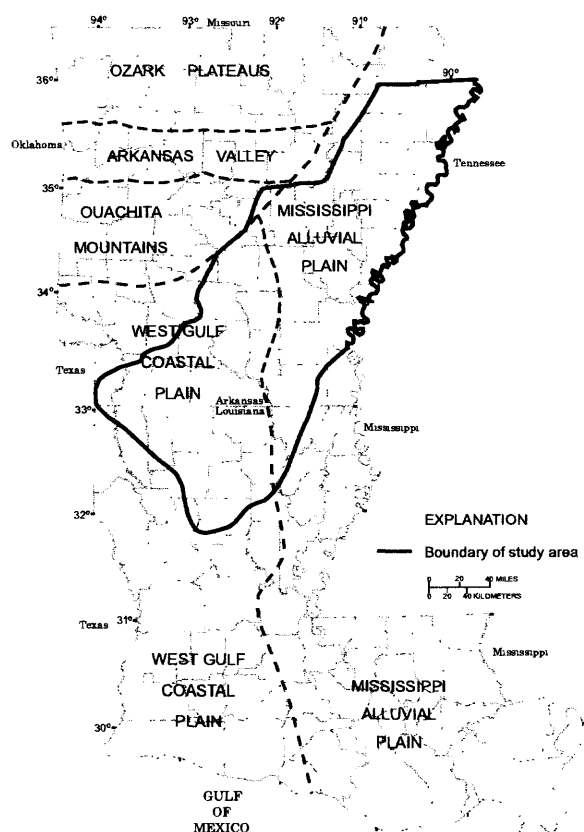




Prepared in cooperation with the
ARKANSAS SOIL AND WATER CONSERVATION COMMISSION,
the ARKANSAS GEOLOGICAL COMMISSION, and the
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

POTENTIOMETRIC SURFACE OF THE SPARTA AQUIFER IN EASTERN AND SOUTH-CENTRAL ARKANSAS AND NORTH-CENTRAL LOUISIANA, AND THE MEMPHIS AQUIFER IN EAST-CENTRAL ARKANSAS, OCTOBER 1996-JULY 1997

Water-Resources Investigations Report 97-4282



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AND THE MEMPHIS AQUIFER IN EAST-CENTRAL
ARKANSAS, OCTOBER 1996-JULY 1997**

By Robert L. Joseph

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Little Rock, Arkansas
1998

U.S. DEPARTMENT OF THE INTERIOR
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CONTENTS

Abstract.....	1
Introduction	1
Description of Aquifers	2
Potentiometric-Surface Map.....	3
Long-Term Hydrographs	12
Summary.....	19
Selected References.....	19

PLATES

Plate	1. Map showing potentiometric surface of the Sparta and Memphis aquifers.....	In pocket
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ILLUSTRATIONS

Figure	1. Map showing location of study area	2
	2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers	13

TABLES

Table	1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas.....	4
	2. Information pertaining to measured wells completed in the Sparta aquifer in Louisiana .	11

POTENTIOMETRIC SURFACE OF THE SPARTA AQUIFER IN EASTERN AND SOUTH-CENTRAL ARKANSAS AND NORTH-CENTRAL LOUISIANA, AND THE MEMPHIS AQUIFER IN EAST-CENTRAL ARKANSAS, OCTOBER 1996-JULY 1997

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ABSTRACT

During the 1997 water year, the water level in the Sparta and Memphis aquifers was measured in about 274 wells in Arkansas, and the water level in the Sparta aquifer was measured in about 55 wells in Louisiana. The potentiometric surface data reveal spatial trends across the study area. In Arkansas, the altitude of the potentiometric surface ranged from 199 feet below sea level in Union County to 307 feet above sea level in Saline County. In Louisiana, the altitude of the potentiometric surface ranged from 224 feet below sea level in Ouachita Parish to 230 feet above sea level in Bienville Parish.

The general direction of ground-water flow in the Sparta and Memphis aquifers is from the west to the southeast. The regional direction of ground-water flow in Arkansas is from the north and west to the south and east, away from the recharge zone in the outcrop and subcrop area, except near areas affected by intense ground-water withdrawals; such areas are manifested by large cones of depression centered in Columbia, Jefferson, and Union Counties. The regional ground-water flow in the Sparta aquifer in north-central Louisiana generally is downdip in an easterly direction from the recharge zone in the outcrop and subcrop area in the west toward the Mississippi Alluvial Plain. The potentiometric surface of the Sparta aquifer in Arkansas and Louisiana exhibits cones of depressions descending below sea level. Comparison of potentiometric surface maps through time shows that the cones of depression in Columbia and Union Counties are coalesc-

ing at or near the Columbia and Union County line. However, the general direction of ground-water movement indicates that heavy pumpage locally has altered or reversed the natural direction of flow in some areas. Flow in these areas is toward the cones of depression at the center of pumping.

Hydrographs from wells in the Sparta and Memphis aquifers reveal that water levels have declined more than 2.0 feet per year in some wells. Long-term hydrographs of eight wells in Arkansas, during the period 1972-1997, reveal water-level declines ranging from less than 0.8 foot per year in Phillips County to more than 2.0 feet per year in Union County. Long-term hydrographs of two wells in Louisiana, during the period 1972-1997, reveal water-level declines were more than 2.0 feet per year in Lincoln and Ouachita Parishes.

INTRODUCTION

The Sparta and Memphis aquifers are major sources of water for eastern and south-central Arkansas and north-central Louisiana, where in 1995 more than 355 million gallons per day (Mgal/d) of water was withdrawn. In Arkansas, major withdrawals are made from the aquifers for industrial and public supply, with lesser but locally significant withdrawals for agricultural uses. An estimated 284 Mgal/d of water was withdrawn from the Sparta and Memphis aquifers in 1995, an increase of about 61 Mgal/d from 1990. The two aquifers are the second most productive source of ground water in Arkansas (Holland, 1993). In Louisiana, major withdrawals are made from the aquifer for industrial and public supply, with lesser withdrawals

for other uses. An estimated 71 Mgal/d of water was withdrawn from the Sparta aquifer in 1995, an increase of about 7 Mgal/d from 1990.

