A-3	Dallas County, sec. 31, T. 7 S., R. 15 W.	Lion Oil Co.	Core Hole No. PW21.
A-4	Cleveland County, sec. 7, T. 8 S., R. 13 W.	Lion Oil Co.	Core Hole No. 8-F-1.
A-5	Cleveland County, sec. 1, T. 8 S., R. 13 W.	Lion Oil Co.	Core Hole No. M-6.
A-6	Cleveland County, sec. 3, T. 8 S., R. 13 W.	W. M. Coates	J. L. Moore No. 1.
A-7	Cleveland County, sec. 13, T. 9 S., R. 9 W.	Desha Basin Corp.	E. A. Merril No. 1.
A-8	Lincoln County, sec. 5, T. 9 S., R. 9 W.	William L. Durham	Tarner No. 1.
	Cross section B		
B-1	Miller County, sec. 11, T. 19 S., R. 28 W.	Arkla Oil Co.	R. T. Dodd No. 1.
B-2	Lafayette County, sec. 4, T. 19 S., R. 23 W.	McAlester Fuel Co.	Cora Jeffus No. 1.
B-3	Columbia County, sec. 22, T. 18 S., R. 21 W.	Crow Drilling Co.	Chaffin No. 1.
B-4	Union County, sec. 24, T. 18 S., R. 18 W.	Lion Oil Co.	Lofton No. 1.
B-5	Union County, sec. 33, T. 18 S., R. 15 W.	C. H. Murphy, Jr.	Cates No. C-1.
B-6	Union County, sec. 31, T. 18 S., R. 10 W.	McAlester Fuel Co.	Crossett Lumber Co. No. H-1.

Table 39.—*Test holes and wells used in defining cross sections*—Continued

Control point	Location	Owner	Lease
		Cross section B—Continued	
B-7	Ashley County, sec. 34, T. 18 S., R. 9 W.	Patoil Corp.	Georgia Pacific Corp. No. 1.
B-8	Ashley County, sec. 2, T. 19 S., R. 9 W.	Patoil Corp.	Georgia Pacific Corp. No. 2.
B-9	Ashley County, sec. 27, T. 18 S., R. 6 W.	Lion Oil Co.	Crossett Lumber Co.
B-10	Ashley County, sec. 31, T. 18 S., R. 4 W.	Chicago Corp.	Mr. Morris No. 1.
		Cross section C	
C-1	Grant County, sec. 13, T. 4 S., R. 15 W.	Lion Oil Co.	Exploratory Hole No. G-2.
C-2	Grant County, sec. 2, T. 5 S., R. 14 W.	C. A. Lee	International Paper Co. No. A-1.
C-3	Grant County, sec. 21, T. 6 S., R. 12 W.	Connelly & Froderman	Ashcraft No. 1.
C-4	Cleveland County, sec. 10, T. 8 S., R. 10 W.	Richardson and Sneed Brothers	Beulah Studdard No. 1.
A-7	(See cross section A)		
C-5	Lincoln County, sec. 18, T. 10 S., R. 7 W.	Curtis Kinard	Payne Estate No. 1.
C-6	Drew County, sec. 2, T. 12 S., R. 5 W.	Davis-McCauley	Lucas No. 1.
		Cross section D	
D-1	Dallas County, sec. 12, T. 7 S., R. 17 W.	Lion Oil Co.	No. 10-PW-7.
A-2	(See cross section A)		
D-2	Dallas County, sec. 33, T. 8 S., R. 15 W.	J. F. Stone	Herbert & Walsh No. 1.

Table 39.—*Test holes and wells used in defining cross sections*—Continued

Control point	Location	Owner	Lease
		Cross section D—Continued	
D-3	Dallas County, sec. 5, T. 10 S., R. 14 W.	Lion Oil Co.	Core Hole No. F-15.
D-4	Calhoun County, sec. 25, T. 11 S., R. 13 W.	Garland Anthony	Brazil No. 1.
D-5	Bradley County, sec. 14, T. 14 S., R. 10 W.	Pan Am Southern Corp.	Mollie Turner No. 1.
D-6	Ashley County, sec. 34, T. 17 S., R. 9 W.	Placid Oil Co.	Crossett Lumber Co. No. 1.
		Cross section E	
E-1	Ouachita County, sec. 8, T. 18 S., R. 18 W.	Garland Anthony	Hirsch No. 1.
E-2	Ouachita County, sec. 15, T. 13 S., R. 17 W.	Garland Anthony	Berg No. 1.
E-3	Calhoun County, sec. 15, T. 14 S., R. 16 W.	J. T. O'Neal	Gaughn No. 1.
E-4	Calhoun County, sec. 35, T. 14 S., R. 15 W.	Placid Oil Co.	Gorth No. 1.
E-5	Calhoun County, sec. 17, T. 15 S., R. 14 W.	Mid-Century Petroleum Corp.	Freeman-Smith No. 1.
E-6	Calhoun County, sec. 3, T. 16 S., R. 14 W.	Ruth L. Markham	Calion Lumber Co. No. 1.
E-7	Calhoun County, sec. 14, T. 16 S., R. 13 W.	Placid Oil Co.	Freeman-Smith No. 5.
E-8	Bradley County, sec. 34, T. 16 S., R. 12 W.	Olin Oil and Gas Corp.	Ferguson No. A-1.
E-9	Bradley County, sec. 10, T. 17 S., R. 11 W.	William R. Wood, Jr.	Hunt No. 2.
E-10	Bradley County sec. 16, T. 17 S., R. 10 W.	Placid Oil Co.	C. H. Murphy No. 3.

Table 39.—*Test holes and wells used in defining cross sections*—Continued

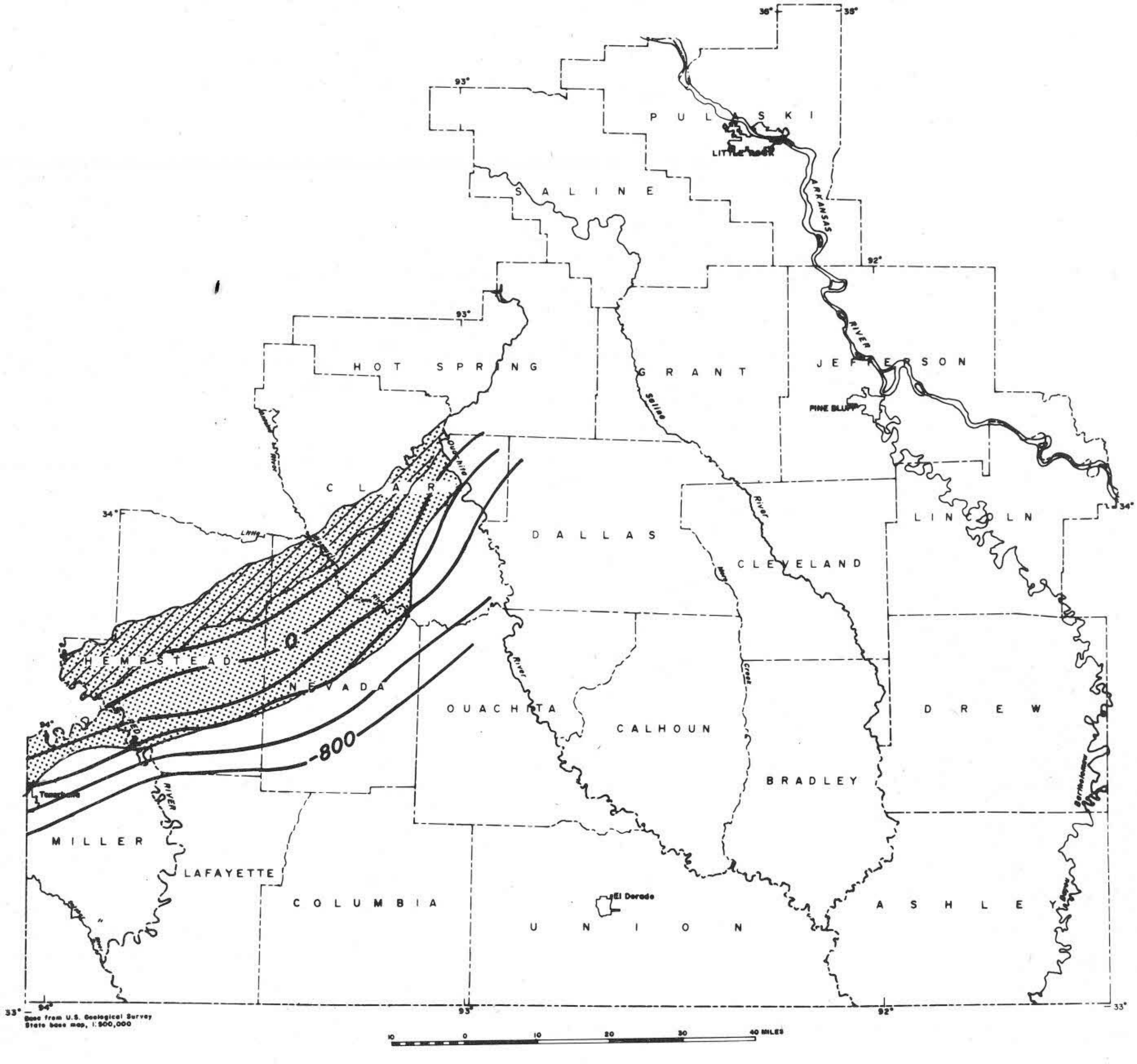
Control Point	Location	Owner	Lease
		Cross section E—Continued	
E-11	Ashley County, sec. 3, T. 18 S., R. 8 W.	Tidewater Oil Co.	Crossett Co. No. D-1.
B-8	(See cross section B)		
E-12	Ashley County sec. 24, T. 19 S., R. 7 W.	Union Production	Crossett Lumber Co. No. F-1.

A network of 600 observation wells has been established in the project area. Water-level measurements will be made in these wells biannually. Spring (1978) measurements have been made, and were used in defining the potentiometric surfaces for the Cockfield Formation, Sparta Sand, Cane River Formation, and the Carrizo Sand. Additional observation wells are being added, when possible, to the existing network.

Nacatoch Sand

The Nacatoch Sand is present in the subsurface throughout most of the project area (fig. 11). However, it contains freshwater in only a small area near its outcrop. This area includes parts of Miller, Hempstead, Nevada, and Clark Counties. The Nacatoch Sand consists mostly of sand and calcareous clay. In the subsurface, adjacent to its outcrop in southwest Arkansas (Boswell and others, 1965), the Nacatoch Sand is from about 150 ft to more than 500 ft thick and the percentage of sand is from less than 20 to as much as 80 (fig. 12). Most of the sandy material is in the upper part of the formation. The sandy upper part of the formation is an aquifer that furnishes as much as 300 gal/min to wells in or near the outcrop. The potentiometric surface (altitude to which water will rise in wells tapping a confined artesian aquifer) for the Nacatoch Sand is shown in figure 13. The general movement of water in the formation is southeastward.

The quality of water from the Nacatoch Sand is generally poor in the project area. Throughout most of the south-Arkansas lignite area, the Nacatoch Sand does not contain freshwater (Cushing, 1966). Only in parts of Miller, Hempstead, Nevada, and Clark Counties does the Nacatoch Sand contain water having less than 1,000 mg/L of dissolved solids. The average specific conductance, as determined from 72 analyses (table 40), is about 1,900 (cm^{-1} at 25°C) μmho with values ranging from 190 to 19,900 μmho. The pH values range from 7.4 to 9.0



EXPLANATION

Area of outcrop

Area of use

——-800—— STRUCTURE CONTOUR--Shows altitude of top of Nacatoch Sand. Contour interval 200 feet. National Geodetic Vertical Datum of 1929

Figure 11.—Structural contours of the top and areas of use of the Nacatoch Sand (modified from Boswell and others, 1965).

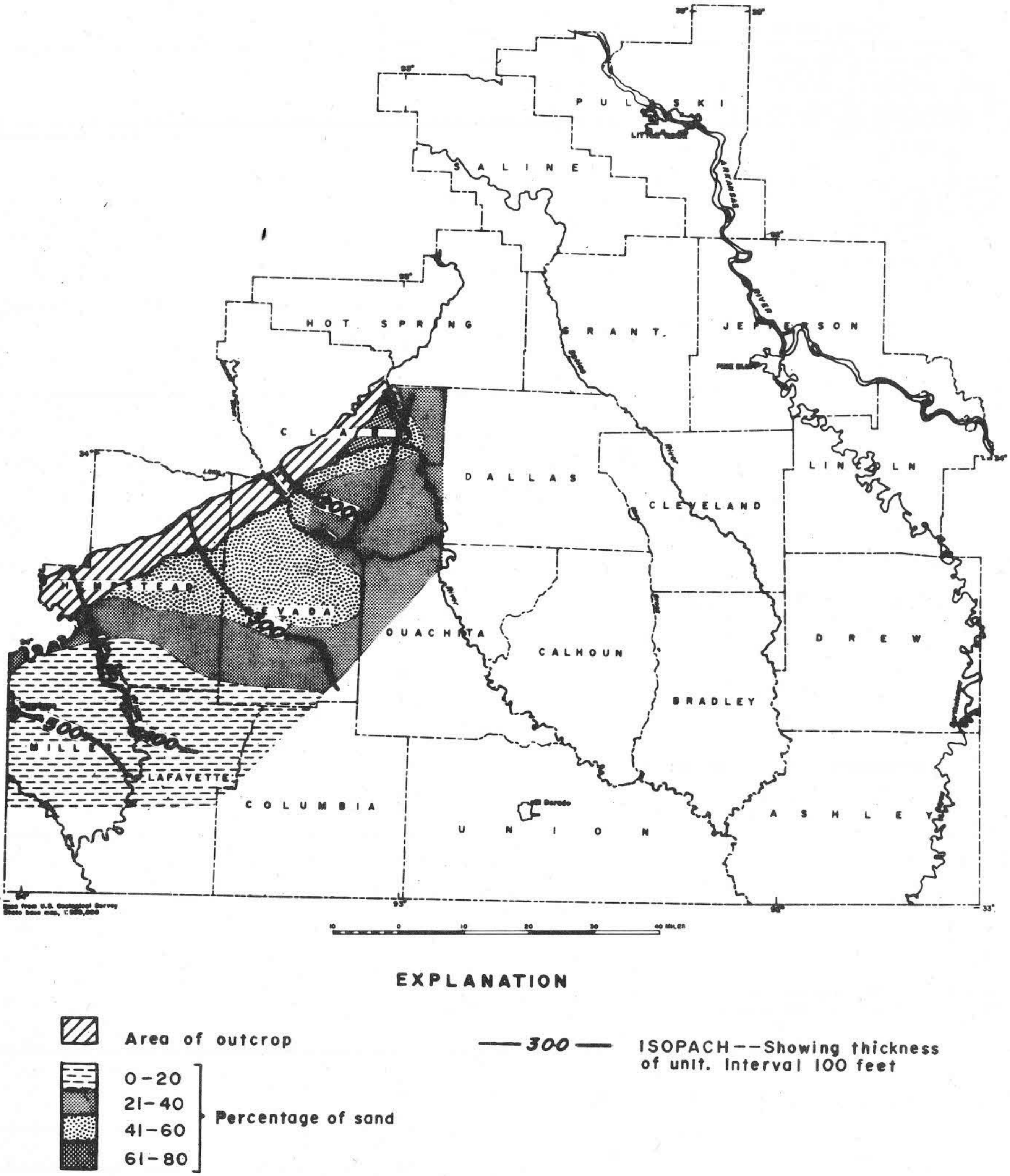


Figure 12.—Thickness and percentage of sand of the Nacatoch Sand (modified from Boswell and others, 1965).

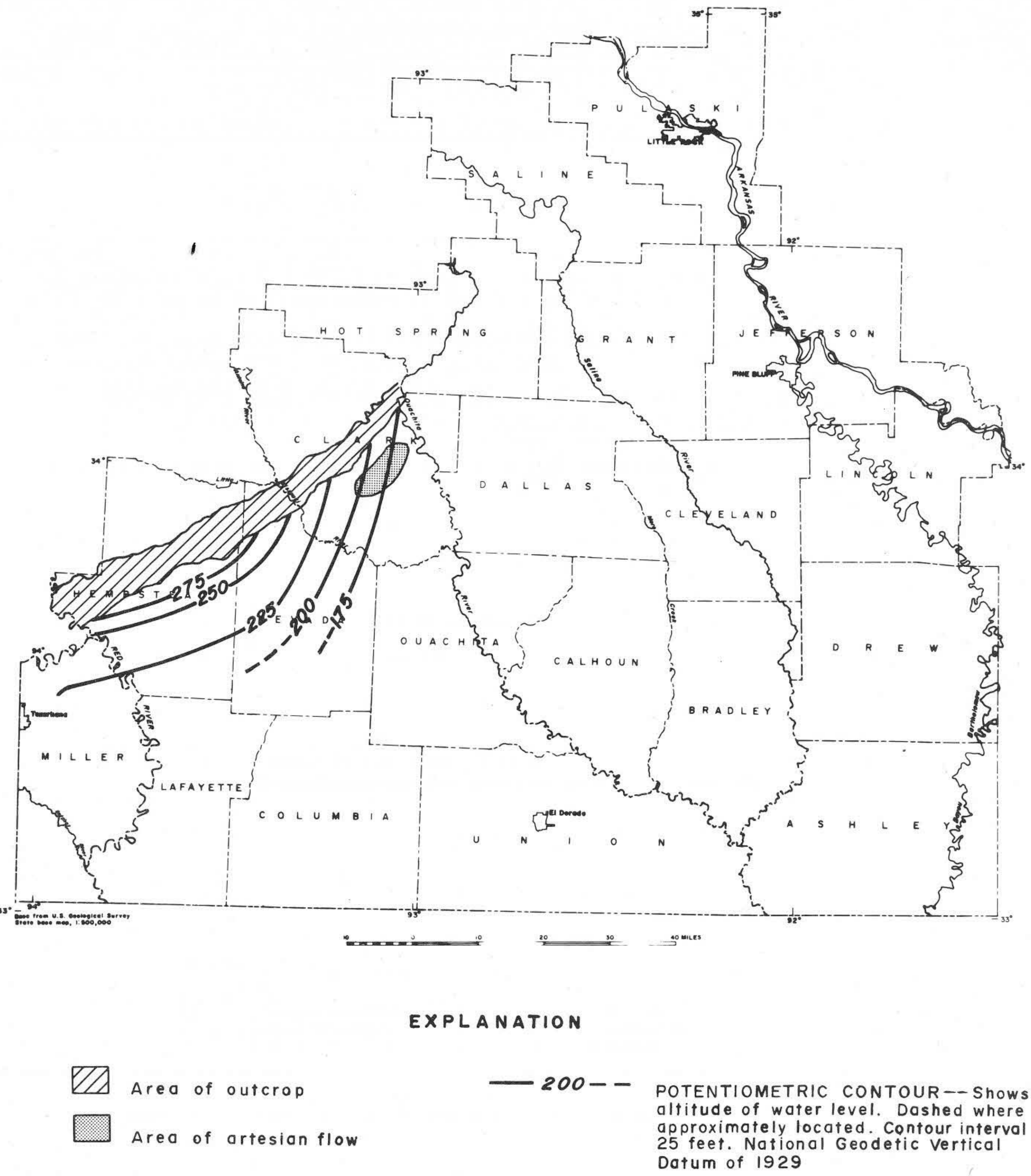


Figure 13.—Potentiometric surface of the Nacatoch Sand (modified from Boswell, 1965).

Table 40.—*Chemical analyses of samples taken from wells tapping the Nacatoch Sand*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Clark County																					
08S19W08BAB1	05-23-63	17.7	--	440	8.0	234	0	154	0	50	7.1	34	----	5.5	10	24	---	47	------	294	0.20
08S19W09ACC1	12-06-62	18.8	3	19,900	7.4	65	0	2,690	2,690	754	196	3,680	----	80	7,560	2.0	---	7.8	------	12,300	--
08S19W18BBD1	01-15-63	18.3	18	190	7.6	86	0	57	0	18	2.9	13	----	3.4	7.0	13	---	63	------	169	.20
09S20W03DCC1	05-23-63	18.8	1	1,740	8.4	343	24	24	0	2.0	4.5	367	----	2.0	337	21	---	12	------	940	.70
09S20W10AAC1	09-14-50	19.4	--	2,260	8.6	392	30	33	0	-----	-----	-----	----	----	535	3.0	---	----	------	------	2.7
09S20W21DCC1	10-11-50	19.4	--	590	8.9	295	21	13	0	-----	-----	-----	----	----	24	24	---	----	------	------	1.9
09S20W22ADB1	09-15-50	19.4	--	1,500	8.5	406	16	34	0	-----	-----	-----	----	----	275	14	---	----	------	------	1.5
09S20W27BCC1	09-15-50	20.0	--	1,660	8.6	428	25	17	0	-----	-----	-----	----	----	310	1.0	---	----	------	------	1.2
09S20W32DCC1	09-15-50	21.6	--	848	8.7	374	32	6	0	-----	-----	-----	----	----	55	40	---	----	------	------	1.1
09S20W33BCD1	07-26-46	----	--	1,820	8.9	350	30	11	0	-----	-----	-----	----	----	158	49	---	----	------	------	.00
09S20W33DDB1	09-14-50	20.5	--	1,820	8.8	372	35	18	0	-----	-----	-----	----	----	402	3.0	---	----	------	------	1.1
09S20W34ABC1	10-11-50	18.3	--	2,310	8.7	380	26	47	0	-----	-----	-----	----	----	562	1.0	---	----	------	------	2.6
09S20W34DAB1	10-11-50	20.5	--	2,040	8.7	348	22	33	0	-----	-----	-----	----	----	490	40	---	----	------	------	1.0
09S20W35CAA1	10-11-50	21.1	--	3,910	8.7	358	28	72	0	-----	-----	-----	----	----	1,080	6.0	---	----	------	------	4.2
10S20W04ACB1	09-14-50	21.6	--	1,950	8.6	367	21	19	0	-----	-----	-----	----	----	445	1.0	---	----	------	------	.50
10S20W09AAA1	09-14-50	20.5	--	2,130	8.7	364	26	22	0	-----	-----	-----	----	----	505	1.0	---	----	------	------	3.4
10S20W22CDD1	09-14-50	19.4	--	3,800	8.2	374	0	42	0	-----	-----	-----	----	----	1,100	1.0	---	----	------	------	.60
10S20W35BCB1	09-13-50	21.1	--	3,200	8.5	408	10	30	0	-----	-----	-----	----	----	825	3.0	---	----	------	------	1.1
Hempstead County																					
12S24W04ADD1	03-30-51	----	--	586	8.4	261	6	262	38	-----	-----	-----	----	----	8.5	100	---	----	------	------	1.1
12S24W14BAC2	03-16-51	----	--	486	8.5	220	8	68	0	-----	-----	-----	----	----	22	48	---	----	------	------	.30
12S24W27CBC1	03-22-51	----	--	546	7.9	256	0	47	0	-----	-----	-----	----	----	30	46	---	----	------	------	1.4
12S24W28DCA1	03-22-51	----	--	563	8.2	54	0	50	6	-----	-----	-----	----	----	31	44	---	----	------	------	.20
12S24W33CBD1	03-22-51	----	--	607	8.6	239	10	55	0	-----	-----	-----	----	----	44	51	---	----	------	------	1.7
12S24W36AAA1	03-22-51	----	--	565	8.9	212	16	15	0	-----	-----	-----	----	----	36	49	---	----	------	------	1.7
13S24W02ADA1	03-22-51	----	--	634	8.6	234	11	10	0	-----	-----	-----	----	----	40	65	---	----	------	------	3.1
13S24W09BDA1	03-21-51	----	--	690	8.9	251	18	8	0	-----	-----	-----	----	----	46	48	---	----	------	------	.40
13S24W09BDC1	03-21-51	----	--	701	8.8	255	16	10	0	-----	-----	-----	----	----	47	42	---	----	------	------	2.0
13S24W12DCB1	03-22-51	----	--	326	8.2	196	0	91	0	-----	-----	-----	----	----	10	2.0	---	----	------	------	.20
13S25W05ABD1	03-20-51	----	--	476	8.6	222	13	15	0	-----	-----	-----	----	----	18	21	---	----	------	------	2.8
13S25W18AAB1	03-22-51	----	--	528	9.0	260	24	28	0	-----	-----	-----	----	----	16	15	---	----	------	------	2.1
13S25W25CCB1	03-21-51	----	--	1,240	8.7	297	12	10	0	-----	-----	-----	----	----	225	35	---	----	------	------	.70
14S25W07BBC1	03-19-51	----	--	1,220	8.8	288	21	9	0	-----	-----	-----	----	----	210	32	---	----	------	------	1.0
14S25W32BBC1	04-11-51	----	--	1,680	8.6	321	14	14	1	-----	-----	-----	----	----	340	40	---	----	------	------	2.7
Miller County																					
14S26W07CAA1	08-15-51	----	--	1,070	8.5	312	--	32	0	-----	-----	-----	----	----	158	46	---	----	------	------	1.3
14S27W01AAA1	08-15-51	----	--	747	8.7	326	--	40	0	-----	-----	-----	----	----	67	34	---	----	------	------	-----
14S27W01AAD1	08-15-51	----	--	711	8.7	303	--	13	0	-----	-----	-----	----	----	62	30	---	----	------	------	-----
14S27W01BBB1	08-09-51	----	--	785	8.7	342	--	27	0	-----	-----	-----	----	----	76	34	---	----	------	------	-----
	08-15-51	----	--	718	8.8	260	16	16	0	-----	-----	-----	----	----	76	40	---	----	------	------	-----
14S27W02AAA1	08-09-51	----	--	785	8.7	342	--	27	0	-----	-----	-----	----	----	76	34	---	----	------	------	-----
14S27W02AAB1	08-15-51	----	--	776	8.3	278	0	25	0	-----	-----	-----	----	----	85	45	---	----	------	------	3.6
	02-27-68	20.0	4	782	8.0	288	0	8	0	3.0	0.3	160	----	1.1	70	31	---	12	------	421	1.1
14S27W02ADD1	08-15-51	----	--	821	8.5	273	11	42	0	-----	-----	-----	----	----	108	40	---	----	------	------	2.0
14S27W07CBC1	08-09-51	22.0	--	1,740	8.6	224	--	28	0	-----	----	-------	----	---	452	1.0	---	----	------	-----	3.6
14S27W12AAB1	08-15-51	----	--	805	8.7	439	--	203	0	-----	----	-------	----	---	59	20	---	----	------	-----	2.0
14S28W07CCA1	08-08-51	----	--	1,140	8.8	347	--	8	0	-----	----	-------	----	---	205	4.0	---	----	------	-----	2.3
14S28W13CCC1	08-08-51	----	--	3,750	7.7	216	0	61	0	-----	----	-------	----	---	-----	2.0	---	----	------	-----	.60
14S28W14CBD1	08-09-51	----	--	4,490	8.4	156	0	78	0	-----	----	-------	----	---	1,410	3.0	---	----	------	-----	.30
14S28W16DAC1	08-09-51	21.0	--	1,680	8.8	398	30	13	0	-----	----	-------	----	---	355	3.0	---	----	------	-----	8.6

Table 40.—*Chemical analyses of samples taken from wells tapping the Nacatoch Sand*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Miller County—Continued																					
14S28W17BBC1	08-09-51	----	--	1,080	8.9	351	25	12	0	-----	----	-------	----	---	186	2.0	---	----	------	-----	2.1
14S28W17CBA1	08-09-51	----	--	1,040	8.8	460	--	12	0	-----	----	-------	----	---	128	1.0	---	----	------	-----	2.1
	02-27-68	17.0	4	1,050	7.9	455	0	5	0	1.6	0.2	240	----	0.8	125	.6	---	13	------	605	.20
14S28W18AAC1	08-08-51	----	--	1,190	8.8	338	25	12	0	-----	----	-------	----	---	218	3.0	---	----	------	-----	4.8
14S28W21AAA1	08-09-51	----	--	2,210	8.5	344	14	22	0	-----	----	-------	----	---	565	2.0	---	----	------	-----	1.9
14S28W22BDA1	08-08-51	----	--	5,320	7.7	218	0	100	0	-----	----	-------	----	---	1,670	2.0	---	----	------	-----	2.0
14S28W30ACA1	08-08-51	----	--	2,400	8.8	432	32	24	0	-----	----	-------	----	---	602	2.0	---	----	------	-----	1.9
14S28W32DCB1	07-26-51	23.0	--	4,900	8.6	273	14	70	0	-----	----	-------	----	---	1,480	2.0	---	----	------	-----	1.0
15S28W10AAB1	07-21-51	23.0	--	11,200	8.2	170	8	306	153	-----	----	-------	----	---	3,850	1.0	---	----	------	-----	1.7
15S28W18ACC1	07-26-51	22.0	--	3,650	8.5	469	13	46	0	-----	----	-------	----	---	955	2.0	---	----	------	-----	1.2
14S28W34CDC1	02-27-68	15.0	5	7,160	7.7	316	0	156	0	46	9.9	1,470	----	6.7	2,220	26	---	11	------	3,940	.10
Nevada County																					
11S21W14CCC1	06-17-53	23.0	--	1,210	8.6	294	13	10	0	-----	----	-------	----	---	222	28	---	----	------	-----	1.4
11S21W18BAA1	04-17-51	----	--	629	8.7	271	14	10	0	-----	----	-------	----	---	38	37	---	----	------	-----	1.9
12S21W27BAC1	10-05-64	18.0	5	1,840	8.1	300	0	11	0	2.1	1.5	377	----	2.7	393	36	---	14	------	976	.40
12S22W09CDA1	10-06-64	22.0	6	828	8.2	282	0	4	0	1.0	.4	180	----	1.1	95	30	---	13	------	460	.60
12S22W10BCB1	06-17-53	22.0	--	816	8.9	265	22	8	0	-----	----	-------	----	---	92	32	---	----	------	-----	.00
12S22W10CDD1	06-17-53	----	--	927	8.7	266	16	6	0	-----	----	-------	----	---	126	28	---	----	------	-----	.00
12S22W15BAB1	06-17-53	----	--	909	8.8	264	16	6	0	-----	----	-------	----	---	128	36	---	----	------	-----	1.6
12S22W23BDC1	10-06-64	22.0	8	1,080	8.2	292	0	4	0	.6	.7	231	----	1.4	167	26	---	14	------	585	.60
12S22W23BDC1	02-28-68	18.0	4	1,070	8.5	294	6	4	0	1.5	.2	243	49	1.1	175	25	---	13	------	611	1.0
12S23W03ACD1	08-30-50	21.0	--	532	8.0	214	--	18	0	-----	----	-------	----	---	43	34	---	----	------	-----	.30
	03-07-68	----	3	517	7.7	212	0	18	0	5.8	.7	108	----	1.8	40	26	---	17	------	304	.40
12S23W03CBD1	09-06-50	----	--	490	8.3	208	0	21	0	-----	----	-------	----	---	31	40	---	----	------	-----	1.6
13S22Wo7BDC1	10-07-64	21.0	3	994	8.0	284	16	4	0	.3	.3	217	----	1.5	124	37	---	15	------	554	1.2
	02-28-68	14.0	5	1,030	8.5	303	7	8	0	2.7	.3	231	----	1.1	141	37	---	14	------	585	1.1

and average 8.5. In Clark County, water from the Nacatoch Sand is hard in many places. For the 18 analyses shown in table 40, the maximum values of hardness, as calcium carbonate ($CaCO_3$), is 2,690 mg/L, with most values ranging between 18 and 154 mg/L. Water from the Nacatoch in Nevada County is soft, averaging 9.4 mg/L $CaCO_3$ for 14 samples. The average hardness is 46 mg/L $CaCO_3$ in 15 samples from Hempstead County and 53 mg/L in 26 samples from Miller County. Overlying the Nacatoch Sand is the Arkadelphia Marl, which is in turn overlain by the Midway Group. The Arkadelphia Marl consists of calcareous clay and limestone and ranges from 0 to 150 ft thick. The formation contains practically no sand beds and is not an aquifer in the project area.

Midway Group

The Midway Group in the project area consists of calcareous clay, sandy limestone, and calcareous sandstone and is from about 400 to 600 ft thick in the subsurface. A structural contour map of the top of the Midway is shown in figure 14. The amount of sand in the Midway ranges from 0 to about 20 percent. The calcareous sandstone and limestone at the base of the Midway Group make up the Clayton Formation, which is an aquifer in the northern part of the project area. In some places there is appreciable sand in the Clayton Formation. The Clayton Formation (Kincaid Formation in the Arkansas bauxite area) is generally about 35 ft thick and furnishes as much as 350 gal/min to wells near its outcrop in Hot Spring, Saline, and Pulaski Counties. The upper part of the Midway Group, the Porters Creek Clay (Wills Point Formation in the Bauxite area), is not an aquifer in the project area.