The study area (fig. 1, plate 1) includes most of the Coastal Plain physiographic province in Arkansas and Louisiana. In Arkansas, the area is bounded on the north by the Missouri State line, and on the east by the Tennessee and Mississippi State lines. The western boundary is defined as the western extent of the outcrop and subcrop (Hosman, 1982) of the Sparta Sand and the Memphis Sand. In Louisiana, the area is bounded on the south and east by the approximate downdip limit of freshwater (Payne, 1968) and the western boundary is defined by the western limit of the Sparta aquifer.

The U.S. Geological Survey in cooperation with the Arkansas Soil and Water Conservation Commission, the Arkansas Geological Commission, and the Louisiana Department of Transportation and Development has monitored water levels in the Sparta and Memphis aquifers since the 1920's. During the 1997 water year (October 1996 through September 1997), about 274 water-level measurements in Arkansas and about 55 water-level measurements in Louisiana were made in wells completed in these aquifers. The purpose of these measurements was to provide information

describing the potentiometric surface of the Sparta and Memphis aquifers. This report presents results as a map and as updated water-level hydrographs.

The author acknowledges the contribution of data from the Louisiana District, U.S. Geological Survey, and the technical assistance of their staff, particularly Jeffrey A. Brantley, in the publication of this report.

DESCRIPTION OF AQUIFERS

The Sparta Sand and Memphis Sand of Eocene age are part of the Claiborne Group and mainly consist of fine- to medium-grain sand. In the central and southern parts of the study area, the Sparta Sand is underlain by the marine clay of the Cane River Formation, which serves as a lower confining unit. In the northern part of the study area (north of about 35 degrees latitude), the Cane River Formation is predominantly composed of sand (Hosman and others, 1968), and the Memphis Sand is thicker and more homogeneous. In this northern area, the Claiborne Group is not subdivided into the Sparta Sand, Cane River Formation, and Carrizo Sand, but the equivalent section is a single formation known

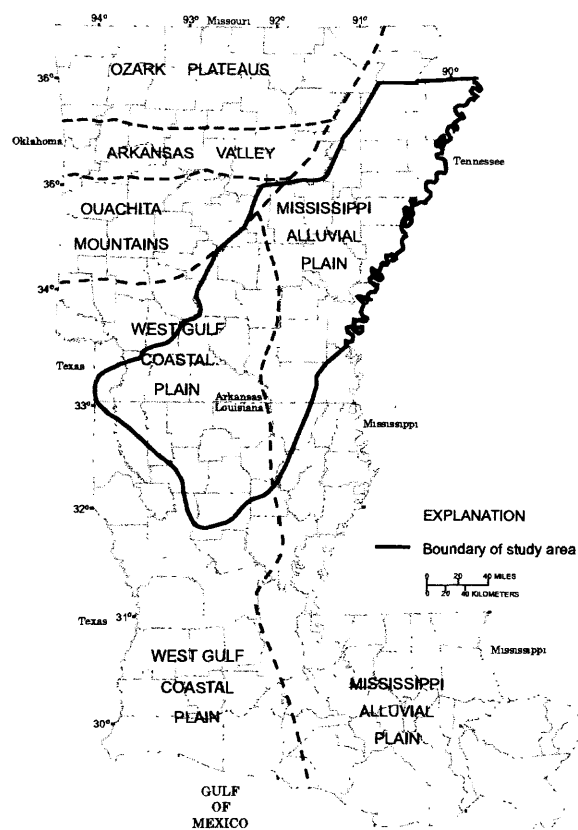


Figure 1. Location of study area (physiographic boundaries from Fenneman, 1938).

as the Memphis Sand. The Memphis Sand is underlain by a thick layer of clay that is part of the Wilcox Group. Some silt, clay, and lignite occur in the upper portion of the Sparta and Memphis Sands. The Sparta Sand in north-central Louisiana consists of very fine- to medium-grain sand, silty clay, lignite, and lesser amounts of clay. The Sparta Sand is composed of a sequence of alternating sand and clay beds between the massive clays of the overlying Cook Mountain and the underlying Cane River confining units. Sands in the Sparta Sand were deposited by shifting streams on a deltaic-fluvial flood plain (Payne, 1968). These sands are mostly interconnected, but separately identifiable sands can be traced for only short distances (Snider and others, 1972). The Cook Mountain Formation overlies the Sparta Sand and Memphis Sand and it serves as an upper confining unit. The permeable units of the Sparta Sand and the Memphis Sand compose the respective aquifers. Water levels in the Sparta aquifer generally correlate with those in the Memphis aquifer; therefore, the water-bearing formations are considered to be one hydrologic unit (Stanton, 1997).

In Arkansas, the Sparta Sand generally thickens and begins to contain saltwater as depth of occurrence increases to the southeast. The Sparta Sand is 50 to 200 feet (ft) thick within the recharge zone (along its western limit) and thickens easterly to nearly 900 ft. The Sparta Sand contains freshwater throughout most of its extent in Arkansas. However, saltwater is present in the extreme southeastern part of the State in parts of Ashley, Chicot, and Union Counties.

In Louisiana, the Sparta Sand generally dips to the east and southeast. From the Sabine uplift (plate 1), the dip in northwestern Louisiana is northeasterly. The Sparta Sand is 50-300 ft thick within the recharge zone and thickens easterly to nearly 700 ft near the downdip limit of freshwater. The approximate downdip limit of freshwater is shown on plate 1. Below the downdip limit of freshwater, all sands in the Sparta aquifer contain saltwater; updip from the freshwater limit, sands in the upper part of the aquifer contain freshwater but some sands in the lower part of the aquifer contain saltwater. A more detailed description of the Sparta and Memphis aquifers is given in Edds and Fitzpatrick, 1989; Hosman and others, 1968; Payne, 1968; Petersen and others, 1985; and Ryals, 1980.

POTENTIOMETRIC-SURFACE MAP

The potentiometric-surface map shows the altitude to which water would have risen in tightly cased wells screened in the aquifers (plate 1). The map is based upon water-level data collected in about 329 wells in the Sparta and Memphis aquifers from October 1996 to July 1997 in eastern and south-central Arkansas and north-central Louisiana. The surface is mapped by determining the altitude of the water levels measured in the wells and is represented on the map by contours that connect points of equal value. The general direction of ground-water flow in the Sparta and Memphis aquifers is perpendicular to the contours in the direction of downward hydraulic gradient.

The natural direction of flow, which is generally eastward from the recharge zone and then southward, is altered in areas of heavy pumpage. The regional direction of ground-water flow in Arkansas is generally to the south to southwest in the northern half of the Arkansas part of the study area and to the east and south in the southern half of Arkansas, away from the recharge zone of the outcrop and subcrop area except where affected by intense ground-water withdrawals. The natural ground-water flow in the Sparta aquifer in northern Louisiana generally is in an easterly direction from the recharge zone of the outcrop and subcrop area in the west toward the Mississippi Alluvial Plain (Ryals, 1980). The highest water-level altitude measured in Arkansas was 307 ft above sea level, located in Saline County near the recharge zone of the outcrop and subcrop; the lowest water level was 199 ft below sea level in Union County (table 1). The highest water-level altitude measured in Louisiana was 230 ft above sea level, located in Bienville Parish, near the recharge zone of the outcrop and subcrop area; the lowest water level was 224 ft below sea level in Ouachita Parish (table 2). However, the potentiometric surface indicates that heavy pumpage has altered or reversed the natural direction of flow in some areas. Flow in these areas is toward the cones of depression at the center of pumping. Four large cones of depression are observed, centered in Columbia, Jefferson, and Union Counties in Arkansas and Ouachita Parish in Louisiana as a result of large withdrawals of water for industrial and public supplies. In Arkansas, the potentiometric surface of the Sparta and Memphis aquifers exhibits cones of depression descending below sea level in the central and southwestern parts of the State. The cone of depression centered in Jefferson County has an elliptical shape because of withdrawals for irrigation in the

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
Arkansas County							
340030	0911447	08S02W09BCC1	79	95.31	174	06-06-97	Sparta
340116	0911131	08S02W01CBA1	92	73.26	165	03-25-97	Sparta
340124	0912039	08S03W04DBC1	84	91.87	176	03-25-97	Sparta
340135	0912152	08S03W05ABB1	72	103.21	175	03-24-97	Sparta
340340	0911410	07S02W28ABA1	94	86.78	181	03-25-97	Sparta
340711	0912248	07S03W06ABC1	71	114.14	185	03-25-97	Sparta
340858	0912008	06S03W27BAA1	74	106.98	181	06-06-97	Sparta
341023	0911451	06S02W17ADA1	83	105.42	188	06-06-97	Sparta
341228	0911622	06S02W06ABB1	74	106.76	181	03-26-97	Sparta
341247	0912946	05S05W36DAA1	53	126.99	180	03-27-97	Sparta
341358	0912435	05S04W26ACA1	65	122.97	188	03-26-97	Sparta
341550	0910742	05S01W17BAA1	77	99.27	176	06-05-97	Sparta
341734	0912006	05S03W04ADB1	63	123.98	187	03-26-97	Sparta
341752	0913004	04S05W36DCC1	48	148.09	196	03-26-97	Sparta
341819	0913139	04S05W34DAA1	38	154.09	192	06-05-97	Sparta
341819	0913448	04S05W31DDA1	36	148.19	184	06-10-97	Sparta
341929	0910739	04S01W28BAA1	94	95.66	190	03-26-97	Sparta
342004	0912514	04S04W22DAA1	57	138.08	195	03-26-97	Sparta
342005	0912926	04S04W19CBB1	48	147.48	195	03-26-97	Sparta
342123	0911331	04S02W09DDC1	115	59.65	175	06-05-97	Sparta
342132	0913133	04S05W15AAA1	39	162.24	201	06-05-97	Sparta
342155	0912503	04S04W11BCC1	54	143.58	198	03-26-97	Sparta
342226	0910758	04S01W04CBD1	93	103.25	196	06-05-97	Sparta
342416	0912437	03S04W26CDA1	57	145.52	203	03-26-97	Sparta
342416	0912645	03S04W33BAA1	60	141.34	201	03-26-97	Sparta
342447	0913238	03S05W28DAB1	37	167.37	204	06-05-97	Sparta
342515	0914210	03S06W30BBD1	47	143.77	191	03-27-97	Sparta
342554	0913925	03S06W21ACC1	54	140.92	195	03-27-97	Sparta
342632	0913005	03S05W13BDC1	39	170.59	210	03-26-97	Sparta
342632	0913227	03S05W15CBB1	44	162.33	206	03-26-97	Sparta
342633	0913523	03S05W18CAB1	46	149.82	196	03-27-97	Sparta
342747	0912457	03S04W02CCB1	61	140.97	202	03-26-97	Sparta
342839	0913032	03S05W02AAB1	65	144.58	210	03-26-97	Sparta
342924	0912700	02S04W33BBB1	58	147.28	205	03-26-97	Sparta
342930	0913034	02S05W35AAB1	35	181.03	216	06-04-97	Sparta
343028	0913230	02S05W27BBB1	49	166.54	216	03-27-97	Sparta
343044	0912349	02S04W23DAA1	84	124.09	208	03-27-97	Sparta
343143	0913318	02S05W16CBC1	21	191.86	213	06-04-97	Sparta
343312	0912849	02S04W06CDB1	64	148.34	212	03-27-97	Sparta
Ashley County							
332117	0915103	15S07W32CDD1	37	153.28	190	03-20-97	Sparta