The only information available at the present time on the chemical quality of water from the Clayton Formation in the project area is from the analyses of

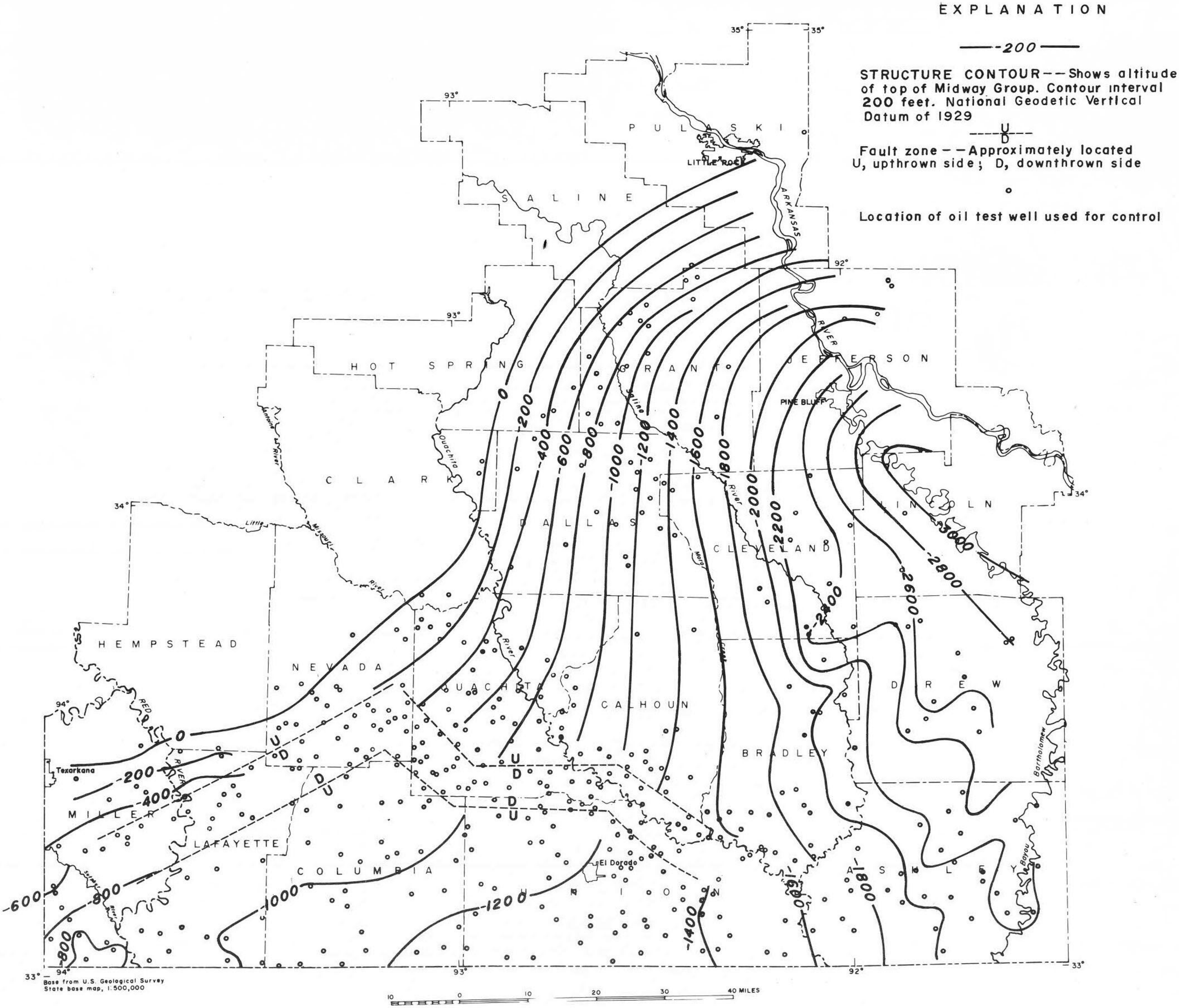


Figure 14.-Structural contours of the top of the Midway Group.

six samples (table 41) from Hot Spring and Saline Counties. With so few analyses concentrated in such a small area, very little can be said about the general quality of water in the formation. However, the available analyses do indicate a lower mineral concentration in the water from the Clayton Formation in Hot Spring County than in Saline County (table 41). Specific conductance averages 355 μmho in three samples from Saline County, and 149 μmho in three samples from Hot Spring County. The pH of the water from the two counties averages 7.2 and ranges from 5.5 to 8.1. The hardness of the water ranges from soft (12 mg/L $CaCO_3$) to hard (154 mg/L $CaCO_3$) in the two counties.

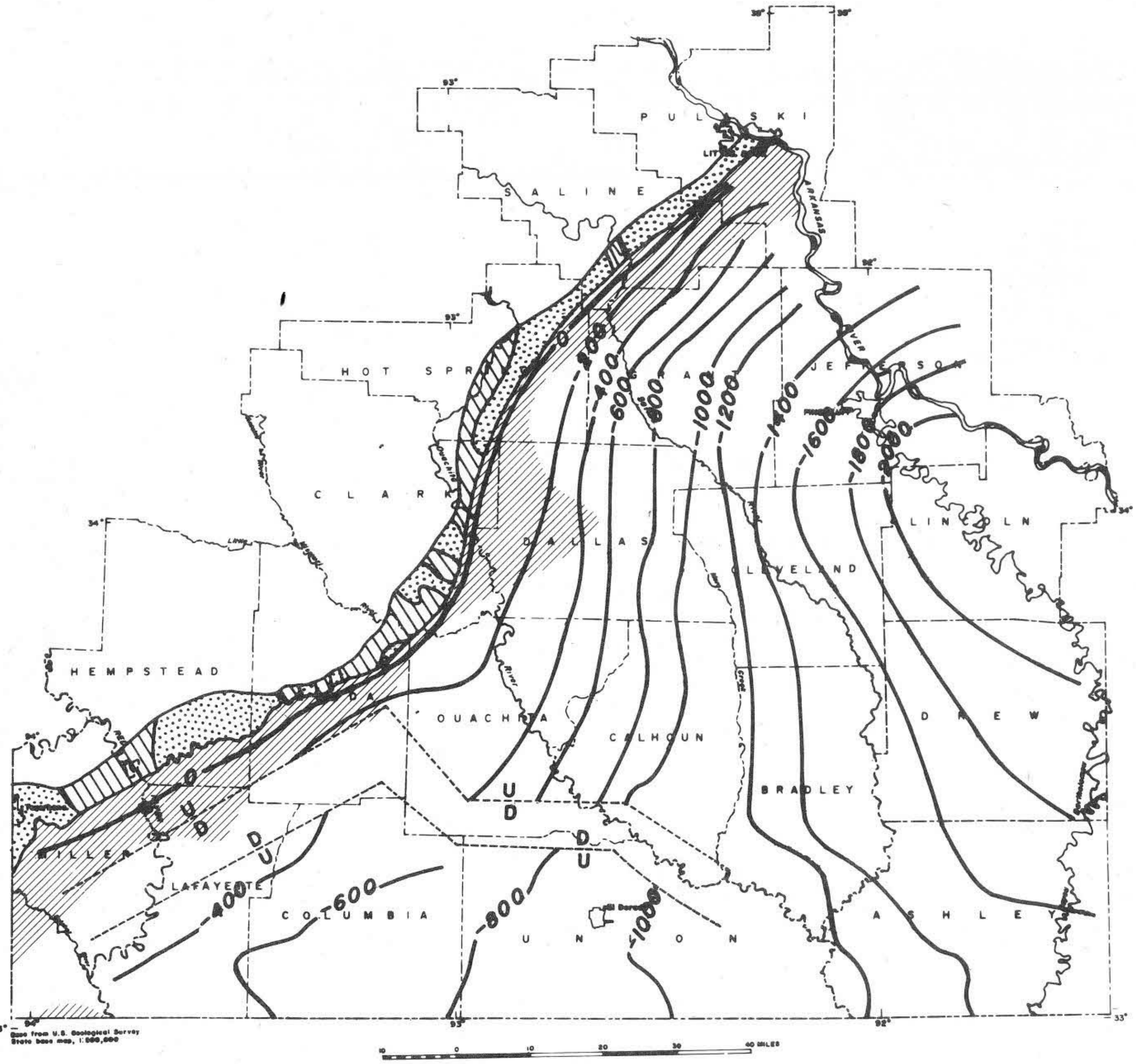
Wilcox Group, Undifferentiated

The lowermost unit of the Eocene section in Arkansas is the undifferentiated Wilcox Group. It consists of interbedded fine-grained sand, clay, silt, lignite, lignitic silt, and lignitic clay. It occurs either at the surface or in the subsurface throughout most of the project area. The exceptions are inliers of older rock (Midway Group and igneous rocks of Cretaceous age) in the northern part of the area. The outcrop area, the structural contours of the top of the formation, and areas of use are shown in figure 15. In the project area, the Wilcox Group ranges in thickness from 200 to 500 ft and in percentage of sand from 10 to 60 (fig. 16).

The Wilcox Group is identified on electric logs as the sequence of interbedded sand and clays above the distinctive clays of the Midway Group and below the more prominent sands of the Carrizo formation. The sand beds in the Wilcox Group are aquifers of local importance in or near the outcrop. Typically, the water in the sands of the Wilcox Group becomes brackish or saline within a short distance downdip and is unfit for most uses.

Table 41.—*Chemical analyses of samples taken from wells tapping the Clayton Formation (Midway Group)*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Hot Spring County																					
04S17W10AAD1	12-07-65	16.5	6	276	7.3	166	0	136	0	48	3.8	3.5	0.1	0.4	1.9	6.2	0.2	22	2,200	170	0.20
05S18W03AAA1	05-11-64	18.0	3	86	5.5	7	0	12	6	2.1	1.6	10	1.3	.2	12	.0	.0	20	60	64	15
05S18W03ADA1	12-08-65	18.0	--	66	6.3	31	0	---	-	----	----	4.6	---	---	1.8	----	---	----	200	---	2.5
Saline County																					
01S13W22BAA1	04-17-63	19.0	2	318	8.1	188	0	154	0	40	13	7.4	0.3	3.1	7.4	8.6	0.2	12	300	184	0.10
01S14W34BDA1	04-12-63	18.0	3	396	7.6	254	0	150	0	40	12	34	1.2	8.8	7.0	11	.5	7.8	0	246	.00
01S14W34BDD1	05-22-63	18.0	1	352	8.5	---	6	101	0	19	13	35	1.5	9.0	12	7.6	.4	16	10	213	2.6



EXPLANATION

—— -200 ——

STRUCTURE CONTOUR--Shows altitude of top of Wilcox Group. Contour interval 200 feet. National Geodetic Vertical Datum of 1929

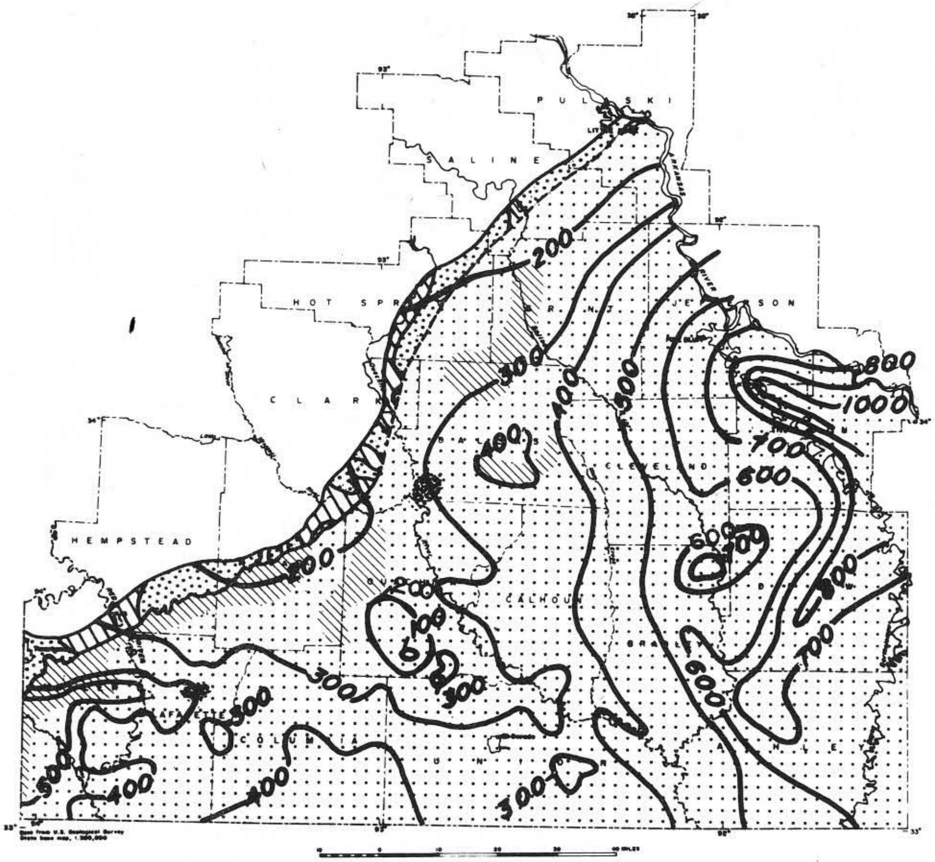
Outcrop area of Wilcox Group. Approximately located

Outcrop Area where Wilcox Group is covered by Quaternary deposits

Fault zone -- Approximately located U, upthrown side; D, downthrown side

Area of use

Figure 15.—Structural contours of the top and areas of use of the Wilcox Group, undifferentiated (modified from Hosman and others, 1968).



EXPLANATION

Area of outcrop. Approximately located

Area of outcrop covered by Quaternary deposits

—— 300 —— ISOPACH--Showing thickness of unit. Interval 100 feet

0 –20 } Percentage of sand
21–40
41–60

Figure 16.—Thickness and percentage of sand of the Wilcox Group undifferentiated (modified from Hosman and others, 1968).

The quantities of water available from the Wilcox Group varies. "About 200-300 gal/min is available from individual wells in southeastern Hot Spring and southwestern Grant counties" (Halberg and others, 1968). Throughout the rest of the project area, quantities of water adequate for household supplies or other small needs are generally available from the Wilcox. Water from the Wilcox Group varies in mineralization. Seven water samples taken from wells tapping the Wilcox in Miller County have specific conductances ranging from 152 to 2,170 μmho (table 42), with an average of 930 μmho. In Hot Spring County, the range in conductance for 16 samples is 16 to 661 μmho. The average pH for 30 analyses shown in table 42 is 7.3 and ranges from 5.0 to 8.9. Most of the pH values are between 6.2 and 8.4. Iron concentrations range from 0.0 to 9.7 mg/L and average 1.2 mg/L in Hot Spring County. For the analyses given in table 42, hardness, as calcium carbonate ($CaCO_3$), ranges from 2 to 143 mg/L and averages 35 mg/L.

Carrizo Sand

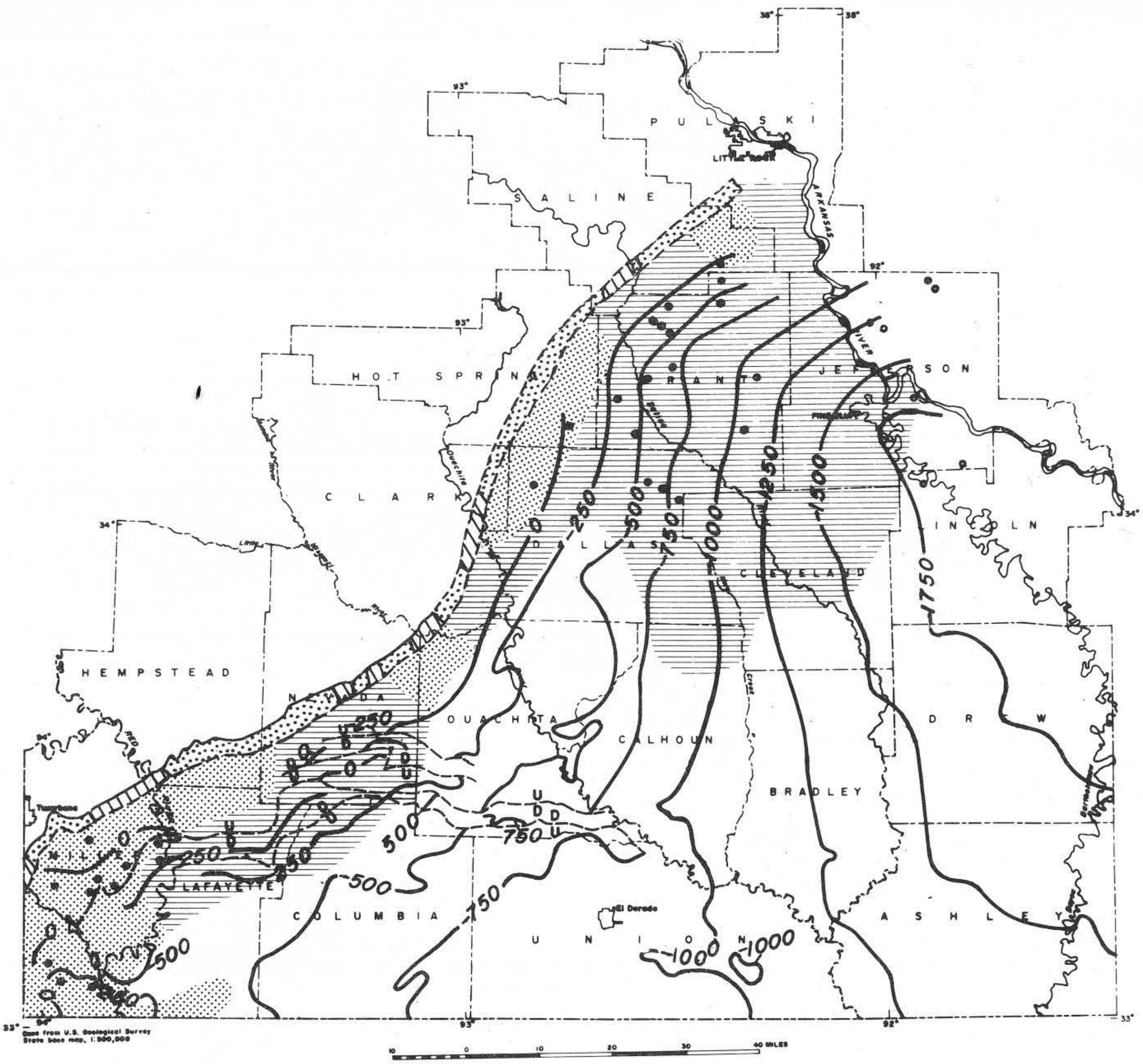
The Carrizo Sand, the basal formation of the Claiborne Group in Arkansas, crops out in central Miller, south Hempstead, and central Nevada Counties (Ludwig, 1972, p. 15), northwest Ouachita County (Albin, 1964 pl. 5), and possibly in southeast Clark County (Plebuch and Hines, 1969, p. A26). Its outcrop in west Dallas County (Plebuch and Hines, pl. 1) and east Hot Spring County (Halberg and others, 1968, pl. 1) has been inferred from updip projections of electric-log data. It is not known whether the Carrizo Sand crops out in Saline and Pulaski Counties, but it is present in the subsurface in north Grant County. The Carrizo Sand generally is present in the subsurface south and east of its outcrop. However, locally, it is missing, and the overlying Cane River Formation rests directly upon the Wilcox Group. Figure 17 shows

Table 42.—*Chemical analyses of samples taken from wells tapping the Wilcox Group, undifferentiated*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
										Clark County											
08S18W16AAA1	05-17-63	20.0	1	231	7.9	110	0	4	0	1.6	0.0	51	----	1.3	17	2.4	---	39	------	167	0.20
										Hempstead County											
12S23W33BDD1	03-22-51	----	---	90	7.4	33	0	26	0	-----	-----	-----	----	----	5.8	1.0	---	----	------	-----	3.7
										Hot Spring County											
03S16W21ACB1	07-01-63	18.5	0	53	7.0	24	0	18	0	4.4	1.6	2.3	0.2	1.6	3.8	1.6	0.1	30	140	58	0.20
03S16W21BDA1	07-05-63	18.0	3	293	7.8	190	0	107	0	29	8.3	27	1.1	3.5	9.8	.0	.1	5.6	140	177	.60
04S16W08ADC1	05-08-64	17.5	0	17	5.7	3	0	4	2	.4	.9	.5	.1	.6	2.5	.0	.0	7.3	20	17	3.0
04S16W17BDB1	06-25-63	23.0	4	16	6.5	5	0	5	1	1.4	.1	1.0	.2	.5	2.8	8.0	.0	7.9	10	17	.00
04S16W19BCD1	05-08-64	18.0	3	82	6.7	41	0	30	0	7.6	2.7	3.2	.3	3.0	3.0	3.6	.2	16	4,000	64	.00
04S17W24ACC1	05-15-65	19.5	2	98	5.1	3	0	23	20	4.8	2.7	6.0	.5	1.2	7.5	16	.2	11	50	62	11
04S17W24ACC2	05-15-64	19.5	3	40	6.5	3	0	11	8	2.9	1.0	2.2	.3	.8	4.5	4.4	1.0	12	440	36	6.3
04S17W25CCB1	04-26-63	18.0	1	32	7.6	4	0	7	4	1.5	.8	1.9	.3	.5	3.6	4.6	.0	8.2	810	25	.70
04S17W28AAC1	06-21-63	20.5	4	270	8.5	157	4	14	0	3.3	1.5	58	6.6	2.0	7.0	.0	.2	12	570	166	.10
05S17W03BAA1	04-11-63	16.5	1	32	7.3	8	0	9	2	1.8	1.1	2.0	.3	.3	2.4	.0	.1	9.9	90	27	5.5
05S17W04DBC	03-28-63	14.0	1	19	6.2	4	0	2	0	1.0	.0	.9	----	.2	1.8	.0	.1	9.4	130	18	0.2
05S17W17AAA1	05-08-64	17.5	2	21	5.0	2	0	2	1	.5	.4	1.5	.4	.1	3.0	1.0	.1	10	0	20	2.2
05S17W18DDC1	05-28-63	19.0	1	661	7.9	178	0	68	0	18	5.5	109	5.8	3.0	114	2.8	.4	12	150	352	.20
05S17W22DDD2	01-15-63	20.5	---	508	8.1	238	0	90	0	23	7.8	81	3.7	5.7	50	10	.4	12	480	307	.00
06S18W01DDD1	05-03-63	19.0	1	125	7.1	71	0	33	0	8.1	3.1	13	1.0	2.5	4.4	.4	.2	51	9,700	127	.10
06S18W35CCC	06-07-63	19.0	2	236	8.4	125	4	84	0	18	9.5	17	----	2.3	9.2	.8	.2	48	2,400	167	0.2
										Lafayette County											
15S25W35BCD1	03-07-68	18.0	4	225	7.5	124	0	36	0	11	1.9	35	----	2.1	3.0	6.8	---	9.9	------	131	.00
										Miller County											
15S26W23DCC1	10-23-68	21.0	5	835	8.3	336	8	10	0	3.0	0.5	184	----	1.3	81	0.4	---	11	------	456	1.6
15S26W23DCC2	10-23-68	23.0	2	791	8.3	312	4	38	0	11	2.6	167	----	3.2	105	1.2	---	10	------	459	1.1
15S28W10AAB2	07-26-51	----	---	274	6.6	8	0	32	25	-----	-----	-----	----	----	45	2.0	---	----	------	-----	86
15S28W32CAB1	07-25-51	----	---	152	7.4	95	0	39	0	-----	-----	-----	----	----	5.5	2.0	---	----	------	-----	.80
17S27W22DBB1	10-23-68	22.0	11	326	8.6	184	8	4	0	1.0	.2	76	----	.7	7.1	.8	---	10	------	195	.20
19S27W30CAC1	10-23-68	25.0	10	2,170	8.7	512	32	18	0	5.5	1.1	500	----	2.5	432	.4	---	14	------	1,240	.30
20S27W05ABB1	10-25-68	----	19	1,960	8.9	504	44	-----	-----	3.0	.7	455	----	2.0	345	.8	---	14	------	1,120	1.7
										Nevada County											
13S21W21CDA1	01-24-46	----	---	29	8.1	148	0	110	-----	30	8.6	18	----	5.0	4.8	26	---	11	------	-----	1.2
	03-01-68	----	4	301	8.0	148	0	143	22	35	8.7	14	----	5.8	5.0	29	---	15	------	186	.00

Table 42.—*Chemical analyses of samples taken from wells tapping the Wilcox Group, undifferentiated*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
										Ouachita County											
12S19W11DCD1	02-06-58	----	6	1,820	---	8	10	53	0	17	2.6	427	25	13	540	8.8	0.9	6.6	0	1,030	0.10
										Saline County											
02S12W18ABB1	06-06-63	17.0	3	26	5.4	5	0	6	2	1.2	0.8	1.0	0.2	0.6	2.0	0.0	0.0	9.7	120	21	3.4
01S13W23DDD1	06-10-67	----	2	72	5.9	22	0	24	6	7.3	1.5	3.3	.3	1.6	.7	15	.2	20	2,300	63	.10



EXPLANATION

—— 250 ——

STRUCTURE CONTOUR--Shows altitude of top of Carrizo Sand. Contour interval 250 feet. National Geodetic Vertical Datum of 1929

Outcrop area of Carrizo Sand. Dashed where approximately located

Outcrop area of Carrizo Sand covered by Quaternary deposits

Fault zone--Approximately located U, upthrown side; D, downthrown side

Location of oil test well used for control

Area of use

Area of potential use

Figure 17.—Structural contours of the top and areas of use of the Carrizo Sand.

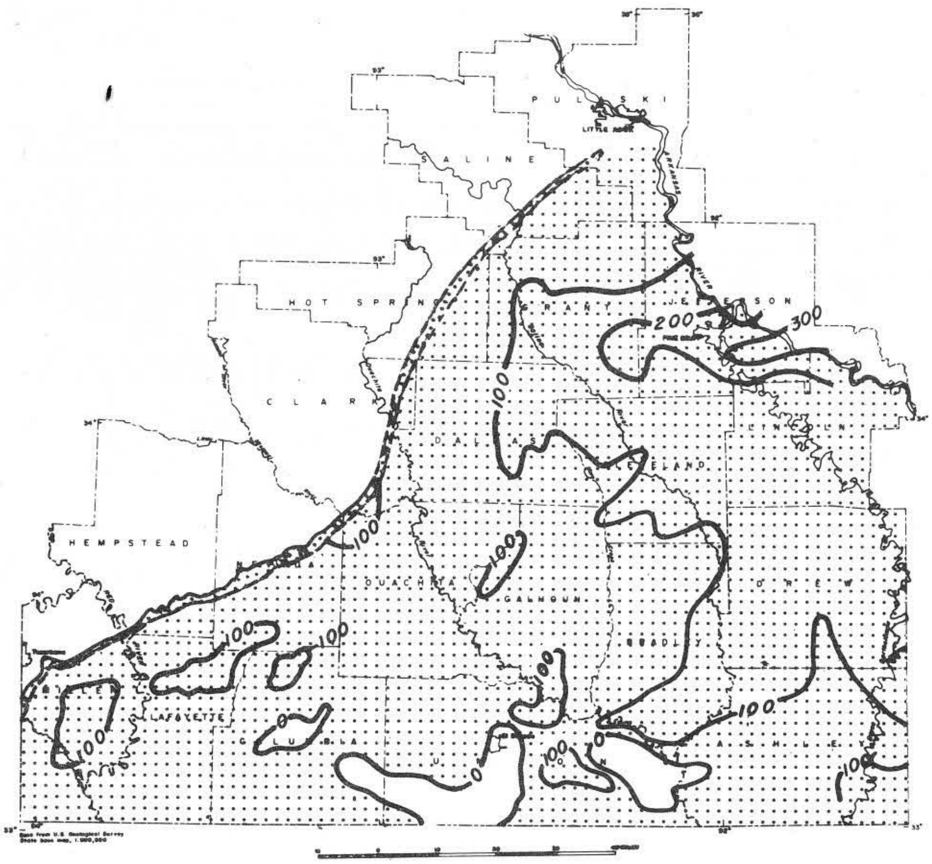
the outcrop area and structural contours of the top of the Carrizo Sand. In the lignite area, the Carrizo Sand is from a few feet to about 100 ft thick in or near its outcrop and generally increases downdip, to a maximum of about 300 ft in Jefferson County (fig. 18). Within the project area, more than 80 percent of the material composing the Carrizo Sand is sand (fig. 18).

Figure 19 shows the potentiometric surface for the Carrizo Sand. Movement of water is generally to the southeast. There is only a small amount of pumping from the Carrizo Sand and there are no significant cones of depression in the project area.

The amount of water used by wells tapping the Carrizo Sand in the lignite area is not large (table 2). Significant withdrawals from the Carrizo Sand in Miller, Hempstead, Nevada, Ouachita, and Hot Spring Counties add up to a total withdrawal of 0.33 Mgal/d. The Carrizo Sand is used as a source of water supply in other counties in the area, but the amount of water withdrawn is not significant.

Most wells tapping the Carrizo are used for domestic supplies. Very few municipal, industrial, or irrigation wells are completed in the Carrizo Sand. Yields range from 30 to 100 gal/min. In the southwestern part of the project area, low-yield flowing wells can be obtained.

Information on the quality of water from the Carrizo Sand is available at a few places in the area. This information is given in table 43. Typically, the water is a sodium bicarbonate type and has a low to moderate mineral concentration. Downdip, water in the Carrizo Sand is unusable for some purposes because of increased chloride concentrations. The specific conductance of water from the Carrizo Sand differs from place to place, ranging from 24 μmho in a sample from Hot Spring County, to 4,680 μmho in a sample from Ouachita County. Figure 20 shows lines of equal specific conductance for the Carrizo



EXPLANATION

Area of outcrop. Dashed where approximately located

Area of outcrop covered by Quaternary deposits

—200— ISOPACH--Showing thickness of unit. Interval 100 feet

81-100 Percentage of sand

Figure 18.—Thickness and percentage of sand of the Carrizo Sand (modified from Hosman and others, 1968).