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas--Continued

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
Bradley County							
331836	0922052	16S12W21CAA1	28	71.56	100	04-05-97	Sparta
333453	0921607	13S11W17BCD1	54	195.69	250	04-03-97	Sparta
333647	0920437	13S09W06ACB2	15	186.36	201	04-02-97	Sparta
333649	0920406	13S09W06BDC1	42	170.00	212	04-02-97	Sparta
334103	0920752	12S10W10BCA1	45	117.61	163	05-22-97	Sparta
Calhoun County							
332811	0922722	14S13W29DAC1	134	13.83	148	04-03-97	Sparta
333040	0922403	14S13W12CCB1	35	170.22	205	04-02-97	Sparta
333055	0923910	14S15W16BAA1	71	75.39	146	04-02-97	Sparta
333226	0922741	13S13W32CDA1	35	172.81	208	03-19-97	Sparta
333233	0922224	13S12W31DAA1	133	67.26	200	04-03-97	Sparta
333252	0923616	13S15W36CBD1	105	53.24	158	04-02-97	Sparta
334630	0922927	11S14W12CAC3	172	141.43	313	03-17-97	Sparta
332407	0922810	15S13W20BDC1	26	82.49	108	11-06-96	Sparta
Chicot County							
333301	0911419	13S01W19CAA1	67	64.43	131	03-24-97	Sparta
Cleveland County							
334543	0921422	11S11W16AAB1	91	212.09	303	04-09-97	Sparta
334917	0920019	10S09W23CDC1	63	157.08	220	04-10-97	Sparta
335133	0921749	10S12W12BDD1	104	116.02	220	04-09-97	Sparta
335623	0921251	09S11W11CDB1	77	155.70	233	04-10-97	Sparta
335728	0921133	09S11W01DCA1	39	191.50	230	04-09-97	Sparta
335729	0921120	09S11W01DDA2	43	206.76	250	04-09-97	Sparta
340133	0921539	08S12W13CAA1	95	166.06	261	04-10-97	Sparta
Columbia County							
330136	0932622	20S23W12AAA1	164	52.99	217	03-05-97	Sparta
330235	0931023	19S20W34BDD1	77	213.16	290	06-11-97	Sparta
330517	0931725	19S21W16DBB1	108	176.19	284	03-06-97	Sparta
330555	0931128	19S20W09CAC1	71	260.62	332	03-06-97	Sparta
330557	0931146	19S20W08DAD1	69	250.68	320	03-06-97	Sparta
330609	0932743	19S23W11CDA2	195	53.38	248	03-05-97	Sparta
331035	0931804	18S21W17ACD1	196	119.17	315	07-09-97	Sparta
331039	0931255	18S20W18ABD1	-31	307.0	276	06-04-97	Sparta
331142	0931248	18S20W06DDC1	-12	311.58	300	03-06-97	Sparta
331214	0931404	18S21W01ACC1	0	295.23	295	06-11-97	Sparta
331306	0930751	17S20W36ABC1	35	300.08	335	06-11-97	Sparta
331406	0930650	17S19W30ABB1	30	217.97	248	03-18-97	Sparta
331512	0930658	17S19W18CBD1	11	293.88	305	07-08-97	Sparta
331516	0932303	17S22W21ABD1	157	84.55	242	05-29-97	Sparta
331519	0931159	17S20W17CDA1	16	308.69	325.10	03-07-97	Sparta
331519	0932136	17S22W23BBB1	137	137.68	275	05-29-97	Sparta
331521	0932209	17S22W22ABC1	114	138.10	252	05-29-97	Sparta
331533	0930807	17S20W13CB1	-1	312.76	312	03-07-97	Sparta
331537	0930328	17S19W15ABD1	39	285.86	325	03-06-97	Sparta

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas--Continued

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
331607	0931818	17S21W17BAA1	197	113.88	311	05-29-97	Sparta
331609	0931449	17S21W11DCC2	2	300.52	303	03-07-97	Sparta
331613	0931758	17S21W08DCA1	150	148.10	298	05-29-97	Sparta
331742	0931423	17S21W01BBC1	-21	326.37	305	03-18-97	Sparta
331753	0931513	16S21W35CCD1	100	175.37	275	07-08-97	Sparta
331948	0932222	16S22W22CCD1	209	130.78	340	03-04-97	Sparta
332003	0930525	16S19W20ABD1	134	160.84	295	06-12-97	Sparta
332041	0931622	16S21W15CBC1	76	212.32	288	03-05-97	Sparta
332049	0931516	16S21W14CBB1	60	221.45	281	07-09-97	Sparta
332117	0931139	16S20W08DCC1	122	272.96	395	07-09-97	Sparta
332453	0931215	15S20W20CCB1	158	213.92	372	03-05-97	Sparta
Craighead County							
354406	0904433	13N03E23CDD1	161	86.54	248	05-15-97	Memphis
354751	0903130	14N05E36CBC1	209	10.69	220	05-15-97	Memphis
354839	0904033	14N04E28DBD1	200	54.15	254	05-14-97	Memphis
354929	0903922	14N04E22CBD1	202	54.28	256	05-14-97	Memphis
355554	0902859	15N06E18ACA1	215	15.44	230	05-15-97	Memphis
Crittenden County							
350344	0901300	05N08E11CCA2	191	19.97	211	04-30-97	Memphis
350744	0900556	06N09E23AAB1	199	22.56	222	05-01-97	Memphis
350958	0901738	06N07E01DAD2	190	18.58	209	05-01-97	Memphis
351349	0900628	07N09E14BAC1	189	28.37	217	05-01-97	Memphis
Cross County							
352231	0904215	09N04E30DCA1	172	256.97	429.32	05-02-97	Memphis
352359	0904514	09N03E22AAD1	164	114.18	278	05-02-97	Memphis
352403	0905949	09N01E16CAC1	157	76.68	234	05-02-97	Memphis
Dallas County							
334832	0922455	10S13W34ACA2	124	148.07	272	04-04-97	Sparta
335041	0923505	10S15W24AAB1	226	16.03	242	04-04-97	Sparta
335304	0922413	09S13W35CCD1	133	67.41	200	04-04-97	Sparta
335853	0923658	08S15W34BDC1	212	27.67	240	05-28-97	Sparta
335935	0924307	08S16W27DDD1	241	31.05	272	04-04-97	Sparta
340429	0923332	07S14W31AAA1	207	122.94	330	04-04-97	Sparta
340559	0924541	07S16W20CAB1	296	25.56	322	05-28-97	Sparta
Desha County							
333636	0912304	12S03W34DAD1	71	75.76	147	03-24-97	Sparta
334605	0911705	11S02W03CCA1	82	57.13	139	03-25-97	Sparta
334748	0911618	10S02W26CCC2	85	62.84	148	03-24-97	Sparta
335304	0913005	09S04W28DDD1SP	56	109.09	165	03-25-97	Sparta
335341	0911522	09S02W26AAC1	89	63.59	153	03-25-97	Sparta
Drew County							
332418	0912726	15S04W12DDA1	68	57.03	125	03-24-97	Sparta
333154	0913404	13S05W36ACB1	80	89.13	169	03-21-97	Sparta
333649	0914400	12S06W32DAD1	52	160.03	212	03-21-97	Sparta
334248	0912708	11S04W25DAA1	68	79.67	148	03-21-97	Sparta

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas--Continued

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
334601	0914121	11S06W11DBC1	61	142.48	203	03-21-97	Sparta
334636	0912832	11S04W02ACA1	65	86.52	152	11-26-97	Sparta
Grant County							
340447	0921838	07S12W27DBC1	136	98.84	235	06-11-97	Sparta
341024	0923545	06S15W26ACA1	211	68.99	280	04-04-97	Sparta
341245	0923251	06S14W08BDC1	179	13.93	193	04-04-97	Sparta
341341	0921414	06S11W05ACA1	84	196.12	280	03-31-97	Sparta
341812	0922653	05S13W07ADB1	167	90.78	258	06-11-97	Sparta
341839	0922402	05S13W03CDA4	174	106.64	281	03-31-97	Sparta
341841	0923320	05S14W06DCC1	203	90.47	293	04-04-97	Sparta
341845	0922359	05S13W03DBC1	158	102.47	260	03-31-97	Sparta
341923	0923825	05S15W05ABD1	217	15.49	232	04-04-97	Sparta
342201	0922931	04S14W14DCD1	166	90.62	257	06-11-97	Sparta
342846	0922106	03S13W12AAA1	232	129.05	361	03-31-97	Sparta
Hot Spring County							
341456	0924150	05S16W35ACA1	306	35.68	342	04-01-97	Sparta
Jefferson County							
340401	0915917	07S09W35CCB1	37	232.62	270	06-03-97	Sparta
340547	0920420	07S10W24CAC1	33	278.01	311	06-03-97	Sparta
340631	0914520	07S07W24BAB1	35	152.57	188	06-06-97	Sparta
340947	0914040	06S06W20CAA1	38	155.79	193.30	05-20-97	Sparta
341026	0915116	06S08W25ADC1	-6	209.80	203.48	05-29-97	Sparta
341054	0914125	06S06W18DAB1	35	153.34	188	05-20-97	Sparta
341105	0920502	06S10W23DBA1	14	216.17	230	06-03-97	Sparta
341117	0920504	06S10W23ACD1	-2	233.83	232	06-03-97	Sparta
341118	0920501	06S10W11DDB1	11	217.07	228	06-03-97	Sparta
341138	0915516	06S08W16CCC1	-38	240.60	202.42	06-01-97	Sparta
341151	0920221	06S09W17CCA1	-27	261.44	234.34	05-21-97	Sparta
341427	0915652	05S09W35AAB1	-71	276.00	205	02-01-97	Sparta
341446	0915526	05S08W30CBA1	-63	270.1	207.46	05-29-97	Sparta
341453	0915441	05S08W30ADB1	-55	275.82	221	05-21-97	Sparta
341530	0915554	05S09W24DBD1	-54	261.90	208.17	05-28-97	Sparta
341634	0920534	05S10W16DBD1	32	268.20	300	05-12-97	Sparta
341639	0920539	05S10W16DBB1	33	282.31	315	05-21-97	Sparta
341658	0920546	05S10W16BAD1	38	239.20	277	05-21-97	Sparta
341918	0915049	04S08W35BBD1	2	198.45	200	05-20-97	Sparta
342025	0920623	04S10W29ADB1	64	203.98	267.55	04-11-97	Sparta
342107	0920440	04S10W22BDD1	51	193.33	244.24	04-11-97	Sparta
342140	0914741	04S07W17BCC1	32	167.57	200	05-20-97	Sparta
342218	0920957	04S11W14BAD1	101	299.33	400	04-08-97	Sparta
342500	0920433	03S10W27AAD1	110	111.55	222	06-04-97	Sparta
342539	0920832	03S11W25ADC4	120	192.87	313	04-08-97	Sparta
342618	0915455	03S08W19BDB1	62	153.45	215	05-20-97	Sparta
342623	0915444	03S08W19BAD1	56	161.36	217	05-20-97	Sparta
342627	0915502	03S08W19BBD1	59	156.35	215	05-20-97	Sparta