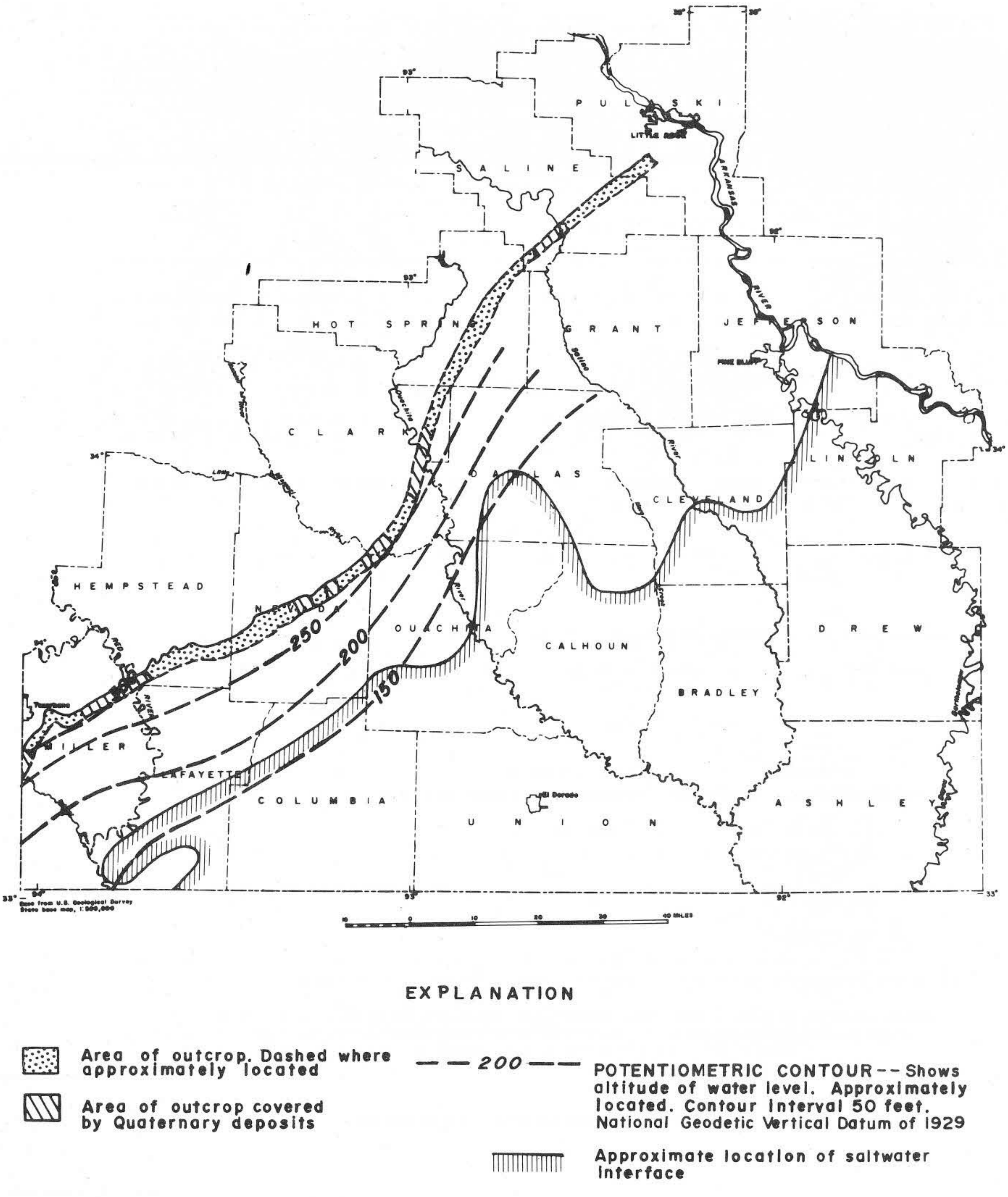
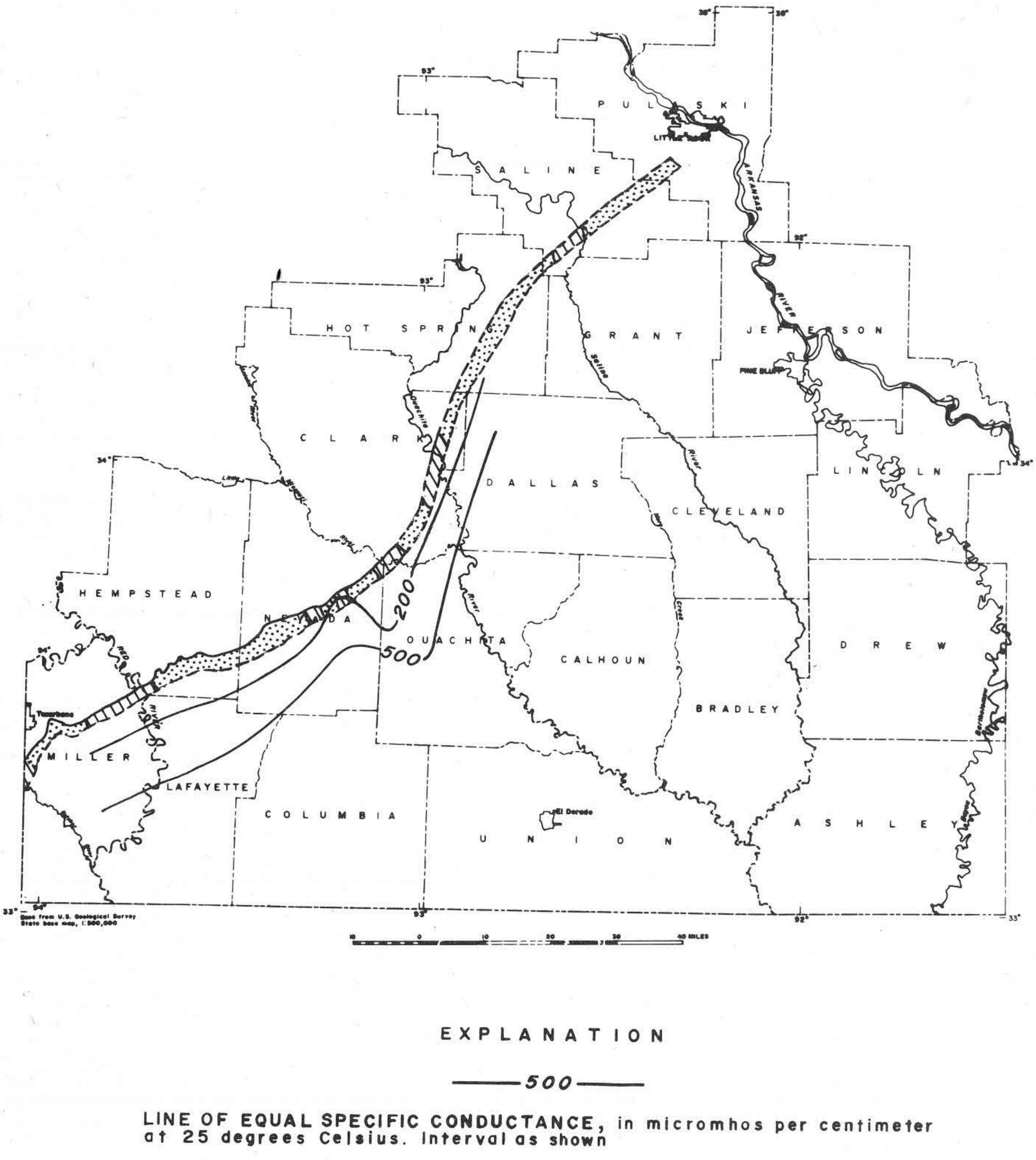


Figure 19.—Potentiometric surface of the Carrizo Sand.

Table 43.—*Chemical analyses of samples taken from wells tapping the Carrizo Sand*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Hot Spring County																					
06S17W34ABB1	06-20-63	19.0	2	24	8.2	82	0	18	0	4.8	1.4	44	4.5	2.8	33	5.8	0.2	12	1,000	146	0.20
Miller County																					
15S26W28CCC1	10-07-64	----	8	692	8.4	344	7	10	0	2.6	0.8	153	----	2.3	34	0.0	---	14	-----	383	.10
17S28W16DDA1	10-07-64	----	12	291	8.3	169	2	4	0	.9	.4	66	----	1.4	2.0	3.0	---	10	-----	169	.20
	02-29-68	----	15	290	7.6	176	0	4	0	1.1	.3	65	14	1.1	4.0	3.4	---	8.5	-----	171	.20
Nevada County																					
12S20W02CDD1	10-06-64	18.0	3	257	7.8	132	0	10	0	3.0	0.7	54	----	2.6	5.8	12	---	12	-----	156	0.00
Ouachita County																					
11S19W32CCC1	08-07-59	20.5	--	59	7.2	13	0	11	0	----	---	-----	----	---	5.0	5.0	---	----	-----	---	5.6
12S19W17ACC1	06-13-61	20.5	7	144	6.4	76	0	51	0	16	2.7	7.0	0.4	1.8	2.8	3.0	---	----	3	---	.50
12S19W26ACC1	04-08-59	18.5	4	-----	7.2	58	0	25	0	7.2	1.7	18	1.6	.6	8.8	90	---	----	0	---	4.7
15S16W13DAD1	04-09-59	18.5	14	4,680	8.4	518	10	79	0	20	7.0	1,050	51	11	1,350	6.0	---	----	0	---	.80



EXPLANATION

——500——

LINE OF EQUAL SPECIFIC CONDUCTANCE, in micromhos per centimeter at 25 degrees Celsius. Interval as shown

Area of outcrop of Carrizo Sand. Dashed where approximately located

Area where outcrop of Carrizo Sand is covered by Quaternary deposits

Figure 20.—Specific conductance for the Carrizo Sand.

Sand. Because of lack of available data, it was not possible to define contours in the central and eastern part of the project area. The specific conductance of water from the Carrizo Sand is generally less than 700 μmho. The pH of water in nine analyses, shown in table 43, ranges from 6.4 to 8.4 and averages 7.7. Water from the Carrizo Sand is generally soft (hardness, less than 60 mg/L), with the exception of one sample of water from the formation in Ouachita County that has a hardness of 79 mg/L ($CaCO_3$). Silica concentrations for five analyses, shown in table 43, averages 11.3 mg/L and ranges from 8.5 to 14 mg/L.

Cane River Formation

The Cane River Formation overlies the Carrizo Sand and is in turn overlain by the Sparta Sand. The Cane River occurs in the subsurface throughout most of the project area. The formation crops out in a zone along the northwestern boundary of the project area, from just south of Little Rock to near Texarkana (fig. 21). The Cane River Formation ranges in thickness from 150 ft, in Pulaski County, to 500 ft, in Jefferson County (fig. 22). The formation is generally from 21 to 60 percent sand. However, in west Grant, east Hot Spring, and central Miller Counties, the percentage of sand is 61 to 80. The percentage of sand decreases downdip (fig. 22). The potentiometric surface for the Cane River Formation is shown in figure 23.

Relatively few wells have been developed in the Cane River Formation. The formation is used mostly as a source of supply for wells in and near its updip limits. In this area, yields of as much as 920 gal/min are obtained (Ludwig, 1972). Total water use from the Cane River Formation in the lignite area was 3.48 Mgal/d in 1975 (table 2). The greatest water use was 2.47 Mgal/d in Lafayette County, with smaller amounts used in Miller, Nevada, Ouachita, Columbia, Dallas, and Hot Spring Counties.

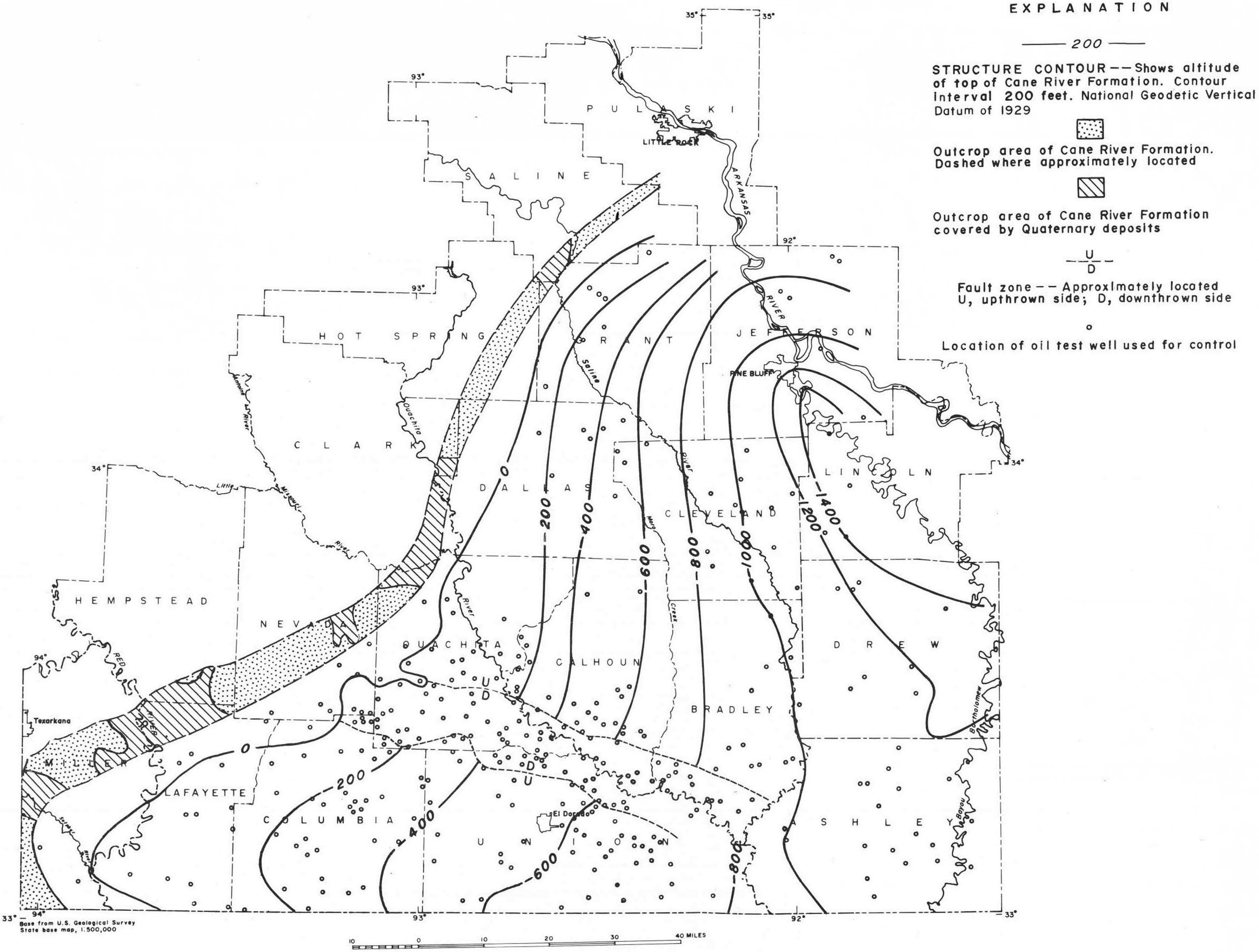


Figure 21.—Structural contours and areas of use of the Cane River Formation.

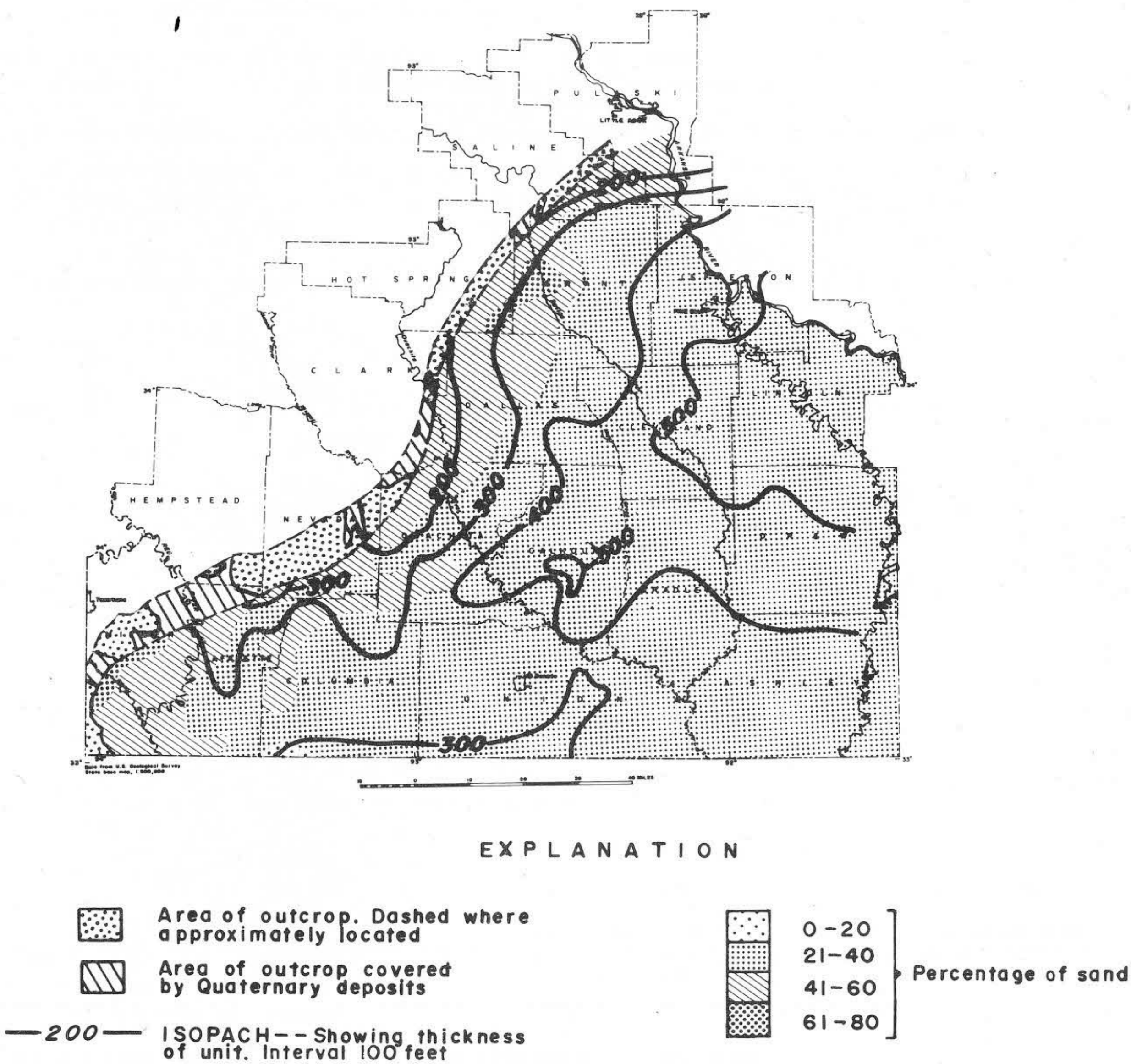
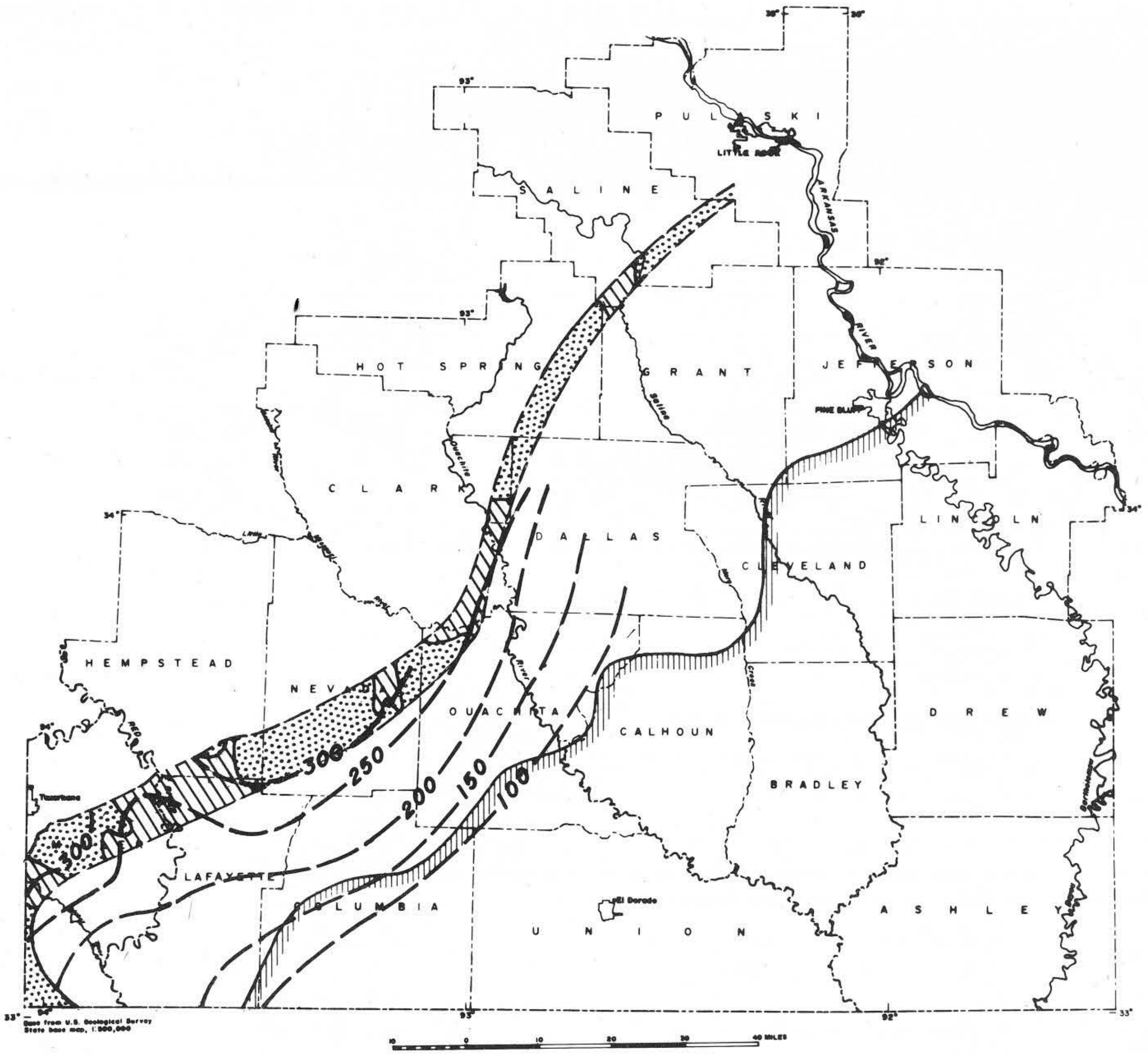


Figure 22.—Thickness and percentage of sand of the Cane River Formation (modified from Hosman and others, 1968).



EXPLANATION

Area of outcrop. Dashed where approximately located

Area of outcrop covered by Quaternary deposits

— — 150 — — POTENTIOMETRIC CONTOUR -- Shows altitude of water level. Approximately located. Contour interval 50 feet. National Geodetic Vertical Datum of 1929

Approximate location of saltwater interface

Figure 23.—Potentiometric surface of the Cane River Formation.

The specific conductance of water from wells tapping the Cane River Formation ranges from 22 μmho, for a sample from Hot Spring County, to 4,360 μmho, for a sample from Ouachita County. The average specific conductance for 39 analyses, shown in table 44, is 443 μmho. Lines of equal specific conductance for the Cane River Formation are shown in figure 24. A general trend can be detected, with conductance increasing downdip, as might be expected. Contours are not fully developed in the central and eastern parts of the project area because sufficient data are not available at this time. The average pH is 7.5 and the range in pH is 4.5 to 8.8, with most values between 6.4 and 8.6. The average hardness for the analyses shown in table 44 is 35 mg/L ($CaCO_3$), which indicates soft water. However, the hardness of water in samples collected in Ouachita County is as much as 236 mg/L $CaCO_3$. Bicarbonate averages 155 mg/L and ranges from 0 to 492 mg/L. Silica averages 12.6 mg/L and ranges from 8.5 to 25 mg/L. Chloride concentrations in water from the Cane River Formation are generally low except in the faulted zone in the south-central part of the project area. Within this zone, chloride concentrations can be so high that the water is unfit for some uses.

Sparta Sand

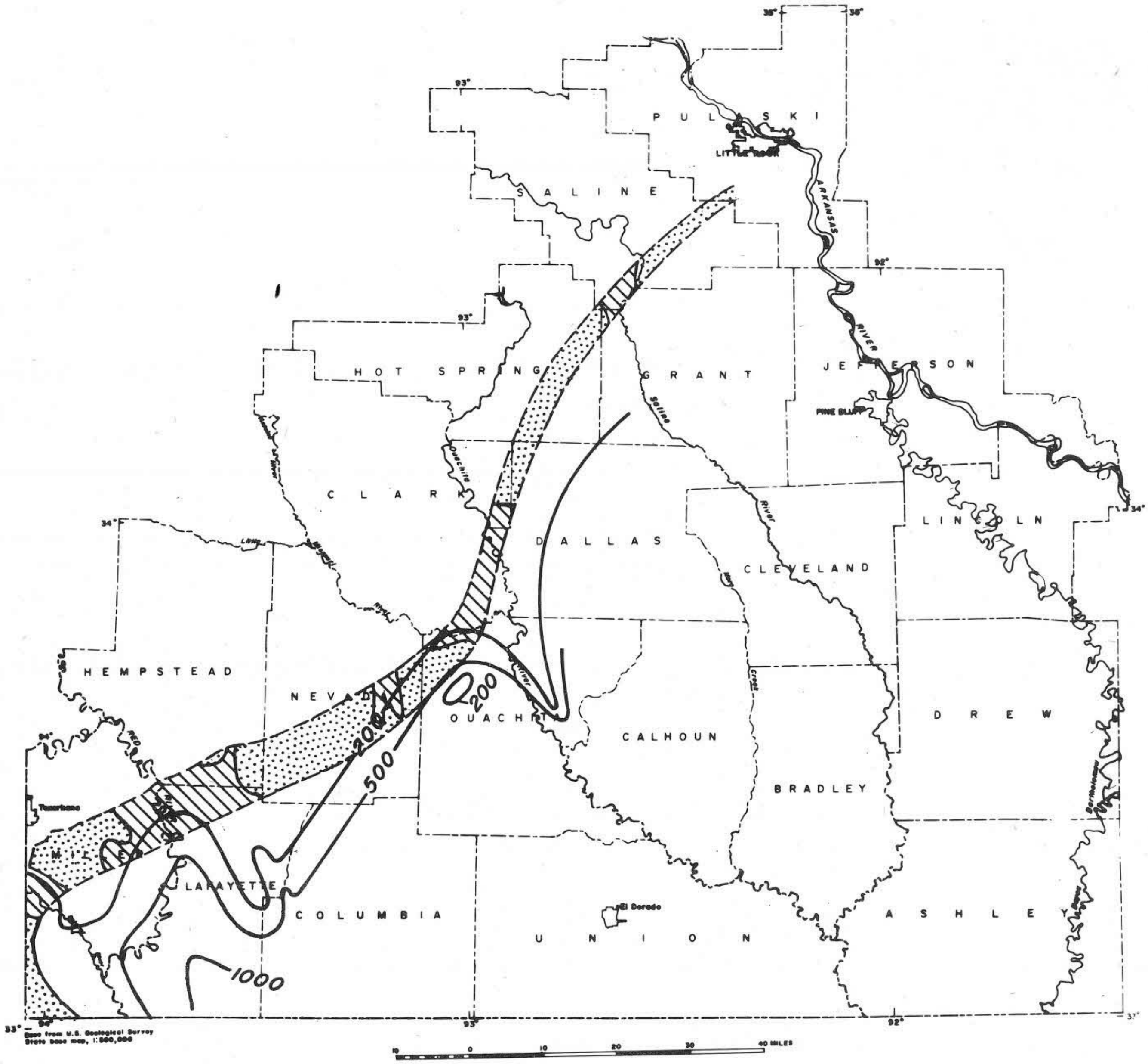
The Sparta Sand overlies the Cane River Formation and is overlain in turn by the Cook Mountain Formation. The Sparta is present throughout the entire project area. Areas of outcrop, structural contours of the top, and areas of use are shown in figure 25. The Sparta consists chiefly of beds of fine- to medium-grained sand in the lower part of the unit, and of beds of sand, clay, and lignite in the upper part. The formation is 300 to 900 ft thick and ranges from 21 to 100 percent sand in the project area (fig. 26). The thickness of the Sparta Sand increases and the percentage of sand generally decreases

Table 44.—*Chemical analyses of samples taken from wells tapping the Cane River Formation*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Columbia County																					
15S20W12CCC1	08-29-50	20.0	--	522	8.3	262	0	40	0	-----	-----	-----	----	----	40	1.0	---	---	------	-----	1.7
15S20W13BBB1	08-29-50	20.0	--	497	7.7	273	0	36	0	10	2.8	106	7.6	4.8	34	.7	0.1	11	100	304	.30
Dallas County																					
07S17W22AAB1	06-27-63	17.7	3	35	7.3	14	0	13	0	2.4	1.7	0.8	----	1.0	1.8	3.2	---	13	------	37	0.00
09S17W28DAB1	07-26-46	----	--	228	8.0	254	0	21	-----	6.4	1.2	313	----	17	364	.2	---	11	------	--	.50
Hempstead County																					
14S24W29BCB1	04-04-51	----	--	113	5.3	3	0	18	16	----	-----	-----	----	----	22	6.0	---	---	------	-----	9.0
	02-28-68	14.0	4	127	4.5	0	0	11	11	1.3	2.0	13	1.7	2.0	24	7.0	---	25	------	81	6.5
Hot Spring County																					
04S16W27AAC1	07-02-63	18.5	3	22	6.2	6	0	4	0	1.1	0.4	1.1	0.2	1.2	2.2	3.0	0.1	16	650	29	0.00
05S16W16CDB1	06-17-64	18.0	5	41	4.7	1	0	6	6	1.9	.5	1.2	.2	.8	2.5	8.4	1.0	16	860	33	.00
05S16W17CCB1	05-08-64	18.5	10	34	5.6	8	0	8	1	1.8	.8	1.7	.3	1.4	.1	2.2	---	23	1,000	4	1.6
Lafayette County																					
16S24W15BCB1	01-24-46	21.0	--	24	8.4	144	0	69	0	12	4.1	24	----	5.0	3.5	3.4	---	8.5	-----	-----	1.8
16S23W10DAC1	07-07-52	----	--	129	7.4	70	0	23	-----	----	---	-----	----	---	4.2	6	0	----	-----	92	.5
16S23W16BCB2	03-07-68	----	3	218	7.5	104	0	45	0	15	2.0	28	1.8	3.8	12	7.4	.3	13	390	132	.0
16S25W14DBB1	02-29-68	16.0	9	480	7.6	244	0	11	0	3.4	.6	106	----	1.9	34	1.6	---	11	-----	280	.70
16S25W35BDC1	10-06-64	----	6	682	7.8	275	0	20	0	5.9	1.5	135	----	3.1	63	.2	---	13	-----	358	1.0
17S23W21BCB1	06-19-50	21	--	134	7.1	64	0	44	0	11	4.0	11	----	1.6	9.5	3.5	.1	20	80	87	.2
19S25W13CDD1	10-06-64	22.2	7	1,190	8.8	428	34	20	0	5.7	1.6	264	----	3.4	137	.0	---	11	-----	668	.20
	02-29-68	20.0	9	1,150	8.3	492	4	22	0	7.1	1.1	269	25	2.7	142	.6	---	9.2	-----	679	.20
19S26W32ADC1	10-25-68	----	6	386	8.5	164	4	16	0	5.0	.9	68	7.3	1.3	6.3	17	.3	9.7	-----	195	1.6
20S26W04DBD1	10-25-68	----	9	399	8.6	204	8	20	0	6.0	1.2	86	8.4	1.4	7.8	21	.2	9.7	-----	244	1.9
Miller County																					
16S26W24ABA1	10-23-68	19.0	3	280	7.8	144	0	52	0	15	3.6	38	----	3.7	9.9	11	---	9.2	-----	162	1.0
16S27W30CCD1	07-25-51	18.0	--	76	7.1	25	0	14	0	----	---	-----	----	---	8.2	7.0	---	----	-----	------	5.0
16S27W36DBB1	10-24-68	----	2	284	8.4	120	4	51	0	15	3.3	26	----	4.3	7.1	1.6	---	11	-----	133	.10
18S26W03BBB1	10-06-64	20.0	6	246	7.9	145	0	4	0	1.2	.4	54	----	1.4	3.7	.2	---	11	-----	144	.60
18S26W27BBA1	03-08-68	18.0	25	658	7.6	370	0	7	0	2.3	.4	156	----	2.3	38	.6	---	11	-----	394	.40
19S27W32CDD1	10-23-68	21.0	3	325	7.9	196	0	29	0	8.0	2.2	65	----	2.4	8.7	.8	---	10	-----	196	2.0
19S28W10ADC1	10-07-64	----	1	274	7.4	98	0	48	0	12	4.5	35	----	5.5	5.6	37	---	15	-----	165	.80
20S28W14AAA1	02-29-68	15.0	1	278	8.0	104	0	53	0	15	3.8	36	2.1	5.2	8.0	37	---	14	-----	174	2.1
	10-23-68	21.0	7	379	8.6	212	8	11	0	3.0	.9	88	----	1.4	11	.8	---	9.6	-----	229	1.9

Table 44.—*Chemical analyses of samples taken from wells tapping the Cane River Formation*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Nevada County																					
14S21W11ADB1	10-08-64	19.0	2	221	7.4	132	0	21	0	-----	-----	41	----	2.0	1.5	3.4	---	10	------	131	0.00
	03-07-68	----	2	230	7.0	140	0	31	0	11	0.9	41	----	2.6	3.4	3.6	---	11	------	143	.50
14S22W08CBC1	10-07-64	18.0	1	44	6.0	4	0	11	8	1.8	1.0	2.0	----	1.0	3.0	.0	---	11	------	34	11
Ouachita County																					
11S19W24DDD1	08-07-59	18.0	---	219	7.9	122	0	112	12	-----	-----	-----	----	----	6.5	5.0	---	----	------	---	10
11S19W33AAC1	08-07-59	20.0	---	226	7.4	73	0	78	18	-----	-----	-----	----	----	16	5.0	---	----	------	---	27
12S16W33BCA1	01-16-59	20.5	5	4,360	8.2	256	0	236	26	65	18	871	25	16	1,360	31	---	----	40	---	1.9
12S19W14AAA2	08-21-58	----	60	916	8.2	196	0	45	0	13	3.0	187	12	6.3	205	1.6	---	----	1,000	---	1.8
	08-22-58	----	35	925	8.2	190	0	44	0	12	3.4	178	12	6.2	202	1.0	---	----	290	---	.80
12S19W14ABB1	08-21-58	----	5	83	7.4	44	0	35	0	4.9	5.6	3.4	.2	.6	4.0	1.6	---	----	100	---	.20
15S16W30DAD1	12-04-45	----	---	37	7.8	214	0	30	0	9.5	1.5	76	6.0	2.7	11	6.1	0.0	9.9	180	225	2.2
15S19W22DCC1	04-09-59	----	18	832	8.3	350	4	22	0	6.0	1.7	192	18	4.2	110	.2	---	----	40	---	.20



EXPLANATION

—— 200 ——

LINE OF EQUAL SPECIFIC CONDUCTANCE, in micromhos per centimeter at 25 degrees Celsius. Interval as shown

Area of outcrop of Cane River Formation. Dashed where approximately located

Area where outcrop of Cane River Formation is covered by Quaternary deposits

Figure 24.—Specific-conductance contours for the Cane River Formation.