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas--Continued

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
342644	0921055	03S11W22ABC1	143	166.92	310	04-11-97	Sparta
Lafayette County							
330223	0933033	20S23W05ADB1	204	38.42	242	03-04-97	Sparta
330351	0933103	19S23W29BDB1	210	40.24	250	03-04-97	Sparta
330546	0933916	19S25W13CAB1	228	27.03	255	03-04-97	Sparta
330911	0933038	18S23W29ACC1	244	10.72	255	03-04-97	Sparta
331523	0932952	17S23W21BCB1	257	38.36	295	03-04-97	Sparta
331526	0933402	17S24W23BBD1	239	21.61	261	03-04-97	Sparta
332026	0933728	16S24W19DBC1	220	45.32	265	03-03-97	Sparta
332140	0932611	16S23W12CAD1	255	67.29	322	03-05-97	Sparta
Lee County							
345011	0904749	03N03E28CDB1	159	47.57	207	04-30-97	Sparta
Lincoln County							
335229	0913758	10S05W05ADB1	62	108.77	171	04-09-97	Sparta
335631	0915121	09S07W07DAD1	34	265.91	300	04-09-97	Sparta
335907	0913333	08S05W35ACC1	52	112.64	165	04-11-97	Sparta
335955	0915301	08S08W35DBB1	34	205.58	240	04-09-97	Sparta
335957	0914352	08S06W31DCC1	27	122.98	150	05-21-97	Sparta
340200	0912800	08S04W22AAA1	59	80.57	140	04-11-97	Sparta
340345	0913446	08S05W03BAA2	50	129.73	180	04-11-97	Sparta
340444	0915042	07S07W30CDC1	37	170.58	208	04-10-97	Sparta
Lonoke County							
343227	0915227	02S08W16BDA1	99	117.06	216	03-27-97	Sparta
344425	0914503	01N07W03BCC1	106	117.19	223	04-17-97	Sparta
344448	0914618	02N07W32DDD1	108	118.37	226	06-12-97	Sparta
344609	0914322	02N07W23BAA1	101	134.51	236	04-24-97	Sparta
344652	0914419	02N07W22DBA1	110	117.47	227	04-17-97	Sparta
344702	0914149	02N07W24DAC1	103	128.22	231	04-14-97	Sparta
344906	0914500	02N07W09AAA1	138	94.04	232	06-09-97	Sparta
344940	0914721	02N07W06ACD1	124	116.88	241	06-09-97	Sparta
345152	0915025	03N08W23DDD1	138	96.00	234	04-14-97	Sparta
345444	0914426	03N07W03CAA1	160	75.34	235	06-09-97	Memphis
Miller County							
331604	0934406	17S25W18CDB1	210	10.03	220	03-03-97	Sparta
Monroe County							
344145	0911756	01N03W14CCB1	108	64.00	172	04-28-97	Sparta
345043	0911026	03N02W26DAB1	150	42.05	192	05-19-97	Sparta
345535	0911221	04N02W28DDD4	166	26.47	192	04-18-97	Sparta
345618	0911509	04N02W30BAC1	162	18.11	180	04-18-97	Sparta
Nevada County							
332818	0931740	14S21W32DCD1	257	113.23	370	03-05-97	Sparta
333324	0930708	13S20W36DCC1	244	105.84	350	03-05-97	Sparta
Ouachita County							
332305	0925434	15S18W36ADD1	66	94.09	160	06-10-97	Sparta
332437	0930431	15S19W21CDD2	136	144.04	280	07-08-97	Sparta

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas--Continued

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
332618	0930318	15S19W10DCC1	144	65.58	210	03-18-97	Sparta
332804	0925251	14S17W32CAD1	135	84.97	220	06-10-97	Sparta
332942	0930513	14S19W29ABB1	194	86.18	280	03-11-97	Sparta
333234	0925252	14S17W05CAD1	121	35.83	157	03-10-97	Sparta
333252	0924926	14S17W02ABB1	9	110.94	120	03-17-97	Sparta
333435	0930417	13S19W28BCD1	193	37.24	230	03-11-97	Sparta
333934	0924206	12S16W26ABD1	94	39.63	134	03-10-97	Sparta
333942	0924252	12S16W25BDA1	102	34.78	137	03-10-97	Sparta
334018	0925948	12S18W19CDC1	204	30.56	235	03-11-97	Sparta
334154	0930109	12S19W14AAA1	226	10.54	237	06-10-97	Sparta
334218	0923914	12S15W09BBA1	159	54.20	213	05-30-97	Sparta
334251	0930351	12S19W09BAB1	276	13.95	290	03-11-97	Sparta
334342	0924835	11S17W36CCA1	129	3.66	133	03-10-97	Sparta
334443	0923725	11S15W27ABD1	134	66.22	200	03-10-97	Sparta
334614	0925759	11S18W20AAA1	270	30.86	301	03-11-97	Sparta
Phillips County							
341822	0905124	04S02E25CCC1	131	35.24	166	04-29-97	Sparta
342403	0904914	03S03E30DAA1	137	34.65	172	04-29-97	Sparta
342754	0903621	03S05E05BAB1	143	36.99	180	04-30-97	Sparta
342856	0903636	02S05E29CCC1	157	21.52	179	04-29-97	Sparta
343110	0903525	02S05E16BCB1	162	28.25	190	04-29-97	Sparta
343242	0903902	02S04E02DBA1	126	123.54	250	04-29-97	Sparta
343322	0905056	02S02E01ADC1	141	34.92	176	04-29-97	Sparta
343324	0905446	01S02E32DDC1	134	77.46	211	04-28-97	Sparta
Poinsett County							
352724	0905846	10N01E27CC1	153	77.86	231	05-13-97	Memphis
352844	0904433	10N03E23CAC1	154	104.08	258	05-13-97	Memphis
352930	0905825	10N01E15DBB1	147	84.99	232	05-13-97	Memphis
353144	0904454	10N03E02BCD1	149	102.09	251	05-14-97	Memphis
353225	0904316	11N03E25ACC1	150	123.03	273	05-13-97	Memphis
353448	0905330	11N02E16CCC1	149	94.29	243	05-13-97	Memphis
353736	0904354	12N03E35DDA1	146	101.34	247	05-13-97	Memphis
354124	0904917	12N02E12DDC1	153	94.67	248	05-13-97	Memphis
Prairie County							
343639	0913352	01S05W20ABB1	74	146.34	220	03-27-97	Sparta
343748	0913654	01S06W11DBD1	77	148.90	226	03-27-97	Sparta
343902	0913531	01S05W06BCB1	76	144.04	220	03-27-97	Sparta
344113	0913504	01N05W19CDC1	84	128.16	212	03-27-97	Sparta
344136	0914145	01N06W19BCD1	101	121.63	223	06-10-97	Sparta
344444	0913658	01N06W02ABB1	117	106.14	223	04-17-97	Sparta
344644	0913828	02N06W21DAD1	115	117.19	232	04-17-97	Sparta
344649	0912801	02N04W19ACB1	126	85.33	211	04-17-97	Sparta
344653	0913800	02N06W22BDD1	112	120.77	233	04-17-97	Sparta
344704	0914033	02N06W20BCB1	106	129.65	236	04-17-97	Sparta
344906	0913837	02N06W04DBD1	136	96.66	233	06-12-97	Memphis

Table 1. Information pertaining to measured wells completed in the Sparta and Memphis aquifers in Arkansas--Continued