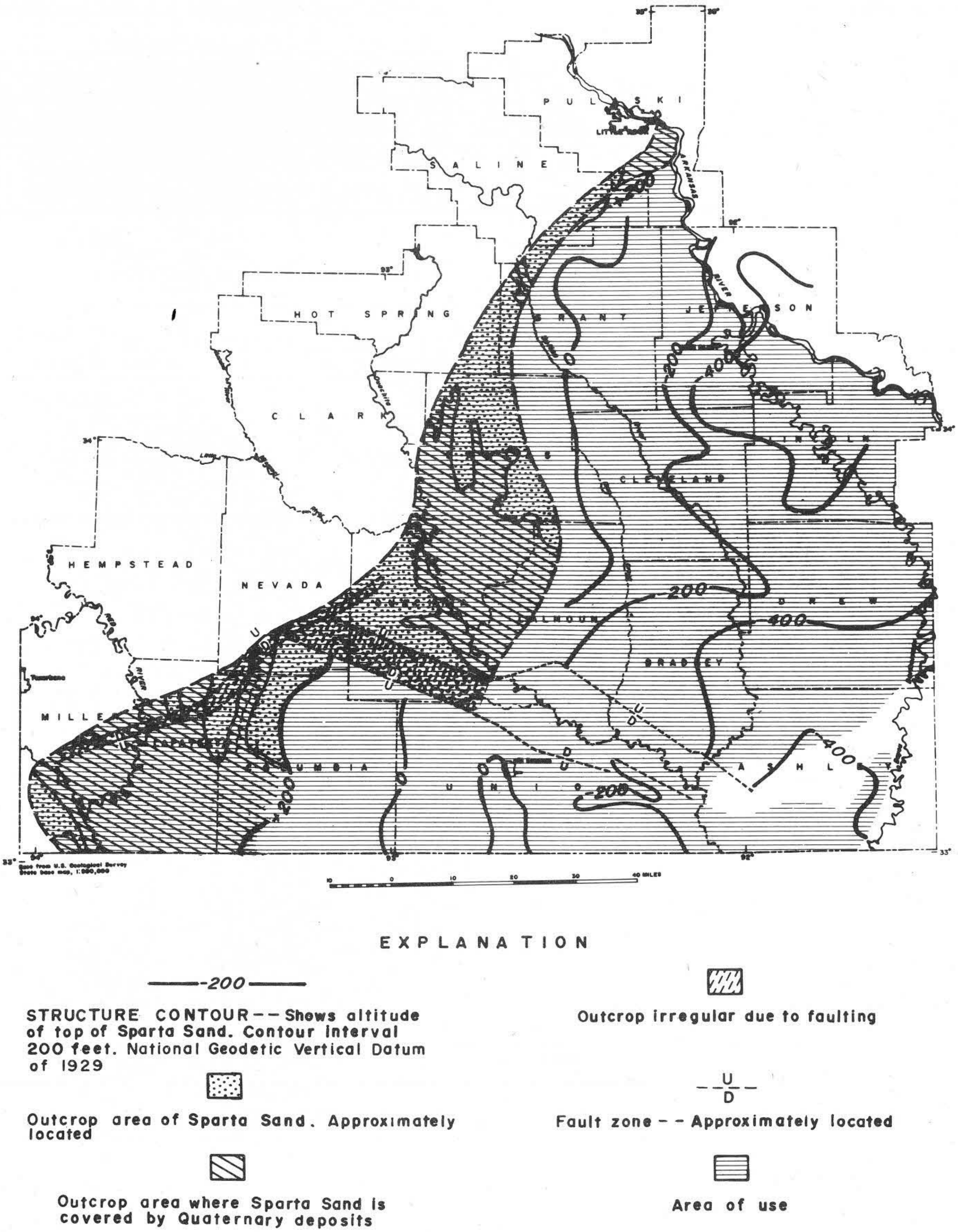
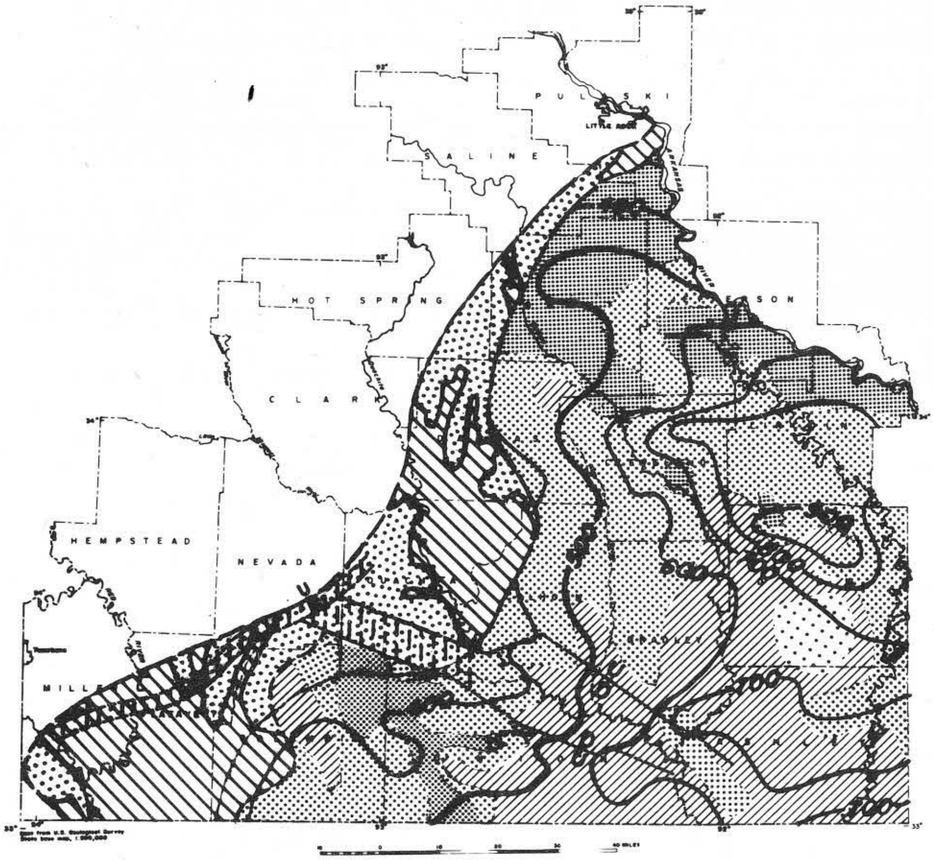


Figure 25.—Structural contours of the top and areas of use of the Sparta Sand.



EXPLANATION

[stippled pattern]	Area of outcrop. Dashed where approximately located	—900—	ISOPACH—Showing thickness of unit. Interval 100 feet
[diagonal hatch pattern]	Area of outcrop covered by Quaternary deposits		
[fault pattern]	Outcrop irregular due to faulting		
U / D	Fault zone—Approximately located U, upthrown side; D, downthrown side		

Percentage of sand:

- 21–40
- 41–60
- 61–80
- 81–100

Figure 26.—Thickness and percentage of sand of the Sparta Sand (modified from Hosman and others, 1968).

downdip. The formation dips toward the Mississippi River and southward toward the gulf. In the lignite area, the Sparta Sand is thinnest in southern Pulaski County and thickest in northern Drew County.

Figure 27 shows the potentiometric surface of the Sparta Sand. General movement of water is southeastward. Depressions exist around Magnolia, El Dorado, and Pine Bluff, where heavy pumping has significantly lowered water levels.

The Sparta Sand is the most productive aquifer in the lignite area. As shown in table 2, it is the source of significant withdrawals in 17 of the 20 counties in the lignite area. In 1975, total withdrawal from the Sparta Sand within the project area was 91.51 Mgal/d. The Sparta Sand is also a productive aquifer in eastern Arkansas, northern Louisiana, and in Mississippi. The Memphis aquifer, of which the Sparta Sand is the upper part, is a dependable source of water supply in northeast Arkansas and in Tennessee, Missouri, and Kentucky. About 350 Mgal/d was pumped from the Sparta Sand and the Memphis aquifer in 1965 in Arkansas, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee. The use of water from the Sparta Sand and the Memphis aquifer in Arkansas increased about 30 percent from 1965 to 1975 and probably increased about the same amount in the other States.

The largest use of water from the Sparta Sand (53.82 Mgal/d in 1975) is in Jefferson County. Water withdrawn from the formation is used for municipal supply for Pine Bluff and smaller cities and industrial supply for two papermills and other industries. The second largest use of water from the Sparta Sand is in Union County (17.4 Mgal/d in 1975). The water is used for public supply by El Dorado and smaller cities and by several refineries and other industries. Substantial amounts of water from the Sparta are used in Columbia (6.02 Mgal/d in 1975) and Ouachita (4.28 Mgal/d in 1975) Counties. In 1975, use in other counties ranged from 0.13 Mgal/d to as much as 2.97 Mgal/d per county. Where

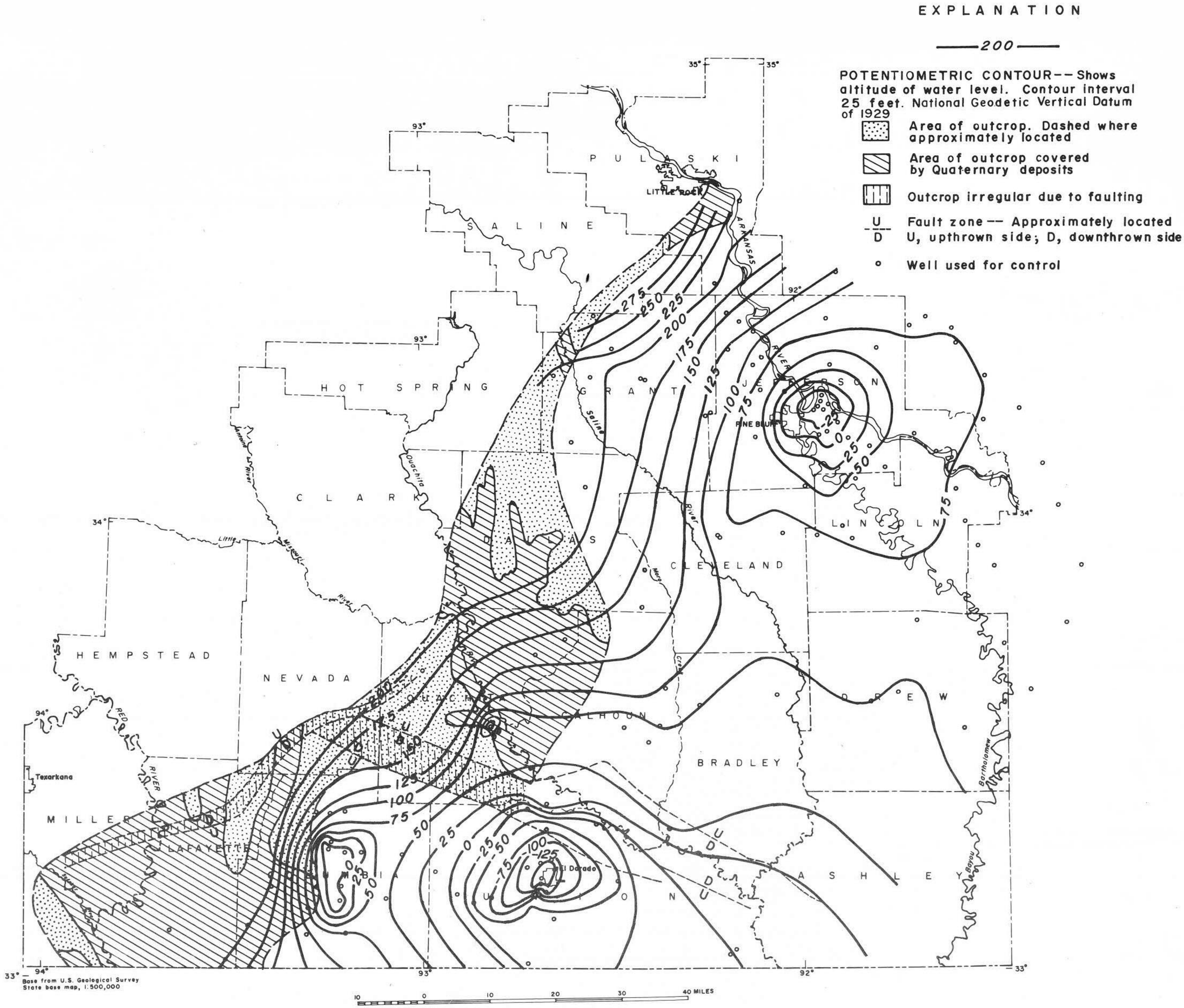


Figure 27.—Potentiometric surface of the Sparta Sand.

present, the Sparta Sand is used as a source of municipal supply by most towns and cities in the project area.

Water in the Sparta Sand is generally soft and is a sodium bicarbonate type. Within the project area, dissolved-solids concentrations range from 24 to 1,320 mg/L and have an average of about 93 mg/L (table 45). Although the range in dissolved solids is large, the average indicates that in most areas water in the Sparta is only moderately mineralized. Specific conductance of water from the Sparta Sand ranges from 20 µmho in a sample from Lafayette County, to 4,610 µmho in a sample from Ouachita County. Figure 28 shows lines of equal specific conductance for the Sparta Sand. Conductance increases downdip, as mineralization of the water increases. Also, locally, specific conductance may be higher than the general trend indicates. These highs are indicated by the closed lines on the map. The pH ranges from 4.0 to 8.8 and averages 7.4. Hardness of water from the Sparta Sand ranges from 1 to 238 mg/L and averages about 30 mg/L. Bicarbonate averages about 145 mg/L and ranges from 0 to 1,280 mg/L. Concentrations of silica range from 1.6 to 58 mg/L and average about 15.5 mg/L.

Cook Mountain Formation

The Cook Mountain Formation overlies the Sparta Sand and is overlain in turn by the Cockfield Formation. It is typically about 100 to 150 ft thick. The formation is composed of carbonaceous clay, lignite, and lenticular beds of sand ranging from a few inches to a few feet thick. These thin sand beds do not contain substantial amounts of water. However, the formation does furnish small amounts of water to shallow wells in its outcrop area in central Grant County east of the Saline River. The Cook Mountain Formation is of only minor importance as an aquifer in the project area.

Table 45.—*Chemical analyses of samples taken from wells tapping the Sparta Sand*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Bradley County																					
13S09W06ACA1	05-02-46	----	--	438	8.0	224	12	11	0	3.2	0.7	182	13	3.5	22	2.8	0.0	14	30	271	0.00
13S09W06ACA2	03-06-58	28	0	465	7.9	252	0	8	0	3.2	.0	112	----	1.8	26	6.2	.1	20	0	286	1.2
13S09W08DCB1	08-17-59	20.0	4	449	7.5	204	0	12	0	3.4	.7	76	9.8	2.7	6.2	5.8	----	----	80	196	1.5
13S11W17CCD2	04-10-59	----	6	457	8.4	236	2	4	0	1.0	.4	111	24	2.0	27	16	----	----	260	------	1.2
14S09W16AAC1	08-17-59	21.5	15	557	8.1	334	0	8	0	29	.2	132	20	2.6	20	.4	----	----	90	324	1.2
Calhoun County																					
11S14W12CCA1	03-06-58	----	2	213	6.3	85	0	61	0	18	3.9	21	1.2	3.0	17	12	1.2	53	------	170	0.00
12S12W33CBC1	08-13-59	----	4	532	7.8	256	0	11	0	3.6	.4	120	16	3.0	30	25	----	----	10	341	1.4
14S13W06AAB1	12-12-55	----	5	391	7.7	210	0	6	0	1.8	0.3	94	----	2.8	13	15	0.1	6.7	30	242	2.1
14S13W29DAC1	08-12-59	23.0	40	447	7.9	268	0	4	0	1.3	.2	105	23	1.6	12	1.4	----	----	0	293	1.3
Cleveland County																					
08S10W29ABD1	11-30-66	----	4	182	7.2	100	0	24	0	7.0	1.5	26	----	5.5	2.0	40	----	17	-----	115	0.00
Columbia County																					
16S20W16BDC2	08-29-50	21.5	--	344	7.9	210	0	19	0	5.3	1.3	79	8.0	5.6	5.5	12	0.1	11	150	225	1.8
16S20W17BBC1	10-13-50	20.0	--	264	7.6	162	0	48	0	15	2.6	43	2.7	3.2	3.8	9.1	.0	12	40	173	1.4
16S20W17BCB1	07-24-50	21.5	--	273	7.6	160	0	52	0	15	3.5	43	2.6	5.3	3.8	7.8	.0	12	60	172	1.4
16S20W18DBD1	06-29-51	20.5	7	334	7.9	196	0	17	0	5.2	.9	72	7.7	5.5	5.8	12	.1	11	170	212	1.7
16S21W18BDB1	01-17-46	----	--	92	8.6	533	9	8	0	2.7	.1	237	39	2.6	47	.5	1.0	10	40	578	3.2
16S21W16BDB2	01-17-46	----	--	21	8.0	117	0	59	0	21	1.7	21	1.2	5.0	4.5	8.2	.0	58	950	180	.20
17S19W18CDB1	08-02-50	----	--	785	8.1	454	0	16	0	4.5	1.3	196	21	6.6	40	1.4	.9	11	20	486	.90
17S19W30ABB1	08-02-50	22.0	--	358	8.4	222	0	7	0	2.2	.4	88	14	4.3	8.0	2.6	.3	12	20	228	.60
17S20W15ABB1	08-02-50	22.0	--	460	8.2	290	0	26	0	7.5	1.9	109	9.2	----	7.8	4.4	.5	11	40	287	2.4
17S20W22CDC1	08-02-50	22.0	--	348	8.0	219	0	6	0	1.8	.4	86	15	7.8	6.5	.7	.3	11	20	225	1.8
17S20W23BCD1	06-19-50	23.5	--	382	8.1	234	0	11	0	2.8	.9	92	12	3.5	11	1.5	20	12	40	243	1.1
17S21W01BBD1	08-01-50	21.5	--	343	8.2	192	0	13	0	3.8	.8	80	9.7	7.4	6.5	15	.0	9.7	20	221	2.7
17S21W01BCA1	08-08-50	21.0	--	342	8.1	197	0	19	0	6.8	.5	74	7.4	4.1	7.5	13	.1	12	20	218	1.9
17S21W11DCB1	01-17-46	20.5	--	33	8.5	192	0	29	0	8.8	1.6	69	5.6	4.5	5.0	18	.0	10	20	213	.20
17S21W11DDB2	02-25-53	21.0	20	382	7.8	224	0	14	0	4.6	.5	87	10	2.1	6.0	16	.1	12	140	240	1.8
17S21W11DDB3	02-25-53	21.0	20	382	7.8	224	0	14	0	4.6	.5	87	10	2.1	6.0	16	.1	12	140	240	1.8
	12-12-55	21.0	7	358	7.5	200	0	21	0	7.2	.8	75	7.1	2.9	5.5	20	.1	6.9	20	219	1.9
17S21W12AAA1	11-08-50	21.5	30	359	8.3	218	0	17	0	5.6	.8	96	10	1.9	6.0	8.9	.1	12	-----	240	.20
17S21W23DDD1	08-22-50	20.0	--	327	8.4	204	0	21	0	6.5	1.2	74	7.0	5.0	6.0	7.5	.1	12	10	216	2.2
17S21W24BAD1	08-29-50	22.0	--	419	8.4	228	6	11	0	----	---	---	----	----	8.0	17	----	----	-----	-----	2.0
17S21W25AAD1	06-01-55	---	25	411	7.7	240	0	14	0	4.4	.8	97	11	2.1	7.8	11	.1	6.6	150	249	1.0
18S19W17BDD1	06-19-50	21.5	--	352	8.1	180	0	14	0	3.6	1.1	78	9.2	3.4	11	18	.1	11	50	231	14
18S21W09AAA1	06-19-50	21.5	--	219	7.8	132	0	12	0	3.3	.8	49	6.3	1.5	4.5	2.7	.1	14	10	143	.70
18S21W19DAC1	10-13-50	20.0	--	295	8.3	194	0	10	0	2.6	.8	69	9.6	2.4	6.5	1.6	.2	11	20	190	1.0
19S20W08DAA1	08-23-50	21.0	--	426	7.0	156	0	118	0	----	---	---	----	----	48	8.0	----	----	-----	-----	.10
19S20W16BAC1	08-14-50	21.0	--	374	7.7	192	0	58	0	18	3.1	60	3.4	5.3	18	11	.0	15	210	229	2.6
19S23W11CAD1	10-13-50	20.0	--	640	7.5	350	0	238	0	56	24	60	1.7	3.8	33	25	.0	16	70	395	1.5
19S23W11CDA1	10-14-50	20.0	--	182	7.5	108	0	30	0	7.7	2.7	29	2.3	2.0	4.8	2.6	.0	19	1,300	125	.90
19S23W11DAB1	10-13-50	20.0	--	232	7.3	140	0	70	0	19	5.5	23	1.2	2.4	4.5	3.5	.1	15	30	146	1.2
Dallas County																					
10S13W34ACA2	02-23-46	----	--	30	7.7	169	0	101	--	30	6.3	25	---	4.6	8.2	9.2	---	39	-----	-----	1.0
07S14W31AAA1	06-17-64	21.1	20	128	6.0	48	0	36	0	11	2.2	7.3	---	4.5	6.5	11	---	20	-----	91	.00
07S14W31AAA1	07-01-64	21.5	0	133	6.8	51	0	38	0	11	2.6	----	---	---	6.5	11	0.2	----	3,800	-----	.00
07S15W29CDB1	12-05-66	----	2	39	6.9	6	0	6	1	1.2	.8	2.9	---	2.1	4.3	2.6	---	14	-----	34	3.5

Table 45.—*Chemical analyses of samples taken from wells tapping the Sparta Sand*—Continued

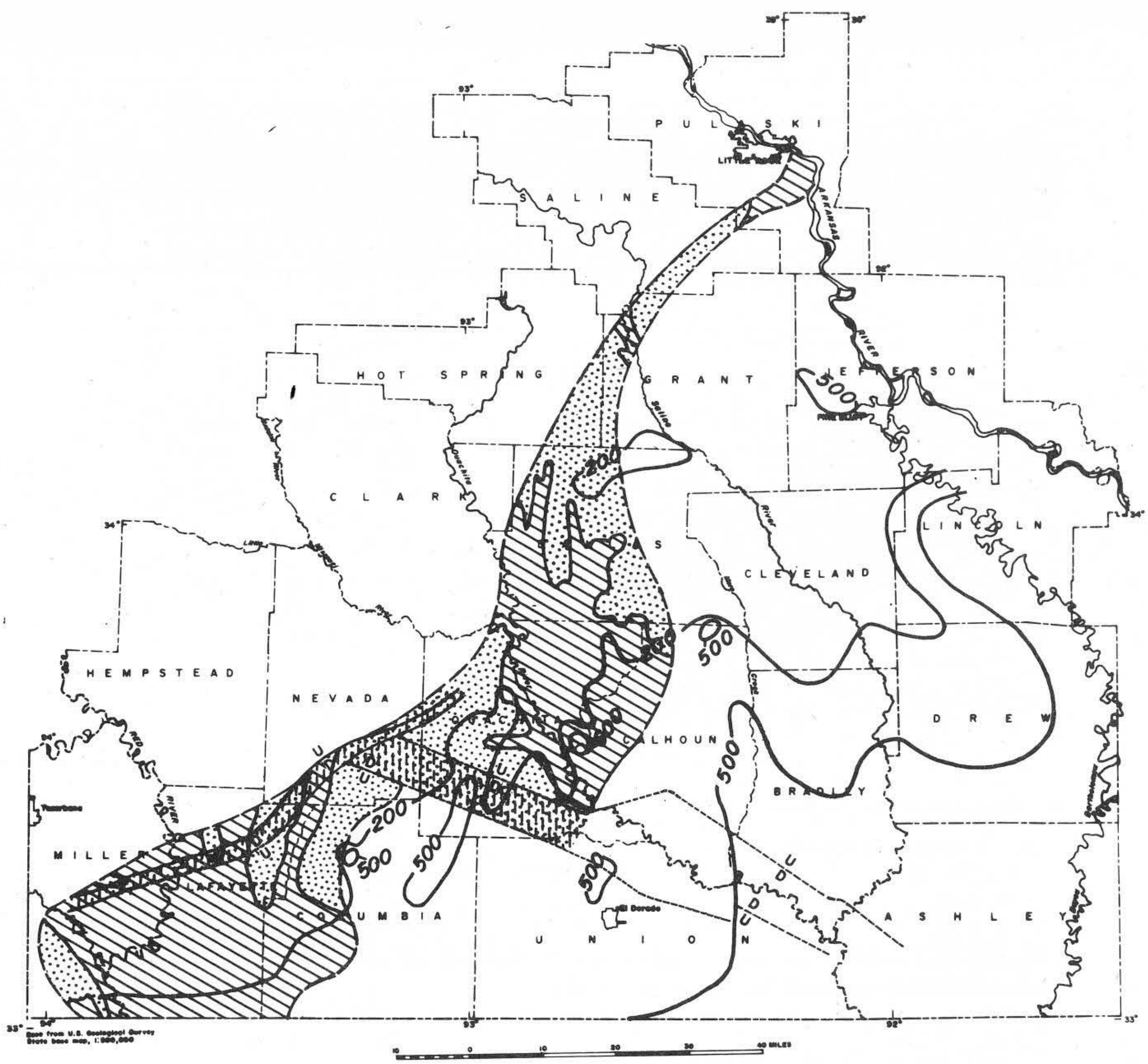
Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Dallas County—Continued																					
07S16W17CDC1	12-05-66	----	5	63	6.9	28	0	22	0	7.8	0.7	2.2	----	1.4	2.3	3.8	----	18	-----	71	.00
07S16W35ABB1	12-05-66	18.3	5	298	6.4	16	0	70	56	15	7.8	22	----	5.9	45	7.0	----	34	-----	197	52
08S15W34BDC1	12-05-66	----	1	54	6.7	18	0	10	0	2.2	1.2	5.1	----	2.0	4.6	2.2	----	15	-----	42	1.0
10S13W34ACA1	10-25-49	26.6	--	813	8.2	520	9	26	0	7.0	1.9	209	----	6.2	14	3.5	----	12	-----	-----	4.1
10S13W34ACA3	05-10-50	22.2	--	315	7.4	172	0	102	0	29	7.1	27	----	3.1	9.0	10	----	28	-----	-----	1.0
Drew County																					
11S06W11DBC1	07-28-53	26.0	20	265	8.0	170	0	1	0	0.4	0.0	68	30	1.5	4.8	0.9	0.1	13	100	174	0.70
11S07W07BBD1	10-21-53	23.0	--	194	7.9	120	0	15	0	4.4	1.0	----	----	----	.3	2.8	----	----	30	-----	.40
11S08W11DDD1	12-16-53	----	--	197	8.5	114	4	15	0	----	----	----	----	----	2.8	3.0	----	----	190	-----	1.2
11S08W14BBA1	12-16-53	----	--	230	8.4	122	4	--	--	----	----	----	----	----	3.5	5.0	----	----	40	-----	.90
12S06W32ADD1	09-10-54	----	10	270	8.3	160	0	1	0	.4	.1	67	25	1.0	4.5	.6	.3	6.6	100	164	.70
12S07W21DDC1	12-16-53	----	--	253	8.4	146	3	4	0	----	----	----	----	----	4.5	3.0	----	----	0	-----	1.3
12S07W26DAC2	02-10-54	26.0	6	255	8.3	140	1	4	0	1.4	.1	58	13	1.4	3.5	3.2	.3	12	0	161	2.0
12S07W26DCD1	02-12-54	27.0	8	231	7.6	142	0	3	0	.8	.2	55	14	1.1	2.8	1.0	.0	12	110	155	1.0
13S07W04ABA1	03-30-54	----	--	357	8.2	208	0	10	0	----	----	----	----	----	7.5	4.0	----	----	130	---	.20
13S07W10BCA1	02-10-54	23.0	15	293	7.7	172	0	3	0	1.0	.1	68	17	1.2	5.0	5.8	.0	12	30	188	1.2
13S07W11CBC1	02-10-54	22.0	--	262	8.3	150	3	5	0	----	----	----	----	----	5.5	3.0	----	----	1,100	---	6.0
13S07W21AAC1	10-03-54	25.0	35	328	8.6	178	8	4	0	1.4	.2	79	17	----	8.0	7.0	----	----	440	232	.40
15S07W08BAC	02-10-54	15.0	35	749	8.0	425	0	6	0	1.9	0.4	184	----	2.0	38	5.4	.6	11	------	464	2.5
Grant County																					
03S14W20DDA	06-27-63	----	1	39	7.2	20	0	12	0	3.8	.8	1.3	----	2.3	2.6	.0	.0	17	100	34	1.7
03S15W25BBB	06-27-63	17.0	1	108	4.9	3	0	20	17	3.8	2.5	4.1	----	8.2	11	8.6	.2	11	10	73	15
03S15W26DAA1	10-20-64	18.5	5	32	6.1	7	0	5	0	1.0	.6	2.8	.5	1.5	3.4	2.0	.1	36	100	52	1.5
04S12W17DCC2	07-21-64	----	5	433	8.4	193	4	64	0	20	3.5	70	3.8	5.4	6.5	42	.3	14	770	264	2.6
04S15W33BCA1	06-20-64	18.5	80	53	6.7	22	0	13	0	3.3	1.2	3.6	.4	2.3	4.0	.0	.2	24	4,200	54	.40
05S13W03CDA3	05-28-64	21.0	0	---	6.4	24	0	20	0	4.4	2.2	4.9	.5	2.7	----	6.4	.0	18	1,700	58	.00
05S13W09ABA1	03-12-65	20.0	2	76	6.3	32	0	19	0	5.2	1.5	5.5	.5	1.9	3.3	4.0	.0	17	7,600	62	.00
05S14W05CBB1	07-01-64	20.0	0	127	6.0	---	-	33	0	10	1.9	9.4	.7	3.8	6.2	13	.2	34	2,200	103	.00
05S14W06DBA1	05-14-64	19.5	6	96	6.4	42	0	24	0	6.7	1.8	8.2	.7	3.0	7.5	3.6	.1	56	7,400	115	.10
05S14W18DDB1	05-29-63	20.0	6	102	7.4	39	0	28	0	8.1	2.1	7.3	.6	3.6	6.2	8.0	.2	30	5,800	90	.00
06S15W25CCC1	06-18-64	20.0	--	181	6.6	70	0	38	0	8.0	4.5	5.1	.4	28	----	----	----	----	300	-----	-----
06S15W25CCC3	05-07-64	20.0	1	266	6.4	122	0	66	0	16	6.5	6.0	.3	38	7.5	11	.1	16	510	166	4.0
06S15W25CCC4	05-07-64	19.0	2	150	6.2	51	0	28	0	6.5	2.8	4.4	.4	23	6.5	11	.3	11	20	96	5.4
06S15W26AAA1	05-11-64	19.0	3	103	4.8	2	0	10	8	1.0	1.7	11	1.6	3.4	14	3.2	.2	11	30	64	17
06S15W26ACA1	10-19-64	18.0	3	81	7.1	21	0	28	11	9.5	1.1	1.5	.1	1.5	2.1	13	.2	16	210	56	.30
07S12W21BDB1	08-04-64	19.5	5	175	6.8	83	0	49	0	12	4.6	13	.8	5.2	6.0	7.8	.0	15	1,200	106	.30
Hot Spring County																					
06S16W07CAC1	08-18-64	18.5	0	169	5.5	3	0	44	42	8.8	5.4	12	0.8	2.3	17	2.2	0.2	18	550	119	51
06S16W07DAD1	06-27-63	18.5	3	83	7.2	40	0	32	0	8.8	2.3	1.7	.1	4.4	2.4	5.2	.3	12	10,000	67	.00
06S16W36CBC	06-27-63	19.0	2	34	6.1	15	0	12	0	4.2	.3	1.4	----	.8	2.8	0	.0	14	1,500	34	1.2
Jefferson County																					
05S09W33CDB1	12-07-48	25.0	5	126	7.3	70	0	19	0	4.9	1.6	20	2.0	4.1	4.0	3.8	20	15	90	88	0.00
05S10W02CDD1	12-06-48	----	0	106	7.6	55	0	25	0	6.9	1.9	12	1.0	2.4	4.0	2.9	.1	13	50	70	.00
05S10W03BBC1	12-06-48	23.0	5	138	7.5	63	0	35	0	9.8	2.5	13	----	3.2	4.0	10	.1	17	80	92	.00
05S10W03CDB1	12-06-48	----	7	104	7.7	48	0	27	0	7.2	2.2	10	----	2.6	4.5	6.8	.1	14	150	70	.00
05S10W04BBD1	12-06-48	23.0	5	87	7.7	41	0	21	0	5.8	1.7	9.9	----	3.5	4.2	7.4	.1	14	100	67	.00
05S10W11ABD1	12-06-48	26.0	5	111	7.2	58	0	29	0	7.8	2.3	14	----	3.2	5.5	6.9	.2	13	60	71	.00