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
345140	0914004	03N06W20CDD1	130	95.22	225	06-12-97	Memphis
345144	0913356	03N05W20CCC1	113	99.92	213	06-12-97	Memphis
345451	0913042	03N05W03ADA1	107	97.86	205	06-12-97	Memphis
Pulaski County							
344203	0920818	01N11W24ACD1	210	27.10	237	04-15-97	Sparta
St. Francis County							
345705	0902842	04N06E16CCB1	154	43.77	198	04-25-97	Memphis
345746	0904320	04N04E18BAB1	156	63.57	220	04-25-97	Memphis
Saline County							
342904	0923222	03S14W05CCC1	307	7.91	315	04-14-97	Sparta
Union County							
330110	0924321	19S16W35DDC1	-48	222.96	175	03-12-97	Sparta
330219	0921112	19S11W25AAA1	-1	136.00	135	03-12-97	Sparta
330327	0920905	19S10W16CBC1	7	74.86	82	03-12-97	Sparta
330631	0923708	18S15W35DAC1	-104	305.39	201	03-12-97	Sparta
330652	0922119	18S12W33BBB1	-13	125.47	112	03-12-97	Sparta
330657	0923859	18S15W33ADA1	-115	368.00	253	03-12-97	Sparta
330807	0924613	18S16W28BBB1	-115	339.88	225	03-07-97	Sparta
330855	0925056	18S17W22BDD1	-78	362.67	285	03-06-97	Sparta
331006	0925448	18S17W18BBD1	-30	300.27	270	03-06-97	Sparta
331011	0924317	18S16W11DAB1	-147	416.72	270	03-07-97	Sparta
331024	0924229	18S16W12ACB1	-167	469.86	303	03-07-97	Sparta
331040	0923531	18S14W06CCA1	-146	371.00	225	03-12-97	Sparta
331057	0925559	18S18W11ACA1	0	244.64	245	03-06-97	Sparta
331142	0924118	17S15W31DCA1	-145	416.74	272	03-12-97	Sparta
331203	0922218	17S12W32BBC1	-7	236.98	230	03-12-97	Sparta
331205	0922916	17S13W31BAC1	-68	284.13	216	03-13-97	Sparta
331228	0924038	17S15W29CDC1	-198	418.44	220	03-19-97	Sparta
331300	0925356	17S17W30DCD1	-29	309.28	280	03-19-97	Sparta
331358	0924248	17S16W24BDB1	-199	403.57	205	03-19-97	Sparta
331438	0924119	17S15W18DBB1	-177	359.74	182.93	05-19-97	Sparta
331805	0925709	16S18W34ABC2	59	189.50	248	03-19-97	Sparta
331900	0923956	16S15W20DAA1	-75	264.87	190	03-18-97	Sparta
331944	0923217	16S14W15CAB1	-56	150.04	94	03-19-97	Sparta
332205	0924330	16S16W02ABC1	-55	170.83	116	03-18-97	Sparta
Woodruff County							
350026	0911454	05N02W31DCB3	178	15.13	193	04-18-97	Memphis
350310	0910727	05N01W17DBB1	169	40.81	210	04-18-97	Memphis
350426	0910406	05N01W11ABA1	160	51.46	211	04-18-97	Memphis
351932	0910310	08N01W12CDA1	155	70.18	225	05-16-97	Memphis

Table 2. Information pertaining to measured wells completed in the Sparta aquifer in Louisiana

Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
Bienville Parish							
321733	0930350	Bi-76	230	50.46	280	10-01-96	Sparta
321402	0925457	Bi-100	187	33.21	220	10-16-96	Sparta
321709	0925239	Bi-112	99	115.82	215	10-01-96	Sparta
323505	0925350	Bi-144	84	236.42	320	10-01-96	Sparta
322436	0925005	Bi-166	79	181.43	260	10-01-96	Sparta
321101	0925221	Bi-186	138	41.97	180	10-16-96	Sparta
321538	0930016	Bi-192	211	74.49	285	10-16-96	Sparta
322119	0925723	Bi-216	183	16.70	200	10-01-96	Sparta
Caldwell Parish							
320154	0921646	Ca-86B	81	79.28	160	10-01-96	Sparta
Claiborne Parish							
325752	0930827	Cl-9	90	270.01	360	10-09-96	Sparta
324707	0930250	Cl-58	110	140.01	250	10-09-96	Sparta
324817	0925125	Cl-111	45	255.46	300	10-08-96	Sparta
325228	0924902	Cl-116	-15	259.73	245	10-10-96	Sparta
325437	0925033	Cl-148	-7	196.80	190	10-10-96	Sparta
330002	0924459	Cl-149	-64	294.36	230	10-10-96	Sparta
Jackson Parish							
321709	0924524	Ja-49	-41	201.19	160	10-02-96	Sparta
322357	0923417	Ja-147	-26	246.47	220	10-16-96	Sparta
321338	0923458	Ja-148	20	225.15	245	10-02-96	Sparta
Lincoln Parish							
324141	0923905	L-26	-25	180.27	155	10-10-96	Sparta
323458	0922751	L-68	-70	249.60	180	10-10-96	Sparta
323013	0924820	L-113	37	317.56	355	10-02-96	Sparta
324202	0923226	L-117	-52	137.85	86	10-15-96	Sparta
Morehouse Parish							
324626	0915439	Mo-5	-36	153.52	117	10-04-96	Sparta
324753	0914712	Mo-342	-2	89.85	88	10-03-96	Sparta
325707	0915747	Mo-350	7	105.56	112	10-03-96	Sparta
Ouachita Parish							
322843	0920844	Ou-80	-224	283.76	60	10-10-96	Sparta
322422	0920207	Ou-401A	-44	106.13	62	10-10-96	Sparta
321714	0920414	Ou-402	4	58.98	63	10-10-96	Sparta
323030	0915548	Ou-404	-19	80.32	61	10-15-96	Sparta
322531	0920539	Ou-406	-91	157.25	67	10-10-96	Sparta
323100	0921658	Ou-444	-111	229.09	118	10-23-96	Sparta
322437	0922431	Ou-488	-53	332.73	280	10-23-96	Sparta

Table 2. Information pertaining to measured wells completed in the Sparta aquifer in Louisiana--Continued