Table 45.—*Chemical analyses of samples taken from wells tapping the Sparta Sand*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Jefferson County—Continued																					
05S10W11ADD1	12-06-48	26.0	0	125	7.6	64	0	23	0	6.2	1.9	16	1.4	3.8	3.8	4.6	1.0	12	60	80	0.00
	07-21-50	25.5	--	-----	---	-----	-	--	--	----	----	---	----	----	--------	----	----	----	40	-----	-----
05S10W16DCD1	02-14-49	----	0	95	6.6	48	0	22	0	5.2	2.1	6.6	.6	2.1	4.0	3.2	.1	14	30	61	.00
06S09W03DDD1	02-04-49	18.5	--	676	8.5	298	12	29	0	7.7	2.4	141	11	5.3	17	74	.3	11	90	438	20
06S09W04CDD1	11-08-45	----	--	119	7.9	65	0	27	0	7.0	2.3	12	1.0	6.9	2.8	3.3	.4	12	70	99	20
06S09W04CDD2	11-08-45	----	--	139	7.9	82	0	41	0	11	3.3	11	.7	7.2	3.0	.6	.4	12	70	89	.20
06S09W04CDD3	11-08-45	----	--	132	8.0	70	0	26	0	7.0	2.2	14	1.2	6.4	2.5	3.7	.4	13	90	84	.20
06S09W04CDD4	12-11-55	24.5	5	123	7.5	64	0	24	0	7.4	1.4	14	1.2	7.1	3.5	5.8	.1	7.7	20	79	.50
06S09W17CCB1	12-23-68	26.0	1	143	7.2	81	0	22	0	6.5	1.5	16	1.5	6.1	1.8	1.4	----	10	1,900	85	-----
	06-23-75	26.0	--	146	7.0	84	0	29	0	8.8	1.8	17	1.4	6.6	1.6	2.8	----	19	2,000	101	-----
06S10W11ACC1	03-28-49	19.0	5	591	7.4	202	0	50	0	15	3.1	105	6.4	1.0	13	93	.1	36	130	367	.30
06S10W24ACA1	12-07-48	24.5	80	162	7.6	94	0	25	0	7.4	1.6	25	2.2	5.0	3.5	3.2	.1	20	180	115	.50
Lafayette County																					
16S23W10DCA1	07-07-52	----	--	129	7.4	70	0	23	0	----	----	---	----	----	4.2	6.0	----	----	-----	-----	0.50
16S23W16BCB2	01-17-46	----	--	20	7.9	105	0	39	0	11	2.9	26	----	4.7	6.5	6.5	----	11	-----	-----	1.5
	03-07-68	----	3	218	7.5	104	0	45	0	15	2.0	28	1.8	3.8	12	7.4	----	13	-----	133	.00
16S24W15BCB1	01-24-46	20.5	--	240	8.4	144	0	69	0	21	4.1	24	----	5.0	3.5	3.4	.0	8.5	490	141	1.8
17S23W21BCB1	06-19-50	21.0	--	134	7.1	64	0	44	0	11	4.0	11	----	1.6	9.5	3.5	----	20	-----	-----	.20
19S23W29ACC1	02-29-68	----	4	240	7.4	145	0	32	0	9.6	1.8	41	----	2.2	5.0	3.6	----	14	----	149	.20
Lincoln County																					
09S08W02CAD1	05-16-56	19.0	60	847	8.8	404	23	18	0	4.8	1.4	196	20	----	52	9.2	----	----	-----	-----	0.70
09S08W05CBB2	03-21-56	----	5	214	8.3	124	1	8	0	2.4	.6	46	6.9	4.3	3.2	3.4	----	----	-----	-----	1.6
09S08W05CBC1	03-21-56	26.5	5	204	7.9	120	0	8	0	2.1	.6	43	6.7	4.1	2.2	3.8	----	----	-----	-----	1.4
09S08W08CAC1	04-12-56	----	5	219	7.9	128	0	8	0	2.2	.7	47	7.1	3.7	3.5	3.4	0.2	2.5	-----	128	1.5
09S08W17BAB1	04-13-56	----	5	218	7.7	1	0	3	0	1.0	.2	50	12	2.6	2.0	3.0	.1	3.0	-----	63	.10
09S08W25ACC1	04-26-56	20.0	45	634	8.2	378	0	9	0	2.9	.5	153	22	3.8	20	.8	.7	3.0	-----	372	1.7
10S06W19DBD1	07-19-56	----	7	230	8.0	142	0	2	0	.7	.1	54	16	----	3.5	1.2	----	----	-----	-----	.80
Miller County																					
19S27W10BBA1	02-29-68	12.0	4	54	6.5	20	0	20	4	7.7	0.3	2.6	----	0.4	8.0	0.6	----	16	-----	46	0.10
19S27W35DDA1	02-29-68	13.0	4	200	6.2	4	0	47	44	2.5	10	12	----	13	37	7.0	----	12	-----	128	32
Ouachita County																					
11S15W20AAB1	04-07-59	18.5	2	297	7.5	1,280	0	84	0	23	6.3	12	0.6	4.2	8.0	0.2	----	----	0	-----	0.40
11S15W27ABD1	04-07-59	20.0	5	147	6.3	71	0	32	0	8.8	2.5	17	1.3	3.6	7.5	7.0	----	----	1	-----	.30
11S15W35CBA1	07-26-46	----	--	45	---	129	15	62	0	20	3.0	39	2.2	5.0	10	7.9	.0	19	510	184	1.2
11S17W18ACA1	08-07-59	18.5	--	78	7.2	23	0	26	7	----	----	-----	----	----	7.0	1.0	----	----	-----	-----	12
11S18W10CDB1	08-07-59	18.5	--	133	6.5	8	0	32	25	----	----	-----	----	----	16	1.0	----	----	-----	-----	39
11S18W24CAA1	08-07-59	19.0	--	72	7.0	15	0	13	0	----	----	-----	----	----	11	3.0	----	----	-----	-----	2.7
11S19W30BCC1	04-08-59	18.0	4	3,970	8.0	320	0	45	0	13	3.1	842	55	8.4	1,120	6.2	----	----	10	-----	1.5
12S15W07DAB1	04-07-59	20.5	15	207	7.3	124	0	16	0	3.9	1.6	41	4.4	3.0	6.5	.2	----	----	270	-----	.60
12S15W09BBA1	04-07-59	21.0	6	209	7.5	116	0	48	0	13	3.8	26	1.6	4.2	6.5	6.6	----	----	0	-----	.50
12S16W22ACC1	01-16-59	19.5	4	2,490	8.2	-----	0	165	0	48	11	464	16	13	612	1.6	----	----	0	-----	1.3
12S16W25BDD1	11-16-49	18.5	--	203	7.2	112	0	36	0	10	2.7	31	2.2	2.6	7.0	10	0.0	16	480	137	1.8
12S16W26AAA1	04-11-50	19.0	--	238	7.3	132	0	26	0	7.8	1.7	42	3.6	56	7.0	5.7	.1	15	280	201	.90
12S16W26ABB1	11-16-49	19.0	--	213	7.2	114	0	34	0	9.0	2.8	33	2.5	3.5	7.5	6.2	.0	22	890	143	1.6
12S18W05BAA1	08-07-59	17.0	--	109	7.2	8	0	21	14	----	----	-----	----	----	7.0	18	----	----	-----	-----	13
12S18W19CDC1	06-01-58	19.0	7	72	6.2	9	0	19	12	4.5	1.9	5.8	.6	1.9	8.0	13	.1	4.6	0	45	.40
	04-07-59	19.0	1	78	6.5	10	0	14	6	3.5	1.5	4.7	.5	2.0	8.5	7.8	----	----	0	-----	.30

Table 45.—*Chemical analyses of samples taken from wells tapping the Sparta Sand*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Ouachita County—Continued																					
12S18W24CAC1	08-06-59	18.5	--	254	7.0	30	0	84	59	----	----	-----	----	----	36	1.0	----	----	-----	-----	45
12S19W14AAA1	09-04-58	18.5	6	45	5.7	4	0	6	3	1.0	1.0	3.7	.6	1.4	5.5	4.0	.3	3.9	170	24	1.1
12S19W28DDC1	08-07-59	20.5	--	161	7.6	64	0	64	12	----	----	-----	----	-----	12	5.0	----	----	-----	-----	11
12S19W30AAA1	08-07-59	18.5	--	137	6.3	32	0	33	7	----	----	-----	----	----	18	5.0	----	----	-----	-----	19
13S16W05ACD1	04-07-59	--	5	154	7.9	84	0	26	0	6.8	2.1	24	2.1	3.0	5.4	----	----	----	10	-----	.50
13S16W18CAC1	04-07-59	21.0	3	2,740	7.9	294	0	92	0	27	6.0	569	26	12	775	.4	----	----	40	-----	1.0
13S16W27BBD1	04-08-59	21.5	4	4,610	8.0	320	0	150	0	42	11	964	34	1.3	141	6.8	----	----	20	-----	.80
13S17W19ABB2	04-08-59	19.0	5	142	6.8	80	0	60	0	17	4.2	5.2	.3	4.0	4.0	3.8	----	----	10	-----	.40
13S17W19CCA1	04-10-59	----	2	61	6.1	18	0	18	3	4.0	2.0	2.3	.2	2.3	4.0	5.8	----	----	0	-----	.30
13S17W23CAA1	04-08-59	19.5	6	91	6.1	24	0	24	4	6.8	1.7	5.4	.5	3.2	6.5	11	----	----	0	-----	.60
13S17W33ADB1	04-08-59	18.5	6	72	4.3	0	0	20	20	6.0	1.2	3.1	.3	1.5	3.5	25	----	----	0	-----	.40
13S18W03BAC1	04-08-59	19.0	5	43	6.0	14	0	9	0	2.5	.7	3.2	.5	1.5	4.5	.4	----	----	10	-----	.60
13S18W10ADB1	08-11-59	18.0	--	199	6.2	6	0	35	0	----	----	-----	----	----	39	1.0	----	----	-----	-----	2.6
13S18W17BBB1	08-10-59	18.5	--	220	4.2	0	0	46	46	----	----	-----	----	----	28	1.0	----	----	-----	-----	51
13S19W16ADA1	08-07-59	18.5	--	39	6.9	10	0	9	1	----	----	-----	----	----	8.0	5.0	----	----	-----	-----	1.4
13S19W28CAB1	08-10-59	20.0	--	148	6.7	7	0	24	18	----	----	-----	----	----	19	9.0	----	----	-----	-----	28
14S16W07CBC1	04-09-59	19.0	5	187	6.8	92	0	68	0	18	5.5	11	.6	4.4	5.0	17	----	----	0	-----	.20
14S16W32BDC1	08-11-59	18.5	--	146	6.2	46	0	38	0	----	----	-----	----	----	15	22	----	----	-----	-----	7.2
14S17W02DCD1	04-09-59	----	4	325	7.8	154	0	44	0	13	2.8	55	3.6	3.9	29	2.4	----	----	40	-----	.40
14S17W04BAD1	04-09-59	--	3	63	6.4	29	0	22	0	7.9	.7	2.6	.2	.7	3.5	.6	----	----	0	-----	.50
14S17W08AAA1	08-11-59	18.5	--	89	5.9	16	0	25	12	----	----	-----	----	----	8.5	----	----	----	-----	-----	12
14S17W11BCB1	04-09-59	--	3	281	8.0	156	0	82	0	24	5.5	30	1.4	4.4	6.0	19	----	----	10	-----	1.5
14S19W02ABB1	08-10-59	19.5	--	240	5.2	3	0	34	32	----	----	-----	----	----	27	16	----	----	-----	-----	39
15S17W11BAB1	04-09-59	19.0	35	250	7.3	138	0	64	0	17	5.3	23	1.2	4.3	4.5	.2	----	----	570	-----	.40
15S18W02ABB1	08-11-59	21.0	--	90	5.5	4	0	26	23	----	----	-----	----	----	8.0	----	----	----	-----	-----	28
15S18W08AAD1	08-11-59	19.5	--	669	4.0	0	0	135	135	----	----	-----	----	----	104	3.0	----	----	-----	-----	148
15S19W21CAB1	01-24-46	----	--	22	8.2	110	0	56	0	16	3.8	21	1.2	5.1	3.8	10	.0	11	120	126	1.0
15S19W22ABB1	04-09-59	----	10	189	7.3	94	0	49	0	14	3.4	18	1.1	4.3	5.2	10	----	----	150	-----	.40
15S19W22ABB1	04-09-59	----	6	182	8.2	98	0	52	0	16	3.1	22	1.3	4.2	5.5	14	----	----	0	-----	.40
15S19W22BDB1	04-09-59	----	5	176	6.6	90	0	48	0	14	3.1	17	1.1	4.5	5.0	13	----	----	0	-----	.30
Union County																					
16S15W21DCD1	09-28-40	----	--	-----	8.1	245	--	---	---	----	2.6	-----	----	----	2.3	----	----	14	-----	-----	0.50
	08-01-46	----	--	54	8.4	241	12	4	0	1.0	.4	128	27	1.1	46	0.4	0.2	12	80	321	.50
16S16W02BAC1	12-04-45	----	--	44	8.2	256	0	6	0	1.8	.3	106	19	1.4	20	.6	1.0	12	20	269	.10
17S15W06CCC1	09-11-42	----	--	-----	---	234	--	6	0	2.1	.3	103	17	----	23	1.4	----	17	-----	263	-----
17S15W07DCC1	09-16-42	----	--	-----	---	232	--	4	0	1.2	.3	106	22	----	25	1.8	----	1.6	-----	251	-----
17S15W08CCC1	12-05-42	----	--	-----	7.8	250	--	6	0	1.9	.4	116	20	----	22	2.0	----	16	-----	282	-----
17S15W08DCC1	09-22-42	----	--	-----	7.8	232	--	4	0	1.2	.3	106	22	----	30	1.0	----	17	-----	271	-----
17S15W09ACB1	09-21-42	----	--	-----	7.0	224	--	5	0	1.5	.4	97	17	----	22	1.1	----	18	-----	250	-----
17S15W09ACC1	02-11-47	----	--	21	7.5	189	0	29	0	8.4	2.0	59	4.8	3.0	2.8	.7	.1	16	30	187	2.0
17S15W09CBB1	02-17-43	----	--	-----	7.0	232	--	3	0	.9	.1	100	24	----	20	.3	----	11	-----	248	-----
17S15W28CDC2	11-28-45	----	--	454	8.4	213	8	8	0	2.2	0.6	106	16	1.5	36	0.8	0.1	10	20	271	0.10
17S15W28DCC1	02-29-52	20.0	15	452	8.3	222	3	16	0	4.5	1.1	104	11	1.6	38	1.3	.2	11	20	276	.00
17S15W33BCC1	02-25-47	----	--	36	8.3	208	12	5	0	1.4	.3	107	21	3.4	36	.3	.3	11	20	275	.20
17S16W01ABB1	11-25-42	----	--	-----	7.0	242	--	7	0	2.3	.6	109	17	----	27	6.8	----	26	-----	292	-----
17S16W01CCC1	12-16-42	----	--	-----	8.0	244	--	2	0	.7	.1	115	32	----	36	1.2	----	32	-----	306	-----
17S16W12ACB1	01-28-43	----	--	-----	8.0	232	--	4	0	1.4	.2	101	21	----	18	6.0	----	24	-----	266	-----
17S16W12DCC1	09-02-42	----	--	-----	---	206	--	8	0	2.6	.4	92	14	----	15	2.9	----	15	-----	230	-----
17S16W24BAC1	06-15-72	23.0	5	446	8.5	224	4	4	0	1.0	.2	110	26	1.5	27	1.8	----	11	20	267	-----
	08-31-77	23.0	--	447	7.8	240	0	---	--	----	---	---	--	----	--	---	----	--	-----	---	-----
18S12W32ABC1	08-01-50	20.0	--	510	7.8	286	0	22	0	5.7	2.1	116	11	7.4	25	.7	----	12	40	314	3.5
19S10W19CCB2	02-08-46	23.0	--	246	7.9	292	0	28	0	7.6	2.3	509	42	3.8	638	.4	.2	8.5	80	1,320	.20
20S16W02AAC1	01-25-46	----	--	35	8.4	158	0	3	0	1.0	.2	81	19	.9	35	2.4	.0	10	20	209	.20



EXPLANATION

——500——

LINE OF EQUAL SPECIFIC CONDUCTANCE, in micromhos per centimeter at 25 degrees Celsius. Interval as shown

Area of outcrop of Sparta Sand. Dashed where approximately located

Area where outcrop of Sparta Sand is covered by Quaternary deposits

Outcrop irregular due to faulting

U/D Fault zone -- Approximately located U, upthrown side; D, downthrown side

Figure 28.—Specific conductance for the Sparta Sand.

The results of analyses of 20 samples taken from wells tapping the Cook Mountain Formation are shown in table 46. Most of the samples were taken from wells in Ouachita and Grant Counties. Specific conductance ranges from 78 to 3,040 μmho and averages about 401 μmho. The average pH is about 6.4 and the range in values is from 5.3 to 8.3. Average hardness is about 98.5 mg/L and values range from 3 to 1,110 mg/L. Bicarbonate ranges from 8 to 210 mg/L and averages 56.0 mg/L.

Cockfield Formation

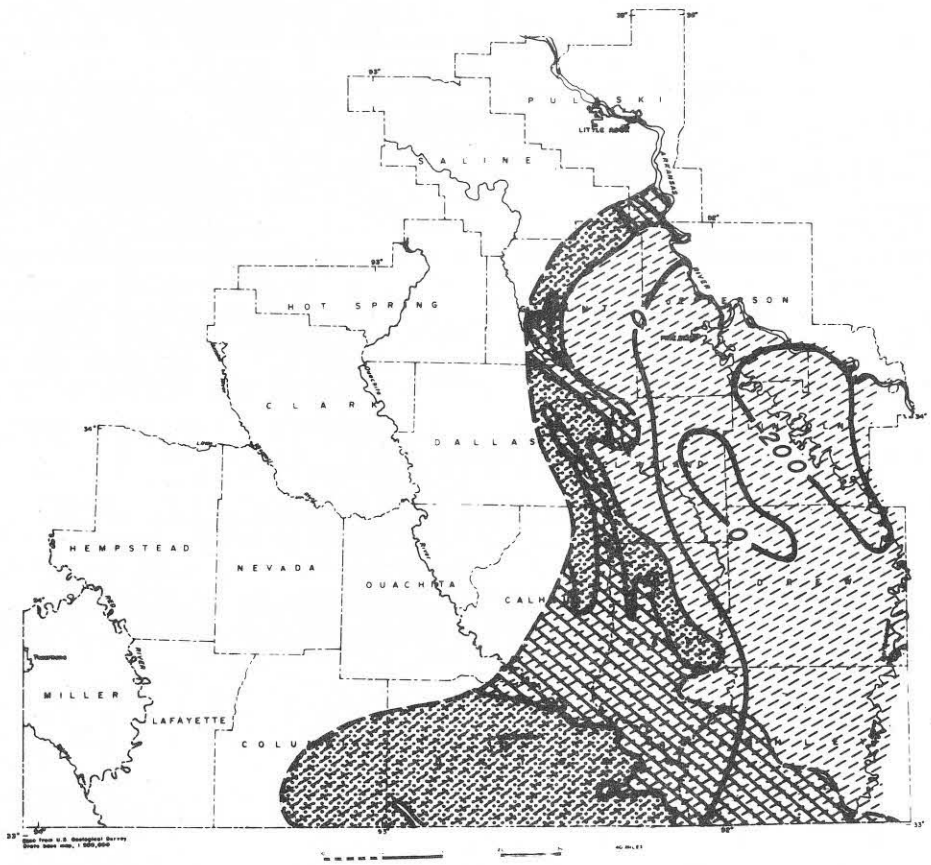
The Cockfield Formation overlies the Cook Mountain Formation and is in turn overlain by the Jackson Group, undifferentiated. The Cockfield is present throughout the eastern part of the project area. Areas of outcrop, structural contours of the top, and areas of use are shown in figure 29. The formation is about 200 ft thick and generally consists of 40 to 80 percent sand in the project area (fig. 30). Figure 31 shows the potentiometric surface for the Cockfield Formation. Movement of water is generally southward.

The Cockfield Formation is a significant source for ground water in 11 counties in the project area. The largest use is for domestic water supply. However, a few municipal and industrial wells also tap the aquifer. Within the project area, yields range from a few gallons per minute to 400 gal/min. The total water use in 1975 from the Cockfield Formation in the project area was 3.19 Mgal/d (table 2). The largest water use from the Cockfield is in Union (0.67 Mgal/d in 1975) and Cleveland (0.44 Mgal/d in 1975) Counties.

Water in the Cockfield is generally soft and is a sodium bicarbonate type. In the project area, dissolved solids range from 25 to 900 mg/L and average about 241 mg/L (table 47). Specific conductance ranges from 25 to 1,740 μmho and averages 435 μmho. Lines of equal specific conductance for the Cockfield are shown in figure 32. Closed contours in certain areas indicate local variations

Table 46.—*Chemical analyses of samples taken from wells tapping the Cook Mountain Formation*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Calhoun County																					
11S14W11BAB1	08-05-59	18.0	--	203	5.3	11	0	30	21	-----	-----	----	----	----	64	7.0	---	---	------	-----	22
Columbia County																					
17S20W36CAB1	08-29-50	20.0	--	300	7.7	193	0	46	0	14	2.7	55	3.5	2.2	4.0	6.7	0.1	15	20	196	1.2
19S19W01DBA1	08-29-50	21.5	--	429	8.3	210	0	57	0	-----	-----	----	----	----	----	------	---	---	------	-----	2.5
Dallas County																					
10S13W18CAA1	12-05-66	----	5	182	6.3	12	0	40	30	6.3	6.0	12	----	6.6	18	5.4	---	12	------	115	40
Grant County																					
04S14W31BCB1	08-14-63	21.0	4	78	6.8	24	0	22	2	7.9	6.0	5.5	0.4	0.6	5.2	2.8	0.1	32	50	74	7.0
05S14W06DBA2	05-14-64	18.5	6	96	6.3	44	0	24	0	6.4	2.0	8.2	.7	3.1	6.0	3.2	.1	53	11,000	115	.20
05S15W12ADA1	05-14-64	17.0	3	80	5.6	8	0	6	0	2.1	.4	11	1.8	.3	14	4.2	.1	28	120	67	2.9
Ouachita County																					
14S17W29ABC1	08-11-59	19.0	--	92	6.8	16	0	30	17	-----	---	----	----	----	12	1.0	---	---	------	-----	8.4
14S18W15ABB1	08-10-59	18.0	--	99	5.5	10	0	18	10	-----	---	----	----	----	12	1.0	---	---	------	-----	5.2
14S18W18DCD1	08-10-59	18.0	--	348	7.4	78	0	115	51	-----	---	----	----	----	38	2.0	---	---	------	-----	59
14S19W20BAA1	08-10-59	18.5	--	101	---	26	0	11	0	-----	---	----	----	----	16	5.0	---	---	------	-----	1.0
14S19W23BCD1	08-10-59	23.5	--	939	7.8	192	0	149	0	-----	---	----	----	----	198	10	---	---	------	-----	8.8
15S16W23ABD1	08-11-59	21.0	--	98	6.1	24	0	19	0	-----	---	----	----	----	8.0	6.0	---	---	------	-----	1.0
15S16W29BCA1	08-11-59	19.5	--	517	5.6	13	0	36	25	-----	---	----	----	----	68	9.0	---	---	------	-----	41
15S17W02ABD1	08-11-59	21.0	--	355	5.9	18	0	78	63	-----	---	----	----	----	52	6.0	---	---	------	-----	79
15S17W16DAA1	08-11-59	19.0	--	437	5.5	10	0	79	71	-----	---	----	----	----	96	25	---	---	------	-----	4.2
15S17W18CAC1	59-08-11	17.0	--	3,040	6.6	145	0	1,110	991	-----	---	----	----	----	750	------	---	---	------	-----	14
15S18W30BBD1	08-11-59	18.5	--	96	6.2	32	0	3	7	-----	---	----	----	----	6.0	------	---	---	------	-----	12
15S18W36AAA1	08-11-59	22.0	--	307	7.0	46	0	59	21	-----	---	----	----	----	50	4.0	---	---	------	-----	40
15S19W21ABB1	08-11-59	18.5	--	223	5.4	8	0	39	32	-----	---	----	----	----	18	1.0	---	---	------	-----	71



EXPLANATION

—— 200 ——

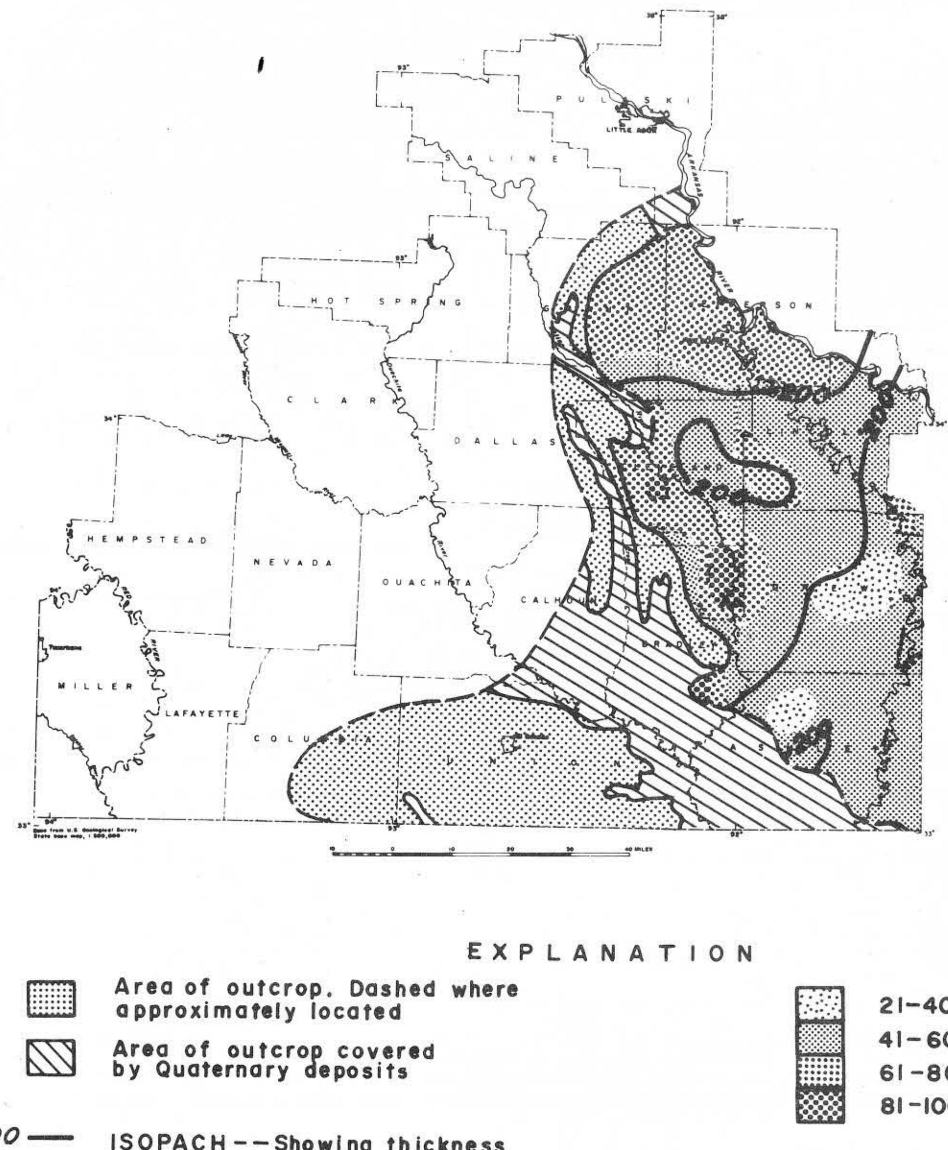
STRUCTURE CONTOUR -- Shows altitude of top of Cockfield Formation. Contour inteval 200 feet. National Geodetic Vertical Datum of 1929

Outcrop area of Cockfield Formation. Dashed where approximately located

Outcrop area where Cockfield Formation is covered by Quaternary deposits

Area of use

Figure 29.—Structural contours of the top and areas of use of the Cockfield Formation (modified from Hosman and others, 1968).



EXPLANATION

Area of outcrop. Dashed where approximately located

Area of outcrop covered by Quaternary deposits

—— 200 —— ISOPACH -- Showing thickness of unit. Interval 100 feet

21–40, 41–60, 61–80, 81–100 — Percentage of sand

Figure 30.—Thickness and percentage of sand of the Cockfield Formation (modified from Hosman and others, 1968).

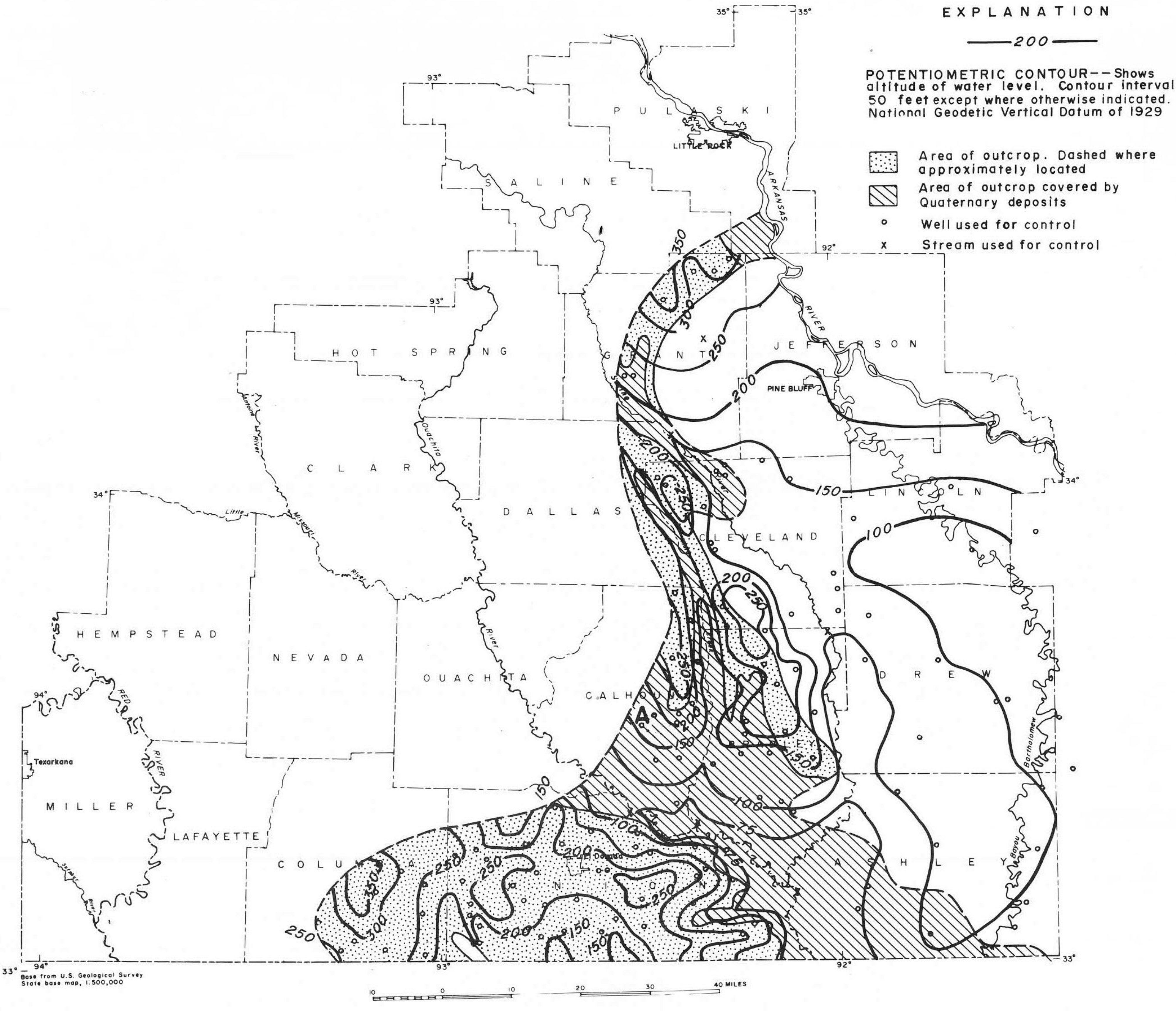


Figure 31.—Potentiometric surface of the Cockfield Formation.

Table 47.—*Chemical analyses of samples taken from wells tapping the Cookfield Formation*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Ashley County																					
15S07W31ADD1	07-25-47	----	--	457	8.0	248	0	41	0	11	3.2	90	----	2.7	15	14	0.1	10	29,000	274	0.2
18S08W04BBC1	04-11-61	----	--	-----	8.2	---	--	21	0	5.8	1.5	57	5.5	----	34	6.2	.2	----	120	---	------
18S08W17ADD1	11-12-46	----	--	1,010	7.7	262	0	28	0	7.9	2.2	215	17	9.1	206	.8	.3	14	20	585	.20
18S09W14CDB1	11-12-46	----	--	680	7.2	210	0	84	0	23	6.3	117	5.6	4.6	122	.3	.1	4.6	2,310	402	.20
18S10W14ACB1	01-19-47	20.0	--	1,110	8.1	316	10	14	0	4.2	1.0	238	27	5.7	187	.6	.2	8.0	>90	646	.20
Bradley County																					
11S07W25BBB1	10-20-53	19.0	--	508	8.1	304	8	19	0	6.1	0.8	-----	----	----	13	1	---	----	91	---	2.4
12S09W08AAA1	08-14-59	20.0	3	293	7.9	168	0	6	0	2.1	.4	66	11	2.2	7.2	7.8	---	----	60	170	1.0
12S09W20BCB	08-14-59	22.0	2	283	7.2	156	0	28	0	7.8	2.2	49	----	3.5	5.5	6.4	---	----	91,000	164	.2
12S10W04ABA1	04-10-59	20.5	5	297	7.5	149	0	72	0	20	5.3	39	2.0	4.8	16	18	---	----	5,100	177	1.0
	08-14-59	20.5	3	306	---	154	0	70	0	20	4.9	32	2.0	4.9	14	14	---	----	280	219	1.2
12S10W19BCC	08-03-59	20.5	--	249	5.8	14	--	60	49	-----	----	-----	----	-----	40	1	---	----	25	---	30
12S12W26BAC1	08-18-59	20.0	1	101	6.1	50	0	22	0	5.6	1.9	8.7	.8	2.5	6.5	.8	---	----	12,000	46	.10
12S12W26BAC2	07-31-59	----	--	274	6.2	85	--	78	8	-----	----	-----	----	-----	32	6	---	----	29	---	8.0
12S07W30DBD2	02-09-54	----	--	326	7.9	200	0	4	0	-----	----	-----	----	-----	10	.2	---	----	------	---	.10
13S10W14ABD1	08-17-59	21.5	2	317	7.6	180	0	29	0	7.6	2.4	63	5.1	3.5	8.5	11	---	----	140	186	1.3
13S10W18ACD	08-19-59	21.0	0	350	7.3	200	0	92	0	27	5.8	40	----	6.7	8.5	11	---	----	0	207	2.2
13S11W01DAC1	08-19-59	21.5	50	309	7.3	69	0	85	28	25	5.4	32	1.5	3.8	15	8.0	6.5	----	13,000	164	.10
13S11W02CCC	07-31-59	----	--	204	5.9	24	0	48	28	-----	----	-----	----	-----	22	1	---	----	32	---	8.60
13S11W17CBD2	04-10-59	----	5	394	7.8	182	0	141	0	41	9.4	32	1.2	6.6	15	50	---	----	0	293	.8
13S12W34CDD	01-13-59	18.5	40	310	8.2	194	0	20	0	4.6	2.0	68	87	6.7	7.0	.6	---	----	22	234	.6
14S09W04AAC1	01-14-59	----	3	1,180	7.8	182	0	448	300	117	38	116	2.4	11	58	470	---	----	1,100	900	.10
14S09W16BDD1	08-17-59	21.5	0	376	7.8	208	0	20	0	5.4	1.5	80	7.9	3.5	8.5	17	---	----	40	219	1.3
14S10W31DBB1	08-18-59	21.0	11	219	7.3	140	0	16	0	4.6	1.1	47	5.1	2.2	5.5	.6	---	----	85	130	.30
15S09W03CDD1	08-17-59	21.0	3	301	8.0	176	0	58	0	16	4.2	45	2.6	4.8	8.2	6.6	---	----	11	172	.20
15S09W27DDB1	08-17-59	23.5	0	323	7.7	7	0	46	0	13	3.3	51	3.3	3.9	---	12	---	----	110	176	1.0
15S10W18DAB	08-18-59	19.0	8	321	7.8	176	0	14	0	4.8	.6	68	7.8	3.2	14	.4	---	----	60	179	1.8
15S10W29ADA1	08-18-59	21.5	0	132	5.8	8	0	22	16	2.4	4.0	13	1.2	.7	26	.0	---	----	1,000	60	9.5
15S11W22CDA1	08-18-59	23.0	5	312	7.8	172	0	12	0	4.1	.6	65	8.0	2.7	9.5	3.8	---	----	90	172	1.2
16S10W11DCB1	08-18-59	21.0	30	731	8.0	428	0	8	0	3.1	.0	182	29	3.3	41	.0	---	----	240	442	1.9
16S11W11ACB1	08-20-59	----	2	43	6.1	24	0	10	2	2.9	.9	4.1	.6	2.1	22	.0	---	----	62,000	25	.80
16S10W11DCA1	08-08-59	----	5	343	7.8	208	0	5	0	1.9	.1	84	16	2.2	9.5	4.6	---	----	280	205	.90
12S09W28CAD1	08-14-59	21.5	2	676	7.3	258	0	146	0	37	13	98	3.5	82	15	136	---	----	180	437	3.0
Calhoun County																					
11S12W29CCA1	08-04-59	18.5	--	112	6.1	29	0	36	12	-----	----	-----	----	-----	4.5	16	---	----	------	---	6.6
11S13W15BBC1	08-04-59	18.5	--	39	6.2	12	0	9	0	-----	----	-----	----	-----	5.0	1.0	---	----	0	---	1.8
11S14W04BAB1	08-13-59	19.0	1	53	5.8	22	0	12	0	3.7	.9	3.6	.5	1.7	3.5	.0	---	----	0	46	.00
13S12W17BAD1	08-14-59	18.5	--	1,180	6.0	48	0	212	192	-----	----	-----	----	-----	310	26	---	----	------	---	2.4
13S12W34CDD1	01-13-59	18.5	40	310	8.2	194	0	20	0	4.6	2.0	68	6.7	2.4	7.0	0.6	---	----	220	234	.60
13S13W09CDB1	08-12-59	20.0	4	344	---	204	0	55	0	16	3.6	56	3.3	4.3	9.5	.0	---	----	0	220	1.0
13S13W30CCC1	08-12-59	20.0	0	25	5.9	11	0	6	0	1.9	.2	1.2	.2	2.5	2.5	.2	---	----	0	27	.10
14S13W01AAA1	01-13-59	18.5	2	243	6.9	60	0	46	0	15	1.9	26	1.7	3.1	38	4.6	---	----	0	166	1.0
14S13W06AAA1	12-12-55	----	5	391	7.7	210	0	6	0	1.8	3.0	94	10	2.8	13	15	.1	6.7	0	242	2.1
14S13W11DDB1	08-12-59	23.0	1	210	6.6	96	0	38	0	11	2.7	27	1.9	3.7	16	20	---	----	0	153	.40
14S14W29AAA1	08-13-59	20.0	1	162	6.6	80	0	28	0	7.8	2.1	18	1.5	3.0	5.0	.0	---	----	0	100	.10
15S13W20BCC1	08-12-59	21.0	1	442	7.4	210	0	42	0	13	2.2	85	5.7	3.6	38	.0	---	----	0	273	1.0

Table 47.—*Chemical analyses of samples taken from wells tapping the Cookfield Formation*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Ashley County																					
15S07W31ABD1	07-25-47	----	--	457	8.0	248	0	41	0	11	3.2	90	----	2.7	15	14	0.1	10	29,000	274	0.2
18S08W04BBC1	04-11-61	----	--	-----	8.2	---	--	21	0	5.8	1.5	57	5.5	----	34	6.2	.2	----	120	---	------
18S08W17ADD1	11-12-46	----	--	1,010	7.7	262	0	28	0	7.9	2.2	215	17	9.1	206	.8	.3	14	20	585	.20
18S09W14CDB1	11-12-46	----	--	680	7.2	210	0	84	0	23	6.3	117	5.6	4.6	122	.3	.1	4.6	2,310	402	.20
18S10W14ACB1	01-19-47	20.0	--	1,110	8.1	316	10	14	0	4.2	1.0	238	27	5.7	187	.6	.2	8.0	>90	646	.20
Bradley County																					
11S07W25BBB1	10-20-53	19.0	--	508	8.1	304	8	19	0	6.1	0.8	-----	----	----	13	1	---	----	91	---	2.4
12S09W08AAA1	08-14-59	20.0	3	293	7.9	168	0	6	0	2.1	.4	66	11	2.2	7.2	7.8	---	----	60	170	1.0
12S09W20BCB	08-14-59	22.0	2	283	7.2	156	0	28	0	7.8	2.2	49	----	3.5	5.5	6.4	---	----	91,000	164	.2
12S10W04ABA1	04-10-59	20.5	5	297	7.5	149	0	72	0	20	5.3	39	2.0	4.8	16	18	---	----	5,100	177	1.0
	08-14-59	20.5	3	306	---	154	0	70	0	20	4.9	32	2.0	4.9	14	14	---	----	280	219	1.2
12S10W19BCC	08-03-59	20.5	--	249	5.8	14	--	60	49	-----	----	-----	----	-----	40	1	---	----	25	---	30
12S12W26BAC1	08-18-59	20.0	1	101	6.1	50	0	22	0	5.6	1.9	8.7	.8	2.5	6.5	.8	---	----	12,000	46	.10
12S12W26BAC2	07-31-59	----	--	274	6.2	85	--	78	8	-----	----	-----	----	-----	32	6	---	----	29	---	8.0
12S07W30DBD2	02-09-54	----	--	326	7.9	200	0	4	0	-----	----	-----	----	-----	10	.2	---	----	------	---	.10
13S10W14ABD1	08-17-59	21.5	2	317	7.6	180	0	29	0	7.6	2.4	63	5.1	3.5	8.5	11	---	----	140	186	1.3
13S10W18ACD	08-19-59	21.0	0	350	7.3	200	0	92	0	27	5.8	40	----	6.7	8.5	11	---	----	0	207	2.2
13S11W01DAC1	08-19-59	21.5	50	309	7.3	69	0	85	28	25	5.4	32	1.5	3.8	15	8.0	6.5	----	13,000	164	.10
13S11W02CCC	07-31-59	----	--	204	5.9	24	0	48	28	-----	----	-----	----	-----	22	1	---	----	32	---	8.60
13S11W17CBD2	04-10-59	----	5	394	7.8	182	0	141	0	41	9.4	32	1.2	6.6	15	50	---	----	0	293	.8
13S12W34CDD	01-13-59	18.5	40	310	8.2	194	0	20	0	4.6	2.0	68	87	6.7	7.0	.6	---	----	22	234	.6
14S09W04AAC1	01-14-59	----	3	1,180	7.8	182	0	448	300	117	38	116	2.4	11	58	470	---	----	1,100	900	.10
14S09W16BDD1	08-17-59	21.5	0	376	7.8	208	0	20	0	5.4	1.5	80	7.9	3.5	8.5	17	---	----	40	219	1.3
14S10W31DBB1	08-18-59	21.0	11	219	7.3	140	0	16	0	4.6	1.1	47	5.1	2.2	5.5	.6	---	----	85	130	.30
15S09W03CDD1	08-17-59	21.0	3	301	8.0	176	0	58	0	16	4.2	45	2.6	4.8	8.2	6.6	---	----	11	172	.20
15S09W27DDB1	08-17-59	23.5	0	323	7.7	7	0	46	0	13	3.3	51	3.3	3.9	---	12	---	----	110	176	1.0
15S10W18DAB	08-18-59	19.0	8	321	7.8	176	0	14	0	4.8	.6	68	7.8	3.2	14	.4	---	----	60	179	1.8
15S10W29ADA1	08-18-59	21.5	0	132	5.8	8	0	22	16	2.4	4.0	13	1.2	.7	26	.0	---	----	1,000	60	9.5
15S11W22CDA1	08-18-59	23.0	5	312	7.8	172	0	12	0	4.1	.6	65	8.0	2.7	9.5	3.8	---	----	90	172	1.2
16S10W11DCB1	08-18-59	21.0	30	731	8.0	428	0	8	0	3.1	.0	182	29	3.3	41	.0	---	----	240	442	1.9
16S11W11ACB1	08-20-59	----	2	43	6.1	24	0	10	2	2.9	.9	4.1	.6	2.1	22	.0	---	----	62,000	25	.80
16S10W11DCA1	08-08-59	----	5	343	7.8	208	0	5	0	1.9	.1	84	16	2.2	9.5	4.6	---	----	280	205	.90
12S09W28CAD1	08-14-59	21.5	2	676	7.3	258	0	146	0	37	13	98	3.5	82	15	136	---	----	180	437	3.0
Calhoun County																					
11S12W29CCA1	08-04-59	18.5	--	112	6.1	29	0	36	12	-----	----	-----	----	-----	4.5	16	---	----	------	---	6.6
11S13W15BBC1	08-04-59	18.5	--	39	6.2	12	0	9	0	-----	----	-----	----	-----	5.0	1.0	---	----	0	---	1.8
11S14W04BAB1	08-13-59	19.0	1	53	5.8	22	0	12	0	3.7	.9	3.6	.5	1.7	3.5	.0	---	----	0	46	.00
13S12W17BAD1	08-14-59	18.5	--	1,180	6.0	48	0	212	192	-----	----	-----	----	-----	310	26	---	----	------	---	2.4
13S12W34CDD1	01-13-59	18.5	40	310	8.2	194	0	20	0	4.6	2.0	68	6.7	2.4	7.0	0.6	---	----	220	234	.60
13S13W09CDB1	08-12-59	20.0	4	344	---	204	0	55	0	16	3.6	56	3.3	4.3	9.5	.0	---	----	0	220	1.0
13S13W30CCC1	08-12-59	20.0	0	25	5.9	11	0	6	0	1.9	.2	1.2	.2	2.5	2.5	.2	---	----	0	27	.10
14S13W01AAA1	01-13-59	18.5	2	243	6.9	60	0	46	0	15	1.9	26	1.7	3.1	38	4.6	---	----	0	166	1.0
14S13W06AAA1	12-12-55	----	5	391	7.7	210	0	6	0	1.8	3.0	94	10	2.8	13	15	.1	6.7	0	242	2.1
14S13W11DDB1	08-12-59	23.0	1	210	6.6	96	0	38	0	11	2.7	27	1.9	3.7	16	20	---	----	0	153	.40
14S14W29AAA1	08-13-59	20.0	1	162	6.6	80	0	28	0	7.8	2.1	18	1.5	3.0	5.0	.0	---	----	0	100	.10
15S13W20BCC1	08-12-59	21.0	1	442	7.4	210	0	42	0	13	2.2	85	5.7	3.6	38	.0	---	----	0	273	1.0

Table 47.—*Chemical analyses of samples taken from wells tapping the Cookfield Formation*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
										Cleveland County											
10S09W23DCC1	11-29-66	----	5	272	7.6	180	0	6	0	2.1	.4	65	----	1.4	3.7	5.8	---	15	---	182	.60
08S10W16DAA1	11-30-66	----	8	480	7.8	272	0	15	0	4.5	1.0	115	----	3.2	20	5.8	---	13	---	298	1.0
08S12W12DBB1	11-29-66	----	4	337	7.8	207	0	8	0	2.6	.4	80	----	1.8	3.6	4.0	---	12	---	207	.70
08S13W34ABC1	11-01-66	----	10	553	7.9	245	0	96	0	29	5.6	86	----	5.6	35	34	---	14	---	332	1.8
10S09W15ACC1	11-29-66	----	1	188	7.2	114	0	14	0	3.8	1.1	37	----	3.5	1.0	2.4	---	17	---	122	.50
10S12W12CAB1	01-15-58	----	6	369	7.4	170	0	62	0	17	4.8	45	----	7.1	8.8	17	---	6.5	---	---	.40
										Columbia County											
19S21W17CCC1	08-07-50	20.0	---	70	6.1	20	0	13	0	2.8	1.4	7.4	0.9	1.6	7.0	3.8	0.1	42	0	77	.60
										Dallas County											
09S13W32ADC1	12-05-66	----	2	42	6.6	16	0	11	0	3.5	0.6	2.6	----	0.9	1.3	2.0	---	26	---	47	1.9
										Drew County											
11S06W08BBD1	03-30-54	18.0	--	464	8.5	284	9	11	0	----	---	-----	----	---	7.2	1.0	---	----	50	---	1.2
11S07W04CDB1	12-16-53	----	--	638	8.8	334	20	16	0	----	---	-----	----	---	16	1.0	---	----	40	---	1.8
11S08W28DDC1	12-17-53	----	--	1,560	8.4	181	4	---	---	----	---	-----	----	---	107	464	---	----	370	---	3.9
12S06W30DAA1	10-03-54	----	20	441	8.4	244	8	13	0	3.5	1.0	108	13	---	15	9.9	---	----	270	266	.70
12S07W01CBC1	10-21-53	21.0	--	348	8.4	210	6	8	0	1.8	.8	----	----	---	5.5	1.0	---	----	80	---	1.9
12S07W15ADC1	12-16-53	14.0	--	433	8.8	243	12	12	0	----	---	----	----	---	8.5	1.0	---	----	30	---	1.8
12S08W27CCD1	02-08-54	----	--	1,270	8.1	184	0	105	0	----	---	----	----	---	54	393	---	----	220	---	2.4
12S08W27CDC1	02-09-54	----	--	908	7.7	242	0	56	0	----	---	----	----	---	64	145	---	----	0	---	.00
12S08W33BAC	02-09-54	20.0	12	539	8.0	283	0	19	0	6.0	1.0	124	12	2.7	14	24	0.6	10	90	338	4.5
12S08W34BBB1	02-09-54	23.5	8	305	7.5	176	0	3	0	1.0	.1	71	18	1.3	7.5	1.2	.2	12	60	182	1.1
13S07W10AAD1	02-10-54	----	--	286	8.3	---	2	6	0	----	---	----	----	---	5.8	12	---	----	130	---	.80
13S07W10ACC1	03-30-54	----	--	292	8.3	157	2	9	0	----	---	----	----	---	4.8	18	---	----	310	---	.00
13S07W11CCB1	02-10-54	----	--	258	8.4	146	2	4	0	----	---	----	----	---	5.2	4.0	---	----	250	---	.80
13S07W11CCC1	02-10-54	----	--	273	7.9	158	0	---	---	----	---	----	----	---	5.2	2.0	---	----	40	---	2.8
13S07W16CBA1	02-10-54	----	--	366	8.2	193	0	10	0	----	---	----	----	---	12	15	---	----	110	---	1.1
13S07W23CBB1	03-30-54	----	--	1,120	7.8	228	0	44	0	----	---	----	----	---	57	263	---	----	250	---	.60
13S08W23BAC1	02-10-54	----	9	406	8.3	218	2	8	0	2.4	0.5	92	14	1.7	20	1.2	0.0	12	90	252	1.4
13S08W23BDD1	03-30-54	----	--	405	7.9	214	0	15	0	---	---	-----	----	---	17	2.0	---	----	0	---	.40
13S08W35CBC1	09-09-54	----	18	396	8.4	212	6	9	0	2.9	.5	91	13	1.6	16	2.4	.3	6.4	130	247	.00
14S07W16BAA1	02-10-54	----	14	338	8.2	175	0	11	0	2.5	1.1	76	10	2.2	10	16	.0	9.7	150	216	1.8
14S07W26BAA1	12-17-53	----	--	1,740	8.0	284	0	598	365	---	---	-----	----	---	50	2.0	---	----	1,700	---	2.3
14S08W01ABA1	02-10-54	----	--	890	8.3	210	2	86	0	---	---	-----	----	---	58	179	---	----	90	---	2.8
										Grant County											
03S12W15CDA1	08-06-64	17.0	--	86	6.5	10	0	24	16	4.8	2.9	5.6	0.5	2.3	6.4	3.2	0.0	23	0	78	25
03S12W18BCA1	08-27-64	18.5	--	344	7.6	--	--	--	--	---	---	-----	----	---	----	-----	---	----	2,700	---	.20
03S12W30CBB1	10-19-64	17.0	--	136	6.2	7	0	22	17	5.2	2.3	-----	----	---	----	.0	.1	----	-----	---	17
03S13W24ADA2	07-22-64	19.5	5	75	5.8	19	0	12	0	2.8	1.1	7.5	1.0	1.1	----	4.0	---	44	2,800	82	1.4
04S13W07DAA1	08-05-64	17.5	5	511	7.8	308	0	212	0	62	14	29	.9	6.2	14	4.8	.0	22	170	304	.20
04S13W11CDA1	07-22-64	19.0	5	347	7.4	183	0	128	0	39	7.3	20	.8	5.9	14	8.6	.0	34	2,800	222	.30
04S13W34ACD1	08-04-64	19.0	5	690	7.4	203	0	229	62	72	12	54	1.6	7.7	9.0	172	.0	16	470	443	.40

Table 47.—*Chemical analyses of samples taken from wells tapping the Cookfield Formation*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Grant County—Continued																					
05S13W05DBD1	07-23-64	18.5	5	482	8.0	201	0	12	0	42	5.9	50	1.9	4.7	6.0	69	.0	20	1,500	299	1.2
05S14W26BCC1	08-05-64	19.5	5	27	6.3	12	0	6	0	1.4	.5	-----	----	---	2.5	.0	.0	30	110	44	.20
06S12W02DCB1	05-11-64	19.5	2	484	8.2	211	0	18	0	6.0	.8	103	10	3.1	10	56	.4	15	40	299	.30
06S12W08ADC1	08-06-64	20.0	5	658	7.7	256	0	128	0	37	8.6	99	3.8	6.5	----	107	.3	17	2,000	423	1.5
06S12W22CAC1	07-29-64	20.0	5	570	7.9	221	0	80	0	25	4.3	93	4.5	4.8	----	86	.0	12	270	348	.70
06S12W29CBC1	07-30-64	18.5	5	289	7.4	---	0	90	0	26	6.1	22	1.0	4.6	14	6.4	.0	37	170	188	.20
07S12W03BBD1	05-14-64	18.5	2	759	7.8	179	0	150	3	46	8.4	105	3.7	6.0	16	218	.2	13	7,200	511	2.1
Jefferson County																					
03S11W15CDC1	02-25-49	20.5	5	987	7.6	356	0	346	54	99	24	84	2.0	5.4	26	220	0.0	2.0	50	640	2.6
05S10W18BBB1	03-28-49	----	60	513	7.6	260	0	39	0	13	1.6	101	7.0	.2	10	34	.1	25	770	316	.80
05S10W22CDC1	02-16-49	15.5	10	579	8.6	213	15	26	0	7.0	2.1	128	11	1.1	11	80	.2	11	100	362	.90
05S10W26CCA1	02-04-49	----	--	525	8.4	217	14	16	0	4.2	1.2	116	13	3.4	13	56	.1	12	70	328	.00
05S10W27DAD1	02-07-49	----	--	675	8.4	250	0	70	0	18	6.1	118	6.1	7.3	11	125	.0	39	100	449	.00
06S09W19CBC1	02-16-49	----	80	460	8.1	168	0	30	0	8.8	2.0	92	7.3	2.4	12	75	.1	43	1,440	321	.90
06S09W29CCC1	02-14-49	18.0	5	609	8.2	239	9	21	0	6.5	1.2	130	12	1.8	12	90	.1	22	170	392	.00
06S10W28BAA1	02-16-49	15.5	50	446	7.7	148	0	54	0	15	4.0	65	3.9	3.8	13	75	.1	43	460	293	.00
07S10W03ABC1	02-16-49	----	30	1,005	8.1	301	0	139	0	41	8.7	-----	----	3.2	17	216	1.0	21	780	---	.00
Ouachita County																					
13S16W08DBB1	04-08-59	19.0	25	210	7.5	114	0	28	0	7.6	2.2	34	2.8	3.6	8.0	2.8	---	----	370	---	1.2
13S16W28ADA1	04-08-59	19.0	5	584	8.0	220	0	28	0	8.3	2.0	122	9.9	3.7	84	.2	---	----	0	---	.20
Union County																					
17S15W28CDC3	11-28-45	----	--	133	6.8	17	0	34	20	7.4	3.8	9.5	0.7	4.4	18	20	0.0	40	440	114	0.10
	02-15-50	----	--	---	---	17	0	14	0	3.4	1.4	5.0	.6	---	5.5	21	.0	20	20	75	10

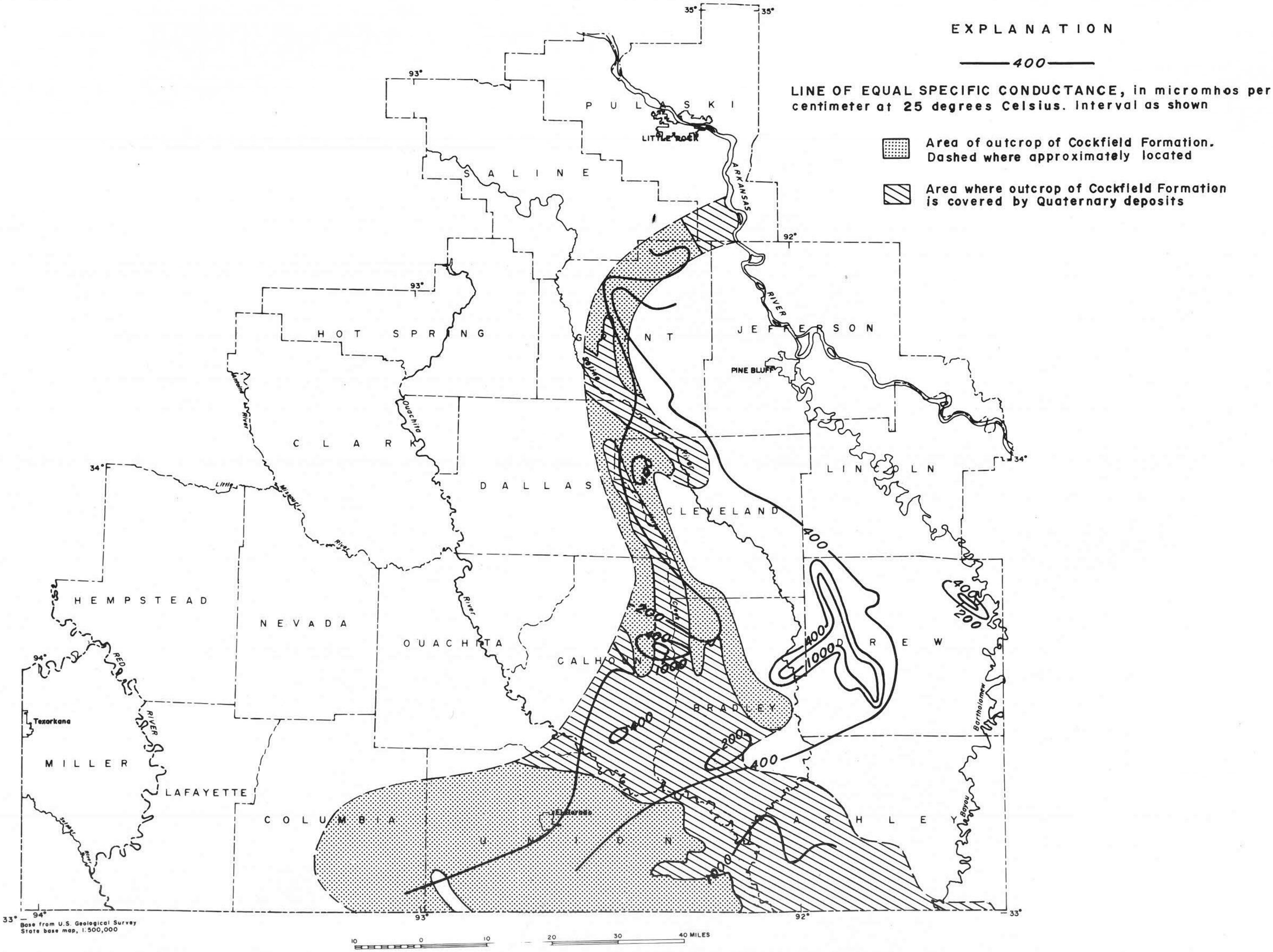


Figure 32.—Specific conductance for the Cockfield Formation.

that do not follow the general trend. Hardness ranges from 3 to 598 mg/L and the average is 54 mg/L. The average pH is 7.5 mg/L and the range in values is from 5.8 to 8.8 mg/L. Bicarbonate ranges from 7 to 428 mg/L and averages about 165 mg/L.

Jackson Group, Undifferentiated

The Jackson Group, undifferentiated, is the uppermost part of the deposits of Eocene age in the project area. It crops out in parts of Grant, Jefferson, Cleveland, Lincoln, Bradley, Drew, and Ashley Counties. The Jackson Group in the project area is a maximum of about 300 ft thick and consists mostly of clay, but it also includes beds of silt, sand, and lignite. The Jackson Group is not an important aquifer in the project area, but it does furnish small amounts of water to domestic wells in Bradley, Cleveland, Drew, Grant, Jefferson, and Lincoln Counties.

The quality of water from the Jackson Group is generally poor. Dissolved solids range from 78 to 5,330 mg/L and average about 852 mg/L (table 48). Average specific conductance is about 839 μmhos and values range from 35 to 5,490 μmho. Hardness ranges from 4 to 2,620 mg/L and averages about 379 mg/L, indicating that water from the Jackson is generally hard. Where large quantities of good-quality water are needed in the outcrop area of the Jackson Group, it is usually necessary to drill a deeper well into the Cockfield Formation or the Sparta Sand.

Deposits of Quaternary Age

The deposits of Quaternary age in the lignite area consist of gravel, sand, silt, and clay. These deposits include alluvium, which underlies the

Table 48.—*Chemical analyses of samples taken from wells tapping the Jackson Group, undifferentiated*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Bradley County																					
12S09W28CAD1	08-14-59	21.5	2	676	7.3	258	0	146	0	37	13	98	3.5	82	15	136	---	----	180	437	3.0
13S10W02BBC1	08-19-59	21.0	0	403	8.0	212	0	153	0	45	9.8	29	1.0	5.5	13	32	---	----	620	239	-----
Cleveland County																					
08S09W10DDB1	11-30-66	----	5	1,422	7.9	297	0	234	0	61	20	226	----	11	55	408	---	23	------	954	3.0
08S10W16BBD1	11-30-66	----	3	172	6.2	8	0	27	26	5.2	3.4	20	----	.6	19	37	---	70	------	160	.40
09S10W17ACC1	09-03-59	----	1	3,320	3.3	0	0	1,500	0	382	133	150	----	21	600	1,030	---	----	------	-----	.20
11S11W05ACC1	11-29-66	----	2	1,410	7.9	248	0	604	384	189	32	82	----	10	45	502	---	28	------	1,010	2.8
Drew County																					
11S06W06AAA1	10-19-54	21.0	5	1,960	6.6	196	0	1,110	945	257	113	52	0.7	14	70	95	1.0	36	------	1,730	1.7
11S06W07CAA1	10-19-54	19.0	7	320	7.6	46	0	89	51	26	5.9	24	1.1	----	20	66	---	----	620	256	10
11S06W08BAD1	10-15-54	19.0	5	2,270	3.3	0	0	1,070	0	25	107	80	1.6	12	18	1,330	---	----	19,000	2,080	.70
11S06W10DBB1	10-18-54	21.0	5	803	4.7	2	0	270	269	59	30	57	1.5	----	16	367	---	----	810	658	.20
11S06W30ABD1	10-20-54	19.0	10	244	7.1	20	0	41	25	8.6	4.8	28	1.9	----	26	42	---	----	350	183	1.2
11S06W30ADB1	10-20-54	----	20	4,360	4.1	0	0	2,080	2,080	461	227	362	3.4	16	310	2,380	2.2	49	7,300	0	3.1
11S07W14BAA1	10-20-53	18.0	--	1,110	6.5	68	0	300	244	-----	-----	-----	----	----	118	282	---	----	120	-----	9.0
11S07W16BAA1	01-04-55	20.0	8	3,240	3.6	0	0	1,700	17	341	206	165	1.7	12	46	2,210	---	----	1,200	2,990	1.7
11S07W25CCA1	10-20-53	19.0	--	508	8.4	304	8	19	0	6.1	.8	-----	----	----	13	1.0	---	----	910	-----	24
12S07W01CBB1	10-21-53	20.0	--	4,300	4.3	0	0	1,040	1,040	-----	-----	-----	----	----	488	1,720	---	----	1,400	-----	7.1
12S07W04BBB1	10-20-53	19.0	--	644	4.1	0	0	158	158	-----	-----	-----	----	----	79	40	---	----	22	-----	128
12S07W04BDD1	10-21-53	21.0	--	3,250	3.7	0	0	1,180	1,180	-----	-----	-----	----	----	282	1,540	---	----	3,700	-----	2.4
12S07W13AAD1	10-15-54	18.0	5	5,490	3.5	0	0	2,620	26	500	333	449	3.8	18	400	3,080	.4	----	14,000	5,330	-------
12S07W15CCB1	10-21-53	----	--	2,250	3.6	0	0	925	925	-----	-----	-----	----	----	50	1,570	---	----	17,000	-----	2.1
12S07W15CDB1	10-21-53	22.0	--	75	6.4	14	0	20	9	-----	-----	-----	----	----	3.5	7.0	---	----	110	-----	10
12S07W25ABC1	01-04-55	17.0	8	980	7.0	19	0	154	138	27	21	83	2.9	63	162	56	---	----	530	617	124
12S07W29DAD1	12-16-54	18.0	5	157	7.3	20	0	32	15	6.5	3.8	16	1.2	----	10	22	---	----	540	104	16
12S07W29DAD2	12-16-54	19.0	7	596	5.4	1	0	110	109	11	20	38	1.6	36	50	54	---	----	150	389	128
12S07W30DBD1	02-09-54	11.0	--	307	7.4	56	0	92	46	-----	-----	-----	----	----	21	69	---	----	670	-----	7.5
13S06W06CDB1	02-02-54	19.0	--	1,060	5.0	2	0	399	39	-----	-----	-----	----	----	32	514	---	----	80	-----	.20
13S06W07CAC1	02-03-54	16.0	--	766	4.0	0	0	250	250	-----	-----	-----	----	----	37	268	---	----	70	-----	17
13S06W17BBB1	12-01-54	19.0	5	859	7.2	32	0	200	174	44	22	74	2.3	----	220	17	---	----	2,400	507	1.8
13S07W16CDB1	02-10-54	13.0	--	171	7.9	57	0	40	0	-----	-----	-----	----	----	10	20	---	----	270	-----	4.5
13S07W21AAC2	10-03-54	----	6	1,110	6.9	8	0	214	208	48	23	121	3.6	----	240	95	---	----	340	577	46
13S07W24BDD1	02-03-54	----	--	1,030	5.5	5	0	317	313	-----	-----	-----	----	----	128	297	---	----	110	-----	10
13S07W28BAB1	02-10-54	17.0	--	43	7.0	10	0	4	0	-----	-----	-----	----	----	6.0	4.0	---	----	90	-----	2.1
Grant County																					
05S12W03ABA1	08-20-65	19.5	3	114	5.1	4	0	17	14	2.6	2.6	13	1.4	1.7	7.1	25	0.0	40	760	99	3.0
Jefferson County																					
04S10W30BDC1	02-17-49	17.0	5	124	7.0	27	0	18	0	4.8	1.4	12	1.2	0.4	18	9.1	0.1	38	100	98	0.00
04S11W11CDB1	05-10-49	----	5	261	6.0	40	0	66	34	18	5.2	14	.7	.2	20	58	.2	100	10	236	.80
06S10W06ABA1	03-28-49	----	5	72	6.8	34	0	4	0	1.3	.2	18	3.9	.1	7.5	3.5	.0	34	150	83	.30
06S10W24BDB1	03-28-49	16.5	10	3,120	4.8	2	0	811	829	196	83	393	5.9	8.8	280	1,260	.6	60	140	2,360	58

Table 48.—*Chemical analyses of samples taken from wells tapping the Jackson Group, undifferentiated*—Continued

Well number	Date of sample	Temper-ature (°C)	Color (plat-inum-cobalt units)	Specif-ic con-duct-ance (µmho)	Ph	Bicar-bonate (HCO_3) (mg/L)	Carbon-ate (CO_3) (mg/L)	Hard-ness as $CaCO_3$ (mg/L)	Non-car-bonate hard-ness (mg/L)	Dis-solved cal-cium (Ca) (mg/L)	Dis-solved magne-sium (Mg) (mg/L)	Dis-solved sodium (Na) (mg/L)	Sodium adsorp-tion ratio	Dis-solved potas-sium (K) (mg/L)	Dis-solved chlo-ride (Cl) (mg/L)	Dis-solved sul-fate (SO_4) (mg/L)	Total fluo-ride (F) (mg/L)	Dis-solved silica (SiO_2) (mg/L)	Dis-solved iron (Fe) (µg/L)	Dis-solved solids (sum of constit-uents) (mg/L)	Dis-solved nitrate (NO_3) (mg/L)
Jefferson County—Continued																					
07S09W03BDD1	02-14-49	----	5	1,120	8.0	302	0	85	0	25	5.5	215	10	2.4	56	243	0.2	25	70	722	0.00
07S09W22ADB1	03-29-49	----	5	1,332	7.0	218	0	178	0	43	17	206	6.7	6.6	100	294	.1	45	200	823	1.4
07S10W22BDD1	05-10-49	----	20	136	5.8	12	0	13	3	2.3	1.7	11	1.3	.7	16	20	.1	51	90	113	1.6
Lincoln County																					
09S07W03CCA1	10-17-56	----	--	275	7.0	16	0	39	26	-----	-----	-----	----	----	101	23	---	----	------	-----	4.5
09S07W03DAA1	10-17-56	----	5	1,260	7.8	272	0	60	0	18	3.5	258	15	----	34	326	---	----	------	-----	5.3
09S07W06BAC1	09-13-56	----	5	461	6.1	56	0	126	80	21	18	35	1.4	----	60	1.4	---	----	80	-----	94
09S07W07DBB1	09-20-56	----	--	459	4.5	0	0	106	10	-----	-----	-----	----	----	20	171	---	----	210	-----	-----
09S07W17CBD1	08-28-56	----	--	223	7.5	46	0	60	22	-----	-----	-----	----	----	10	25	---	----	------	-----	.90
09S07W19ADB1	04-26-56	16.0	10	146	5.5	10	0	19	11	4.1	2.1	15	1.5	6.6	17	24	0.1	3.1	------	78	1.4
09S07W29BAB1	08-28-56	----	5	40	6.1	16	0	10	0	2.1	1.1	2.3	.3	1.8	2.5	1.0	---	----	------	-----	.70
09S07W35ABA1	08-30-56	----	5	35	6.5	6	0	11	6	2.5	1.1	2.7	.4	----	6.0	.6	---	----	------	-----	2.1
09S08W01DDB1	09-18-56	----	--	4,230	3.6	0	0	2,560	2,560	-----	-----	-----	----	----	345	2,360	---	----	------	-----	1.3
09S08W02DAC1	05-16-56	19.0	5	476	6.5	64	0	192	140	44	20	20	.6	----	9.0	170	---	----	------	-----	.40
09S08W05BAB1	11-30-56	----	--	436	7.0	10	0	56	48	-----	-----	-----	----	----	32	138	---	----	------	-----	2.1
09S08W20ACB1	04-26-56	----	5	351	5.2	0	0	61	57	14	6.3	28	1.6	5.8	22	88	.1	12	------	179	2.5
10S06W32CBB1	11-30-56	----	--	394	4.7	1	0	103	102	-----	-----	-----	----	----	28	110	---	----	------	-----	2.1
10S07W07DDC1	08-24-56	----	--	1,070	6.8	132	0	389	281	-----	-----	-----	----	----	52	479	---	----	------	-----	2.3
10S07W08DCC1	08-29-56	----	--	320	7.6	73	0	102	0	-----	-----	-----	----	----	26	42	---	----	------	-----	45
10S07W10CDC1	08-29-56	----	--	160	7.8	58	0	51	3	-----	-----	-----	----	----	11	7.0	---	----	------	-----	4.7
10S07W14BAB1	08-29-56	----	--	201	7.0	5	0	27	23	-----	-----	-----	----	----	36	18	---	----	------	-----	8.0
10S07W17BCC1	08-24-56	----	--	815	7.5	34	0	114	86	-----	-----	-----	----	----	88	85	---	----	------	-----	170
10S08W15CCD1	08-26-56	----	--	4,840	2.9	0	0	2,160	0	-----	-----	-----	----	----	392	2,330	---	----	------	-----	2.0
10S08W18DBC1	11-30-56	----	--	1,100	7.8	51	0	186	144	-----	-----	-----	----	----	150	240	---	----	------	-----	1.9
10S08W27DBA1	11-30-56	----	--	594	5.4	4	0	80	77	-----	-----	-----	----	----	97	100	---	----	------	-----	2.4
10S08W34AAD1	11-30-56	----	--	119	4.7	1	0	19	18	-----	-----	-----	----	----	7.0	18	---	----	------	-----	4.3
10S08W35BDB1	11-30-56	----	--	1,300	7.0	23	0	432	413	-----	-----	-----	----	----	54	565	---	----	------	-----	-----

flood plains of the streams, and terrace deposits, which are older alluvial deposits situated at higher altitudes above the present flood plains. Where present, these deposits are always at the surface; no younger formations overlie them. In many places the terrace deposits are dissected and function as independent aquifers. The locations of terrace and alluvial deposits are shown in figure 33. Figure 34 shows the thickness of the Quaternary deposits in the project area. The terrace deposits are from 0 to more than 100 ft thick and are commonly about 40 ft thick. The alluvial material varies in thickness from one drainage basin to another. Alluvium underlying the Red River flood plain ranges from 0 to 90 ft in thickness. Ouachita River alluvium ranges from 0 to 50 ft thick in most places. Alluvium underlying the Little Missouri River and the Saline River flood plains has a maximum thickness of about 40 ft. Alluvium deposited by smaller streams in the project area is generally less than 25 ft thick and commonly consists mostly of fine-grained material (silts and clays).

A large percentage of the total ground water used in the 20 counties containing the project area in 1975 (312.23 Mgal/d) is pumped from Quaternary aquifers. Most of this water (297.77 Mgal/d in 1975) is pumped from thick alluvial and terrace deposits which are beyond the eastern boundary of the project area. The water pumped outside the project boundary is used in Ashley, Drew, Lincoln, Jefferson, and Pulaski Counties. Less than 20 Mgal/d of water is pumped from Quaternary deposits within the project area. The largest use from the Quaternary aquifers in the lignite area is in Lafayette County (12.19 Mgal/d in 1975) followed by Miller County (1.74 Mgal/d in 1975).

The alluvial aquifer can furnish as much as 1,500 gal/min to properly constructed wells in Miller and Lafayette Counties (Ludwig, 1972), where

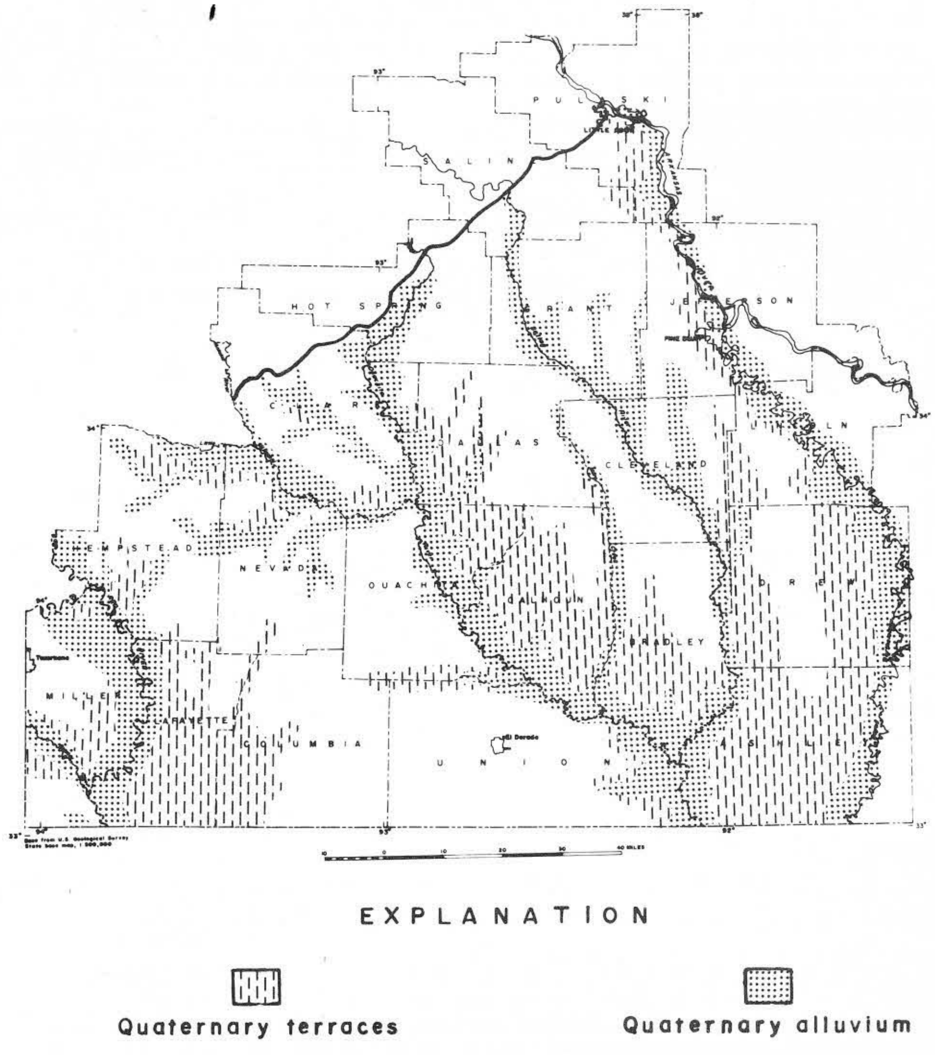


Figure 33.—Distribution of the Quaternary deposits (modified from Boswell and others, 1968).

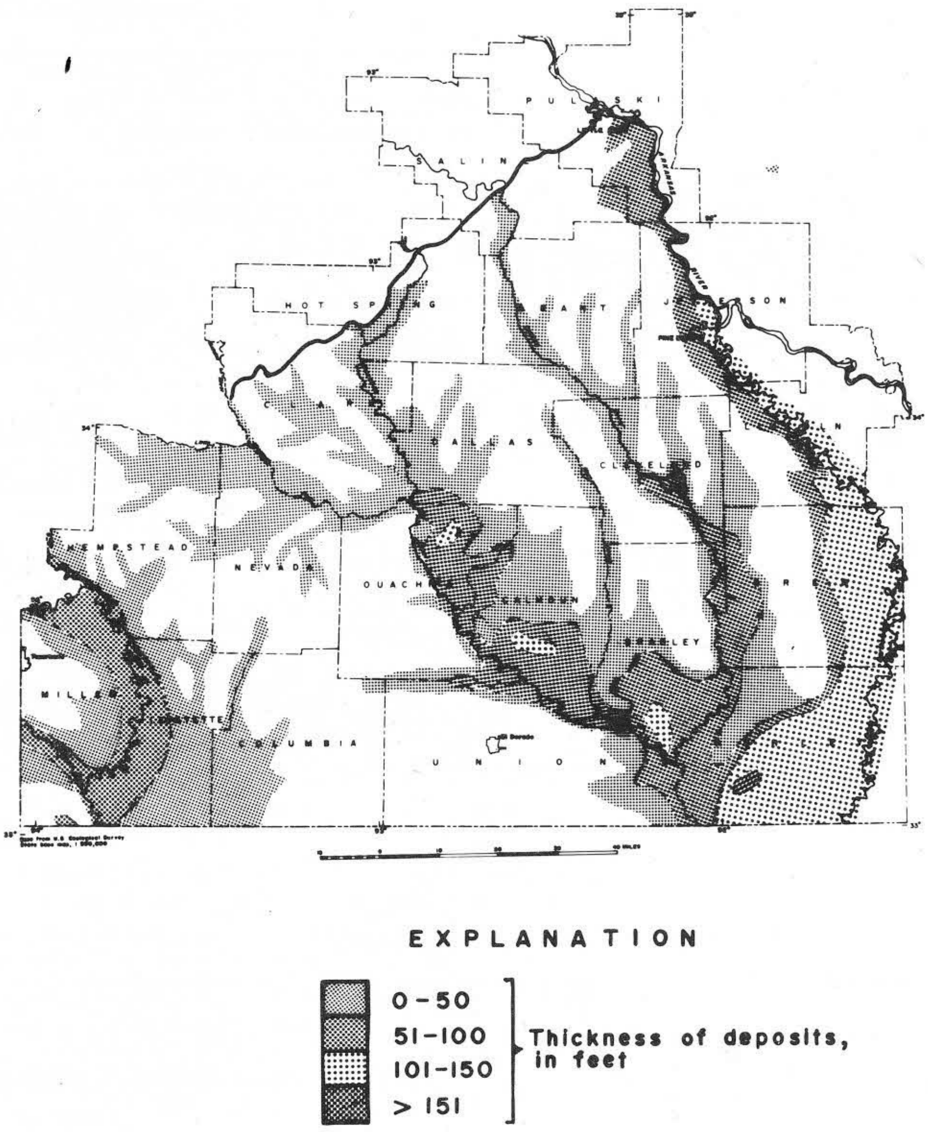


Figure 34.—Thickness of the Quaternary deposits (modified from Boswell and others, 1968).

the alluvium is as much as 90 ft thick. Many large-yielding irrigation wells tap the aquifer in these two counties. Little is known about the maximum yield of the alluvial aquifer in other parts of the lignite area. Yields of 240 gal/min were reported by Plebuch and Hines (1969, p. A29) for wells tapping the alluvium in the Ouachita River flood plain, south of Arkadelphia, in Clark County. Halberg and others (1968, p. 33) reported that the maximum yield of the alluvium in Grant and Hot Spring Counties was probably about 25 gal/min.

In the project area, water from the alluvium is generally moderately to highly mineralized, hard, and contains excessive iron (table 49). For the counties represented in table 49, the range in dissolved solids is 28 to 1,610 mg/L and the average is about 414 mg/L. Figure 35 shows the distribution of dissolved solids in the significant Quaternary aquifers (alluvium and terraces). Specific conductance ranges from 27 to 2,900 μmho and averages 523 μmho. Hardness averages about 158 mg/L and ranges from 6 to 864 mg/L. Dissolved iron concentrations are highly variable from place to place. For the counties represented in table 49, the maximum concentration of dissolved iron (24,000 mg/L) occurs in Drew County.

The only high yields (1,100 gal/min) reported from the terrace deposits have been in Lafayette County (Ludwig, 1972, p. 12). In other parts of the lignite area, the terrace deposits are known to furnish supplies sufficient for only domestic use. The terrace deposits form only a thin surface mantle in many areas of their occurrence and shallow dug and bored wells may tap both the terrace deposits and underlying older formations of Tertiary age.

Table 50 shows the results of the analyses of samples taken from wells tapping terrace deposits in 13 counties in the project area. The average specific conductance is about 345 μmhos and ranges from 21 to 4,130 μmho.

Table 49.—*Chemical analyses of samples taken from wells tapping the alluvium*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Calhoun County																					
15S13W36BAD1	08-06-59	19.5	--	233	7.0	19	0	38	22	-----	----	-----	----	---	34	16	---	----	------	-----	23
15S14W19DCD1	08-05-59	19.5	--	46	6.7	14	0	6	0	-----	----	-----	----	---	7.0	8.0	---	----	------	-----	.70
15S15W11CDB1	08-05-59	21.0	--	88	5.9	12	0	22	12	-----	----	-----	----	---	5.5	20	---	----	------	-----	19
Clark County																					
06S19W30DBB1	06-18-63	17.7	2	291	6.9	27	0	34	12	6.7	4.4	37	----	4.0	48	10	---	16	------	165	26
07S19W20CCD1	01-15-63	19.4	5	1,600	7.4	137	0	476	364	156	21	176	----	3.8	96	591	---	36	------	1,180	.80
	05-27-63	18.8	6	1,460	8.4	124	7	413	300	134	19	162	----	4.2	111	477	---	39	------	1,040	.80
07S19W22CDC1	06-18-63	17.7	11	224	6.6	29	0	54	30	15	4.0	14	----	9.4	20	11	---	11	------	139	40
07S19W31ACD1	05-27-63	17.7	2	720	7.2	331	0	299	28	104	9.5	35	----	2.4	54	26	---	18	------	427	.20
Drew County																					
11S04W02ADC1	08-12-52	18.0	--	573	7.9	341	0	250	0	74	16	34	0.9	2.0	26	2.3	0.2	25	10,000	350	1.6
11S04W24BDD1	02-03-54	18.0	--	495	8.5	256	17	227	0	-----	----	---	----	---	18	5.0	---	----	15,000	-----	.00
11S04W25ADA1	09-24-52	18.0	--	367	8.3	192	2	162	1	-----	----	---	----	---	22	7.0	---	----	24,000	-----	.00
11S05W08CBC1	03-30-54	16.0	--	431	6.5	64	0	82	30	-----	----	---	----	---	82	1.0	---	----	90	-----	15
11S05W27AAD1	10-13-54	20.0	10	117	7.1	50	0	32	0	8.4	2.6	12	.9	---	8.8	4.9	---	----	4,300	107	.50
11S06W34BCC1	03-30-54	18.0	--	290	6.5	8	0	52	45	-----	----	---	----	---	20	87	---	----	240	-----	.50
11S08W09CAB1	02-04-54	----	--	938	6.6	36	0	117	87	-----	----	---	----	---	196	23	---	----	290	-----	120
11S08W15BBD1	01-04-55	16.0	8	1,620	4.7	2	0	707	706	153	79	106	1.7	---	58	812	---	----	330	1,340	4.8
11S08W34ABA1	02-04-54	----	--	557	7.0	29	0	80	56	-----	----	---	----	---	16	105	---	----	360	-----	.39
12S04W18BDA1	10-13-54	----	5	256	7.8	89	0	83	10	22	6.9	18	.9	---	31	6.6	---	----	18,000	180	.40
12S05W01BBA1	10-12-54	----	10	134	8.0	63	0	37	0	8.5	3.9	14	1.0	---	9.0	3.7	---	----	20,000	110	.50
12S05W11CBA1	10-14-54	----	10	185	7.5	108	0	70	0	17	6.6	15	.8	---	9.0	3.1	---	----	13,000	118	7.0
12S06W15CAB1	07-28-53	19.0	10	186	6.5	72	0	37	0	9.5	3.2	21	1.5	1.2	16	3.8	.2	52	570	143	.20
12S06W16AAD1	10-13-54	20.0	7	179	7.7	56	0	37	0	9.7	3.0	21	1.5	---	22	3.5	---	----	190	141	.50
12S06W29DAB1	10-14-54	----	10	237	8.0	105	0	68	0	17	6.1	25	1.3	---	22	6.0	---	----	2,600	178	.40
12S06W31DDC1	02-03-54	11.0	--	130	6.8	10	0	20	12	-----	----	---	----	---	25	22	---	----	560	-----	.21
12S08W09BDB1	02-04-54	----	--	1,260	6.9	21	0	159	142	-----	----	---	----	---	198	130	---	----	3,800	-----	115
12S08W13BAC1	01-03-55	17.0	5	223	6.5	3	0	37	34	5.6	5.5	23	1.7	---	46	7.0	---	----	470	136	15
12S08W19ABC1	02-04-54	15.0	--	238	7.3	--	0	31	0	-----	----	---	----	---	38	23	---	----	60	-----	6.0
13S05W28BDB1	02-03-54	----	--	280	7.0	29	0	55	31	-----	----	---	----	---	16	22	---	----	520	-----	12
13S06W04BCB1	10-26-54	----	6	172	7.9	70	0	50	0	12	5.0	15	.9	---	17	2.0	---	----	310	142	1.3
13S06W12BBD1	02-03-54	17.0	--	824	6.5	28	0	117	94	-----	----	---	----	---	232	5.0	---	----	430	-----	1.5
13S06W21BBB1	07-28-53	19.0	4	323	6.9	166	0	108	0	31	7.4	29	1.2	1.6	14	11	.2	50	2,200	228	.30
13S08W06ADA1	12-16-54	----	10	155	7.1	10	0	22	14	3.2	3.5	18	1.7	---	18	17	---	----	1,100	119	5.6
13S08W10CBC1	03-29-54	18.0	--	587	6.8	--	0	88	74	-----	----	---	----	---	89	1.0	---	----	2,300	-----	76
13S08W16DAD1	02-04-54	16.0	--	307	7.4	39	0	63	31	-----	----	---	----	---	44	2.0	---	----	40	-----	40
13S08W19BAA1	12-15-54	19.0	5	281	8.2	108	0	12	0	2.3	1.4	54	6.9	---	22	3.0	---	----	2,700	281	8.0
13S08W23ADB1	02-09-54	----	--	355	5.7	4	0	78	75	-----	----	---	----	---	40	20	---	----	80	-----	75
13S08W33BCC1	03-29-54	17.0	--	185	6.7	11	0	17	8	-----	----	---	----	---	32	1.0	---	----	130	-----	2.4
13S08W35CBC2	09-09-54	18.0	5	453	7.3	23	0	74	55	17	7.7	58	2.9	---	48	108	---	----	5,700	314	3.1
14S05W12ABC1	10-26-54	----	6	220	7.9	68	0	58	2	14	5.5	19	1.1	---	32	2.0	---	----	7,200	107	1.3
14S05W20BAD1	12-02-54	19.0	6	445	7.4	34	0	125	97	32	11	28	1.1	---	112	2.0	---	----	4,200	263	2.4
14S06W16CDC1	12-01-54	18.0	5	320	7.6	163	0	90	0	22	8.6	34	1.6	---	20	2.0	---	----	23,000	167	.30
14S07W06ACC1	12-15-54	----	15	46	6.7	5	0	11	7	.9	2.2	2.2	.3	2.1	5.0	5.0	---	----	1	28	3.5

Table 49.—*Chemical analyses of samples taken from wells tapping the alluvium*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Drew County—Continued																					
14S07W18ABD1	02-10-54	17.0	--	267	6.8	13	0	33	22	-----	----	-----	----	---	29	42	---	----	1,200	-----	16
14S07W18CBB1	12-14-54	--	10	32	6.8	6	0	8	3	0.9	1.3	3.4	0.5	---	4.5	3.0	---	----	250	50	2.3
14S08W09ABA1	02-04-54	15.0	--	353	7.1	21	0	31	14	-----	----	-----	----	---	59	10	---	----	90	-----	14
14S08W22BBA1	12-07-54	17.0	5	2,900	7.3	44	0	190	154	45	19	486	15	---	845	7.0	---	----	2,100	1,430	2.6
14S08W29AAA1	02-04-54	17.0	--	514	7.0	34	0	46	18	-----	----	-----	----	---	117	3.0	---	----	200	-----	16
Grant County																					
05S15W05ABB1	06-21-63	19.0	1	103	6.8	5	0	16	12	1.4	3.2	11	1.2	1.3	21	2.2	0.1	15	30	66	8.8
05S15W05ABB2	10-13-54	----	--	-----	---	--	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	45
Hempstead County																					
10S24W14DDD2	04-05-51	----	--	124	7.7	30	0	38	13	-----	----	-----	----	---	7.0	5.0	---	----	-----	-----	6.6
Hot Spring County																					
04S16W09BBB1	06-16-64	19.0	10	189	8.2	105	0	49	0	16	2.2	20	1.2	4.2	3.5	8.6	0.2	25	1,100	132	.00
04S17W29DCB1	06-25-63	17.0	4	132	6.9	7	0	36	30	2.1	7.5	8.0	.6	1.0	16	5.0	.1	16	80	86	27
06S18W02CBD1	05-03-63	17.0	3	63	6.9	6	0	14	10	2.9	1.8	4.5	.5	1.5	6.2	3.8	.1	9.6	610	46	12
	04-16-64	15.5	5	74	5.9	6	0	19	14	4.3	2.1	5.4	.5	1.2	9.0	5.6	.0	11	540	54	12
06S18W03AAC1	09-22-64	22.0	--	335	7.3	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	14
06S18W03ACC1	09-22-64	20.0	--	328	6.8	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	49
06S18W03ACD1	09-21-64	21.0	--	94	6.0	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	23
06S18W03ADB1	09-21-64	18.5	--	298	7.2	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	45
	09-22-64	21.0	--	180	7.2	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	27
06S18W03ADC1	09-22-64	19.5	--	124	7.4	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	12
06S18W03ADD1	09-22-64	19.0	--	94	6.9	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	5.0
06S18W03BDD1	11-06-64	----	--	209	5.8	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	20
06S18W03DAA1	09-23-64	21.5	--	125	7.7	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	14
06S18W03DBA1	09-23-64	20.5	--	27	6.6	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	5.1
06S18W03DBA2	09-23-64	20.5	--	108	7.0	---	--	---	---	-----	----	-----	----	---	-----	----	---	----	-----	-----	23
06S18W03DBC1	05-02-63	16.5	5	176	6.7	6	0	34	30	7.3	4.0	17	1.3	1.4	27	.1	.1	12	580	108	36
	04-16-64	16.0	5	166	5.7	5	0	31	27	7.3	3.2	16	1.2	1.2	20	.4	.0	13	230	106	42
Miller County																					
14S28W14CBD2	08-09-51	----	--	714	8.1	328	--	349	---	-----	----	-----	----	---	7.2	30	---	----	-----	-----	9.6
15S26W26DCC1	06-16-53	18.0	--	1,840	7.9	418	0	654	---	-----	----	-----	----	---	226	328	---	----	-----	-----	.00
15S26W35AAB1	06-16-53	----	--	2,130	7.9	480	0	787	393	-----	----	-----	----	---	300	387	---	----	-----	-----	.00
15S27W12BCB1	02-27068	18.0	4	600	7.7	448	0	378	10	97	33	16	----	1.1	11	34	---	22	-----	440	.40
16S26W22AAA1	03-14-68	----	4	2,660	4.2	0	0	864	864	232	69	202	----	9.4	625	446	---	21	-----	1,610	1.4
18S26W29CBC1	03-08-68	18.0	2	374	7.9	206	0	80	0	24	4.7	55	----	2.2	19	.6	---	9.6	-----	217	.40

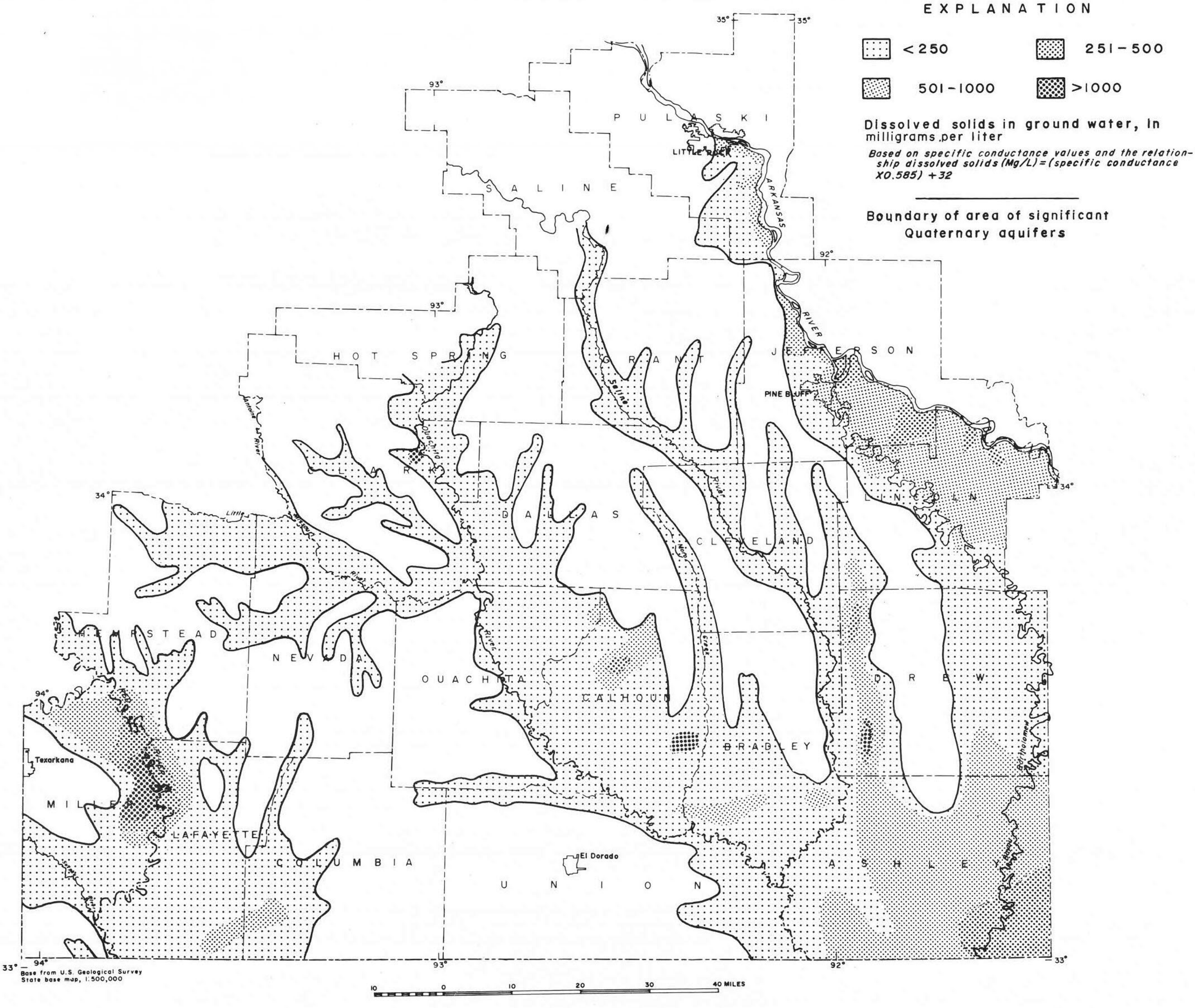


Figure 35.—Distribution of dissolved solids in the Quaternary aquifers (modified from Boswell and others, 1968).

Table 50.—*Chemical analyses of samples taken from wells tapping terrace deposits of Quaternary age*

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (µmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (µg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
Ashley County																					
18S08W16BBC1	01-20-47	----	--	178	6.5	59	0	53	5	11	6.2	13	0.8	1.2	20	5.1	0.1	51	0	147	1.0
18S08W16BCD1	11-12-46	----	--	289	7.0	93	0	81	5	20	7.5	31	1.5	1.8	48	4.7	.1	----	20	---	.80
18S08W21BDB1	02-07-47	18.0	--	269	6.8	141	0	79	0	18	8.4	38	1.9	2.2	31	4.4	.1	46	80	212	.20
Calhoun County																					
11S12W19ADC1	08-04-59	19.5	--	63	5.4	6	0	11	6	----	----	----	---	----	7.0	2.0	---	----	-----	---	10
11S14W07DDD1	08-05-59	18.0	--	493	6.2	9	0	95	88	----	----	----	---	----	122	23	---	----	-----	---	2.8
11S14W30CCD1	08-05-59	22.0	--	75	6.8	20	0	13	0	----	----	----	---	----	7.0	1.0	---	----	-----	---	2.4
11S14W33BBD1	08-05-59	18.0	--	123	6.9	32	0	42	16	----	----	----	---	----	16	1.0	---	----	-----	---	11
12S12W08DAC1	08-04-59	20.0	--	196	6.3	96	0	58	0	----	----	----	---	----	16	1.0	---	----	-----	---	1.7
12S12W33CBB1	08-04-59	23.0	--	120	6.0	30	0	24	0	----	----	----	---	----	4.5	12	---	----	-----	---	5.8
12S13W03DBA1	08-04-59	21.0	--	709	5.4	6	0	99	94	----	----	----	---	----	27	99	---	----	-----	---	150
12S13W35CDB1	08-04-59	18.5	--	245	5.8	20	0	76	60	----	----	----	---	----	17	2.0	---	----	-----	---	66
12S14W08BAA1	11-03-59	18.5	--	89	6.4	22	0	15	0	----	----	----	---	----	3.0	2.0	---	----	-----	---	6.7
12S14W29DCC1	11-03-59	----	--	1,620	4.5	0	0	218	218	----	----	----	---	----	270	2.0	---	----	-----	---	198
12S15W15ABA1	11-03-59	----	--	53	6.8	20	0	14	0	----	----	----	---	----	2.5	1.0	---	----	-----	---	2.7
12S15W33BDD1	11-03-59	----	--	107	6.7	8	0	9	2	----	----	----	---	----	5.0	12	---	----	-----	---	1.6
13S12W29BDD1	08-04-59	18.0	--	447	5.2	14	0	75	64	----	----	----	---	----	37	16	---	----	-----	---	146
13S13W10DCD1	08-04-59	20.5	--	317	6.1	30	0	17	0	----	----	----	---	----	53	9.0	---	----	-----	---	30
13S13W19ADD1	08-05-59	19.0	--	85	6.2	22	0	64	46	----	----	----	---	----	6.0	1.0	---	----	-----	---	12
13S14W09BBA1	08-04-59	19.5	--	500	5.6	6	0	57	52	----	----	----	---	----	42	5.0	---	----	-----	---	108
13S14W23BAC1	08-05-59	23.0	--	222	7.9	118	0	108	11	----	----	----	---	----	7.0	2.0	---	----	-----	---	16
13S16W13ADC1	11-03-59	17.0	--	78	5.3	4	0	20	17	----	----	----	---	----	5.5	18	---	----	-----	---	8.4
14S12W05DDB1	08-04-59	19.5	--	73	5.6	14	0	17	6	----	----	----	---	----	10	3.0	---	----	-----	---	5.5
14S12W21BBB1	08-06-59	20.5	--	105	6.9	19	0	34	18	----	----	----	---	----	10	1.0	---	----	-----	---	20
14S12W28CBB1	08-06-59	19.0	--	220	7.7	113	0	50	0	----	----	----	---	----	34	1.0	---	----	-----	---	52
14S13W03BDB1	08-06-59	20.0	--	257	7.1	28	0	40	17	----	----	----	---	----	32	10	---	----	-----	---	54
14S13W11DAA1	08-04-59	18.5	--	4,130	4.5	25	0	399	399	----	----	----	---	----	1,190	68	---	----	-----	---	95
14S13W29DDD1	08-05-59	18.5	--	645	5.1	2	0	67	65	----	----	----	---	----	118	11	---	----	-----	---	102
14S14W06BBB1	08-06-59	20.5	--	90	7.0	25	0	28	8	----	----	----	---	----	8.0	1.0	---	----	-----	---	13
14S14W15CAC1	08-05-59	21.5	--	80	6.4	8	0	9	2	----	----	----	---	----	9.0	2.0	---	----	-----	---	6.6
14S15W04BCC1	08-06-59	20.5	--	241	7.9	118	0	99	2	----	----	----	---	----	20	2.0	---	----	-----	---	3.6
14S15W14CDA1	08-06-59	22.0	--	70	6.7	7	0	10	4	----	----	----	---	----	14	1.0	---	----	-----	---	5.2
14S15W29ADA1	08-05-59	19.5	--	216	7.0	48	0	68	29	----	----	----	---	----	16	11	---	----	-----	---	37
15S13W07ABA1	08-06-59	19.0	--	143	6.6	6	0	26	21	----	----	----	---	----	22	12	---	----	-----	---	20
15S13W09DCB2	08-06-59	18.5	--	104	7.3	39	0	19	0	----	----	----	---	----	4.0	13	---	----	-----	---	6.8
16S13W14DDA1	08-06-59	18.0	--	374	6.0	26	0	60	39	----	----	----	---	----	84	3.0	---	----	-----	---	.50
11S13W11ACA1	08-04-59	20.0	--	177	5.3	6	0	40	35	----	----	----	---	-----	16	1.0	---	----	10	---	56
Cleveland County																					
11S09W36CDA1	08-04-59	20.0	--	153	6.4	22	0	25	7	----	----	----	---	----	15	21	---	----	------	---	17
Columbia County																					
19S23W13CCB1	10-13-50	20.0	--	669	7.2	328	0	266	0	59	29	47	1.3	3.3	60	----	0.0	18	40	---	0.60
Dallas County																					
08S17W18BCA1	06-18-63	17.7	4	102	6.8	8	0	22	15	3.2	3.3	8.4	----	2.1	15	0.0	---	9.8	-----	64	18

Table 50.—*Chemical analyses of samples taken from wells tapping terrace deposits of Quaternary age*—Continued

Well number	Date of sample	Temperature (°C)	Color (platinum-cobalt units)	Specific conductance (μmho)	Ph	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hardness as $CaCO_3$ (mg/L)	Noncarbonate hardness (mg/L)	Dissolved calcium (Ca) (mg/L)	Dissolved magnesium (Mg) (mg/L)	Dissolved sodium (Na) (mg/L)	Sodium adsorption ratio	Dissolved potassium (K) (mg/L)	Dissolved chloride (Cl) (mg/L)	Dissolved sulfate (SO_4) (mg/L)	Total fluoride (F) (mg/L)	Dissolved silica (SiO_2) (mg/L)	Dissolved iron (Fe) (μg/L)	Dissolved solids (sum of constituents) (mg/L)	Dissolved nitrate (NO_3) (mg/L)
										Drew County											
13S07W02ACC1	02-03-54	16.0	--	201	6.9	16	0	54	41	----	----	----	----	----	19	1.0	---	----	200	---	43
13S07W02BAC1	02-03-54	19.0	--	352	6.7	6	0	52	47	----	----	----	----	----	83	2.0	---	----	290	---	16
										Grant County											
05S15W08ABA2	04-16-64	16.0	5	21	5.8	10	0	19	11	3.3	2.7	13	1.3	1.5	20	16	0.0	----	3,600	90	0.20
										Hot Spring County											
06S19W11DBA1	05-11-64	----	1	49	4.9	2	0	4	3	0.6	0.8	4.3	0.9	1.8	6.0	0.0	0.1	21	50	47	11
										Jefferson County											
05S09W19BAB1	03-28-49	----	10	298	5.7	4	0	29	26	8.0	2.3	41	3.3	0.2	78	6.5	0.0	43	230	182	0.20
06S09W05DDD1	02-16-49	18.5	5	409	6.7	86	0	63	0	14	6.7	57	3.1	1.2	74	17	.2	53	220	266	.00
										Lafayette County											
16S25W13CCC1	01-08-55	----	7	640	8.0	242	0	268	0	68	24	30	0.8	----	59	45	---	----	0	---	0.60
19S24W25DDD1	02-29-68	----	4	567	8.6	344	20	370	38	94	28	19	---	0.7	32	23	---	19	---	406	.10
19S26W24DDD1	03-07-68	18.0	5	286	8.1	132	0	78	0	6.7	15	17	---	1.2	8.0	.0	---	2.3	---	117	.00
20S23W04BDA1	02-29-68	15.0	3	200	7.1	88	0	72	0	17	7.0	15	---	1.2	18	3.0	---	35	---	146	.00
										Lincoln County											
08S08W12DAA1	11-30-56	----	--	329	8.0	84	0	25	0	----	----	----	---	----	20	17	---	----	---	---	34
08S08W29ABB1	11-30-56	----	--	686	8.2	142	0	113	0	----	----	----	---	----	75	85	---	----	0	---	20
09S08W01DDA1	09-18-56	----	--	200	6.5	25	--	42	22	----	----	----	---	----	16	16	---	----	---	---	9.6
09S08W25AAC1	04-26-56	18.0	5	400	5.2	4	0	52	49	2.7	11	47	2.8	4.0	72	5.2	0.2	1.5	---	210	65
10S06W11CDB1	11-30-56	----	--	383	7.0	28	0	122	99	----	----	----	---	----	84	2.0	---	----	---	---	16
10S06W16DDC1	11-30-56	----	--	163	7.4	32	0	19	0	----	----	----	---	----	25	2.0	---	----	---	---	8.6
10S06W23CDA1	04-27-56	18.0	5	441	5.4	7	0	97	92	16	14	32	1.4	12	41	23	.1	4.8	---	263	117
10S07W11CCA1	08-29-56	----	--	136	6.5	6	0	33	28	----	----	----	---	----	18	12	---	----	---	---	18
10S07W19DBB1	08-23-56	----	--	72	6.8	8	0	14	7	----	----	----	---	----	8.0	2.0	---	----	---	---	16
10S07W30BBB1	08-24-56	----	--	289	7.0	10	0	54	46	----	----	----	---	----	62	17	---	----	---	---	------
10S08W05CBC3	10-04-56	----	10	357	6.1	5	0	56	52	9.4	7.9	38	2.2	14	42	13	---	----	---	---	96
10S08W14AAC1	08-23-56	----	--	571	4.3	0	0	49	49	----	----	----	---	----	83	15	---	----	---	---	68
10S08W16ABC1	11-30-56	----	--	170	4.5	0	0	27	27	----	----	----	---	----	26	3.0	---	----	---	---	23
10S08W20BDA1	11-07-56	----	--	275	7.6	41	0	72	38	----	----	----	---	----	37	1.0	---	----	---	---	14
										Ouachita County											
11S15W25CCB1	08-19-59	20.5	--	362	7.6	98	0	85	5	----	----	----	---	----	54	5.0	---	----	---	---	16
11S16W12CCC1	08-19-59	23.0	--	96	7.0	46	0	32	0	----	----	----	---	----	5.0	1.0	---	----	---	---	3.1
11S17W35ABD1	08-12-59	20.5	--	202	6.1	17	0	32	18	----	----	----	---	----	51	1.0	---	----	---	---	3.6
12S15WW08ACA1	11-03-59	18.5	--	281	7.3	129	0	--	53	----	----	----	---	----	12	3.0	---	----	---	---	2.3

Dissolved solids range from 47 to 406 mg/L and average about 179 mg/L. Hardness averages 70.9 mg/L and ranges from 4 to 399 mg/L. The pH averages about 6.59 and ranges from 4.3 to 8.6.

IMPACT OF LIGNITE DEVELOPMENT

The development of lignite resources in south Arkansas could have a variety of effects on available water resources. Direct effects will result from the mining activity, processing and conversion of the lignite, and land reclamation. Indirect effects will be related to population growth, increased public services, and expansion of commercial activities in the area.

An in-depth analysis of direct and indirect effects of lignite development is beyond the scope of this report. However, the reader should be aware of both types of effects because each will cause impacts on local and regional water resources in terms of quantity and quality. The following is an overview of the possible direct effects of lignite development.

The direct effects of lignite development include not only the obvious changes in the physical features of the land, but also changes in the hydrologic environment. The quantity and quality of surface and ground water can be affected.

Before mining can begin, the area where a pit is to be located and the perimeter area must be dewatered. This is generally done by using galleries of dewatering wells around the perimeter and a grid network of wells over the pit area. The dewatering directly affects the quantity and quality of surface and ground water.

In the project area, lignite generally is found in or near the outcrop areas of the Tertiary aquifers. (See figures 17, 21, 25, and 29.) In many places, large parts of these outcrop areas are covered by alluvial or terrace deposits of Quaternary age. Therefore, the mine excavations will, in some areas, cut through one or more shallow aquifers as well as significantly incise the Tertiary outcrop. Dewatering of these aquifers in the area of mining will probably have varying effects upon the ground-water regime, depend- on the local hydrologic characteristics of the aquifers. The shallow Quatern- ary deposits, which are disconnected and function independently in many places, may be virtually "dried up" locally. This would affect primarily household supplies in the immediate area which might be tapping that aquifer. The dewatering of parts of the outcrop areas of the Tertiary aquifers will reduce water levels updip and downdip from the excavation sites. Updip water users may experience a continuing drop in water levels until eventually their wells may "dry up" and deeper wells may have to be drilled. Downdip, the effects could be equally or more severe.

When making plans for dewatering at a site in preparation for strip min- ing, the depth below land surface, and the thickness, of the saturated zone are of primary interest. In the outcrop areas of the Tertiary aquifers, water- table (unconfined) conditions exist and the saturated zone is nearer to the land surface than in areas where the aquifers are confined. Dewatering a portion of a Tertiary outcrop will require the pumpage of substantial quantities of water and could cause significant changes in water levels updip and downdip from the excavation site.

The most extensive and productive aquifers in the project area are the Cockfield Formation and the Sparta Sand. The outcrop areas of these aquifers are quite large (figs. 25 and 29) and contain most of the potential lignite strip-mining sites (fig. 4) in the area. Figure 36 shows the saturated thickness of material in in the outcrop areas of the Cockfield Formation and the Sparta Sand. An estimate of the depth at which the saturated zone will be encountered can be made by subtracting the altitude of the potentiometric surface (water-table in outcrop area) (figs. 27 and 31) from the land-surface altitude (plate 1).

For example, at site A (plate 1) the land-surface altitude is approximately 200 ft. The altitude of the water table (fig. 31) in the Cockfield Formation at this site is 150 ft. The depth to the saturated zone is therefore approximately 50 ft. The saturated thickness of the Cockfield at this site is approximately 300 ft (fig. 36). Therefore, if an excavation 150 ft deep is planned, approximately 100 ft of saturated material will have to be dewatered.

The land-surface contours on the map on plate 1 are rather coarse. However, reasonable estimates of depth to the saturated zone can be obtained by using them. Better estimates can be determined by obtaining more accurate land-surface altitudes.

Dewatering also stresses the surface-water regime. Changes in both quantity and quality may occur as a result of dewatering. Water discharged from the dewatering wells, and "mine water" pumped from the mines after excavation begins, must be disposed of. The most obvious receptacles will be local streams. Downstream from a mining area, receiving streams will experience increased flows that are directly proportional to the quantities of ground water that is necessary to pump for dewatering. The discharged ground water will also affect the quality of the stream. This change in quality will present no problem if the quality of the ground water is as

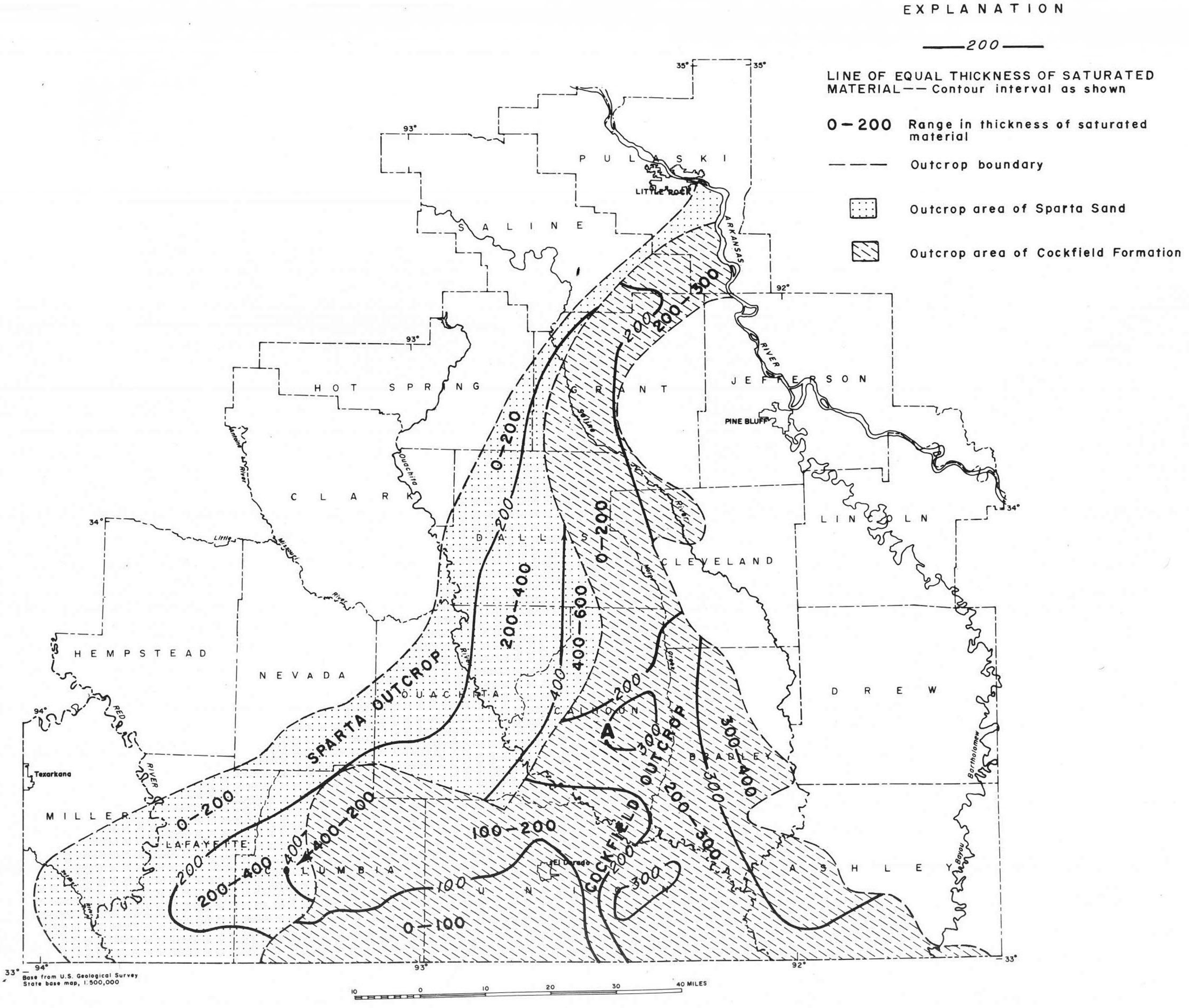


Figure 36.—Saturated thickness of the Sparta Sand and Cockfield Formation in outcrop areas.

good or better than the water in the receiving streams. However, although by existing standards the quality of water in the streams may not be reduced, the character of the water may be altered somewhat. In some local areas, within the project area, near oil wells and associated saltwater pits, shallow wells are no longer used because of deterioration of water quality. "Chloride concentrations of as much as 46,250 mg/L have been found in the alluvium near Garland City in Miller County. The high chloride content of the water in the alluvial aquifer has made ground water in this area unsuitable for irrigation. The contamination is associated with oil-field activity in the area and is related directly to effluent seepage from brine-storage pits, some of which have been in use for as long as 30 years" (Ludwig, 1972). It would be wise to sample the shallow ground water at each mine site before development and select the best method for disposal if it shows poor quality.

When mining actually begins at a site, it may be necessary to divert certain streams in order to maintain the integrity of existing surface-drainage systems. These diversions, coupled with earth-moving activities associated with the mine excavation, will cause increased sediment loads in the streams unless controlled on the mining site. Greatly increased sediment loads could impact severely upon streambed biota. In most of the streams in the project area the habitat for benthic organisms is generally good (Arkansas Department of Pollution Control and Ecology, 1976 and 1977). A significant increase in sediment concentration in a stream over an extended period of time could reduce the variety of benthic organisms by virtually "silting up" existing habitat. This in turn would reduce the available food supply for larger aquatic life. Figure 7 shows the locations of stations where sampling for benthic organisms and sediment is continuing. In addition, plans are being made to establish other sampling sites as necessary through the mining period in order to monitor any changes that may occur.

When processing the lignite as it is removed, water will probably be used for ore-dust control when hauling, handling, and crushing the lignite, and for washing it to lower the ash and sulphur content. Road dust can be controlled in the mine area and on the haul roads by wetting these areas. A conservative estimate of water requirements can be made by assuming that roads and mine areas are kept wet through the deposition of water equal to the net annual-evaporation rate (Argonne National Laboratories, 1977). The average annual lake evaporation rate in the project area ranges from 46 in. in the southwest to 43 in. in the northeast. Dust can also be a problem during loading, unloading, and crushing the lignite. Generally, application of a water spray is the best means of preventing the dust from becoming airborne. Available data indicate that a consumptive use of 1 pound of water for every 50 pounds of ore handled and crushed is a reasonable estimate (Argonne National Laboratories, 1977). Washing requires about 1,500 to 2,000 gallons of water per ton of ore processed. However, about 80 percent of this water is recirculated.

Because lignite has a low heating value and a high moisture content, transporting it for long distances is not economical. Accordingly, the lignite will probably be utilized in near mine-mouth operations. In the case of a mine-mouth steam-electric generating plant, about 50 percent of the energy generated is expended in waste heat. Removal of this waste heat generally requires water for cooling purposes. Some of the lignite could be converted to gas or oil. The gasification and liquification procedures require water for processing and cooling.

There are two basic methods which require water for removing waste heat from steam-electric powerplants: once-through and evaporative cooling. In once-through cooling, the excess heat is transferred from the steam to water which has been withdrawn from a large body of water. The heated water is then returned to its source where it is diluted and the heat dissipated. This cooling method requires withdrawal of large amounts of water and is used only where adequate surface-water flows are available. For streams that are considered as a source of cooling water and as recipients for plant discharge, the 7-day, 10-year low flow must be three times the amount required for withdrawal (Argonne National Laboratory, 1977). The Red and Ouachita Rivers are the only streams within the project area that could be considered as sources of water for a once-through cooling system. Consumption of water for plants using the once-through cooling system is 0.011-0.018 (ft^3/s)/MWe (megawatts of electricity) (Argonne National Laboratory, 1977).

In using evaporative cooling, excess heat is transferred to water which is then exposed to the air so that most of the heat is dissipated as some of the water evaporates. Cooling ponds or cooling towers may be used in evaporative cooling. Use of cooling ponds involves taking water from natural or artificial ponds, circulating it through the condenser and returning it to the ponds. When using a cooling tower, the heated water is cooled by the forced circulation of air through a falling spray of water. These methods require withdrawal of water from streams, reservoirs or ground-water sources to replace evaporation and spray drift losses. There should be adequate quantities of ground water available for this purpose almost anywhere in the project area. Water consumption by powerplants is 0.018-0.026 (ft^3/s)/MWe for plants using cooling towers, and 0.022-0.037 (ft^3/s)/MWe for those using cooling ponds (Argonne National Laboratory, 1977).

In the gasification and liquification processes, water is used in processing and cooling. In processing, water is used to generate steam and supply hydrogen for the reaction, and for quenching and sluicing and control of air pollution. Many of the conversion reactions are highly exothermic, therefore, extensive process cooling is required. A gasification plant generating 250 million scf/day (standard cubic feet per day) of gas will require approximately 8-24 ft^3/s of water. A gasification plant of this size or a liquification plant producing 100,000 barrels of oil per day will consume approximately 19 ft^3/s of water (Argonne National Laboratories, 1977).

During reclamation, return of the overburden to the pits should be done as carefully as possible in order to restore, as nearly as possible, the integrity of the aquifers that have been disturbed. On properly reclaimed lands, infiltration and ground-water movement in the area will eventually approximate premining conditions. Streams diverted during mining should be rechanneled across the mine fill and premining gradients approximated as closely as possible. Postmining flows in such streams may differ somewhat due to changes in the ground-water/surface-water relationship throughout the mine area and that area in the perimeter affected by dewatering. The direction of water movement and (or) the quantity of water moving between stream and aquifer may differ after reclamation.

Soil stabilization plant cover should be established over the mine fill. This should be done immediately after filling the excavations in order to minimize erosion and avoid excessive sediment transport. Studies have concluded that strip-mined areas having greater than 10 in. of mean annual precipitation can be reclaimed without supplemental irrigation (Argonne National Laboratories, 1977). Mean annual precipitation for the project area is 48-52 in., so no supplemental water for irrigation of plant cover should be necessary.

SUMMARY AND RECOMMENDATIONS

Both water and lignite are important resources in south-central Arkansas. Removal and utilization of the lignite will undoubtedly have impacts upon the water resources. In order to effectively assess the significance of these impacts, existing baseline hydrologic conditions have been defined. Much of the information presented represents a compilation of data that is available as a result of previous water-resources investigations in the area. Data currently being collected in the project area are being added to the data base to more clearly define existing conditions.

Using data presented in this report as primary input, a digital model will be used to predict the effects of mining upon the ground-water regime. Various scenarios will be analyzed at each proposed mining site (fig. 7) to determine the drawdown necessary for dewatering, the quantities of water that will have to be pumped to maintain desired drawdown, and the distance from the excavation sites that cones of depression will significantly affect water levels.

Collection of data should continue at its current level in the project area for a minimum of 3 years. Flow duration, flood frequency, and low-flow frequency are already determined for the major streams. However, sediment transport and stream biota should be well defined in the area before mining begins. Also, seasonal ground-water fluctuations and local water-level patterns should be defined. Ground-water samples should be collected in the proposed mining areas to check the quality of water in the formations that are likely to be disturbed. A skeleton data-collection network should be maintained throughout the mining period to monitor changes as they occur. These data could be used to check the accuracy of long-term predictions and identify unforeseen problems. Early detection of problems in the hydrologic environment is vital to proper and timely corrective action.

Lignite is a very valuable resource for Arkansas. Aside from its obvious asset as an energy source, the mining and associated activity could be a stimulus upon the economy of the south-central part of the State. However, care should be taken that in utilizing one resource, irreversible damage is not done to another.

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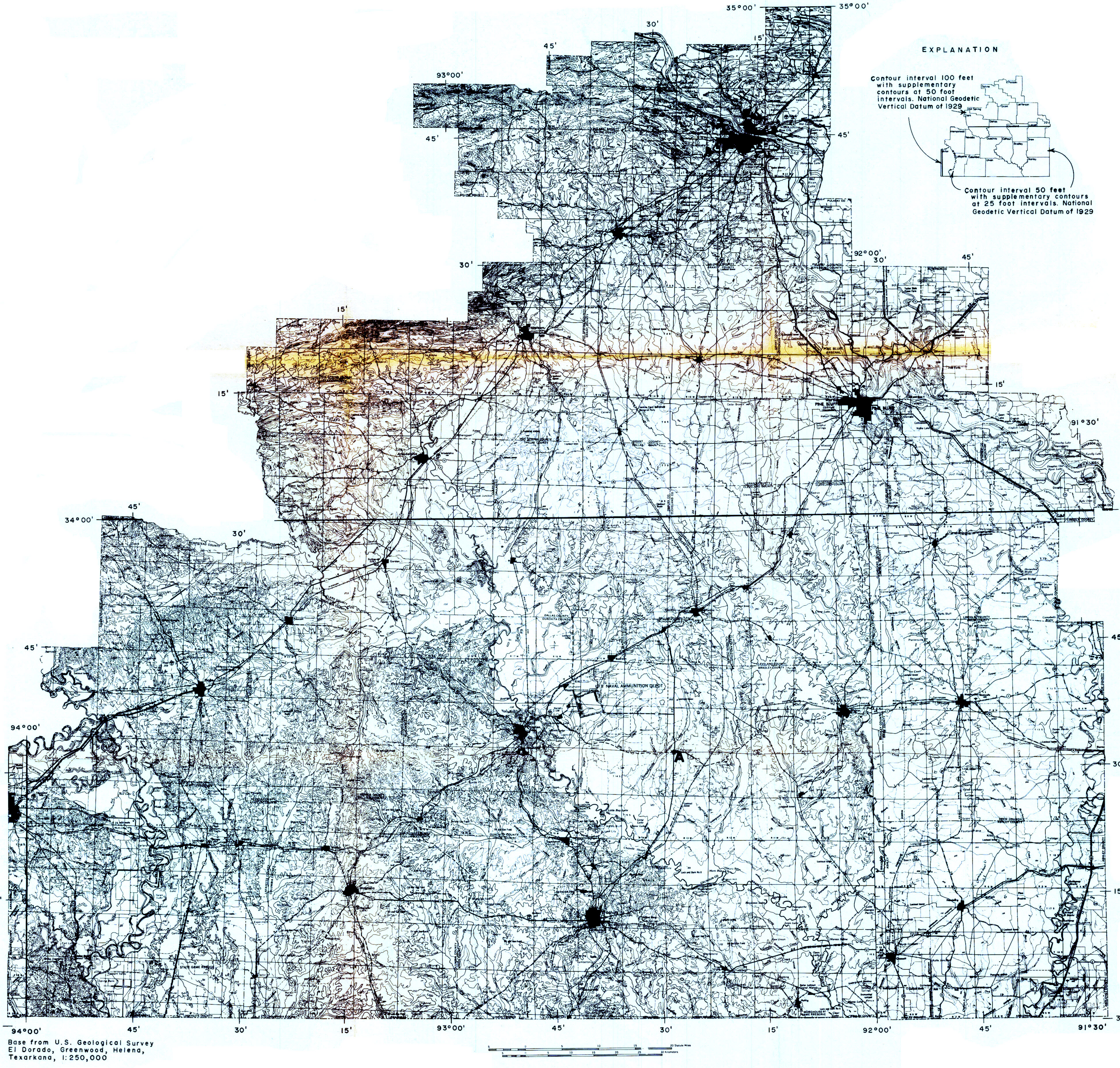

PLATE I.—LAND-SURFACE CONTOURS IN THE SOUTH-ARKANSAS LIGNITE AREA.