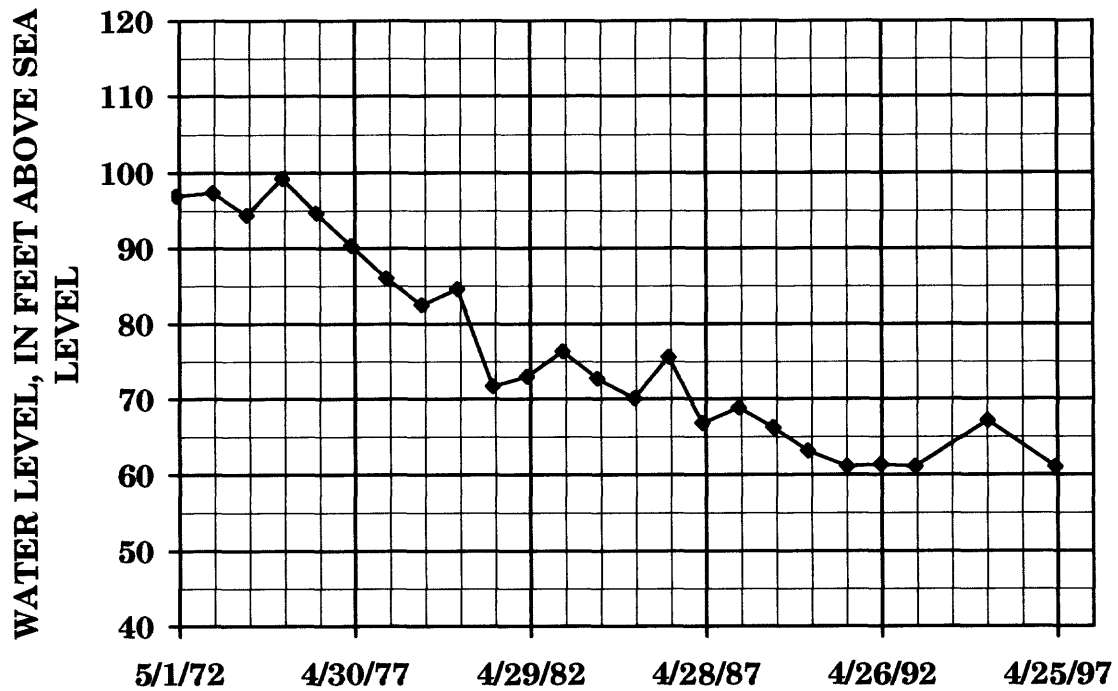
Latitude (degrees)	Longitude (degrees)	Local well number	Water level altitude (feet above sea level)	Depth to water (feet below land-surface datum)	Land-surface datum altitude (feet above sea level)	Date of measure- ment	Aquifer
Union Parish							
324415	0920902	Un-26	-50	184.00	134	10-04-96	Sparta
325028	0921133	Un-78	-34	208.60	175	10-24-96	Sparta
324955	0920840	Un-79	-35	153.40	118	10-24-96	Sparta
325550	0923916	Un-83	-52	174.00	122	10-16-96	Sparta
325647	0922415	Un-84	-39	248.70	210	10-24-96	Sparta
325929	0921140	Un-86	-11	100.63	90	10-16-96	Sparta
323655	0922117	Un-134	-87	307.13	220	10-23-96	Sparta
Webster Parish							
325948	0932720	Wb-127	209	61.37	270	10-21-96	Sparta
324919	0932507	Wb-164	156	64.32	220	10-07-96	Sparta
323220	0931659	Wb-219	185	5.17	190	10-08-96	Sparta
323221	0931404	Wb-271	194	84.25	278	10-09-96	Sparta
323553	0931411	Wb-285	159	180.68	340	10-08-96	Sparta
325200	0931517	Wb-326	145	114.51	260	10-04-96	Sparta
330040	0931900	Wb-338	135	94.89	230	10-04-96	Sparta
323630	0931736	Wb-349	110	70.38	180	10-07-96	Sparta
323423	0931459	Wb-359	200	79.68	280	10-09-96	Sparta
325518	0932219	Wb-399	160	45.24	205	10-04-96	Sparta
323534	0932005	Wb-415	143	17.20	160	10-09-96	Sparta
Winn Parish							
315527	0923708	W-28	53	52.14	105	10-01-96	Sparta
315450	0923101	W-144B	102	37.55	140	10-01-96	Sparta
320541	0922916	W-172	49	91.21	140	10-01-96	Sparta
315338	0924000	W-177	132	53.34	185	10-01-96	Sparta
315948	0923003	W-179	86	108.70	195	10-01-96	Sparta

adjoining counties, Arkansas and Prairie Counties. The cones of depression in Columbia and Union Counties are elongated to the southeast and northwest because of heavy industrial pumpage, respectively, and coalesce at or near the Columbia and Union County line. In Louisiana, the potentiometric surface of the Sparta aquifer contains a cone of depression descending below sea level in the north-central parts of the State. The cone of depression in Ouachita Parish is elongated to the northwest and coalesces with the Union County cone of depression near the Arkansas-Louisiana State line. There are several smaller cones of depression throughout the study area, which represent localized pumpage of one or two wells that do not influence water levels on a regional scale.

LONG-TERM HYDROGRAPHS

Twenty-five years of water-level data from each of 10 selected wells completed in the Sparta and Memphis aquifers were plotted to illustrate the history of water-levels in selected areas of Arkansas and Louisiana (fig. 2). During the period 1972-1997, water-level declines were less than 0.8 feet per year (ft/yr) in Columbia and Phillips Counties, between 1.0 and 1.5 ft/yr in Arkansas, Bradley, Desha, Jefferson, Poinsett, and Union Counties, and more than 2.0 ft/yr in Lincoln and Ouachita Parishes. Two hydrographs from Louisiana with a shorter period of record (1979-1997) illustrate that the water level in a Claiborne Parish well has decreased more than 1.5 ft/yr and that the water level in a Webster Parish well has fluctuated slightly since 1979.

A. ARKANSAS COUNTY 03S04W02CCB1



B. BRADLEY COUNTY 16S12W21CAA1

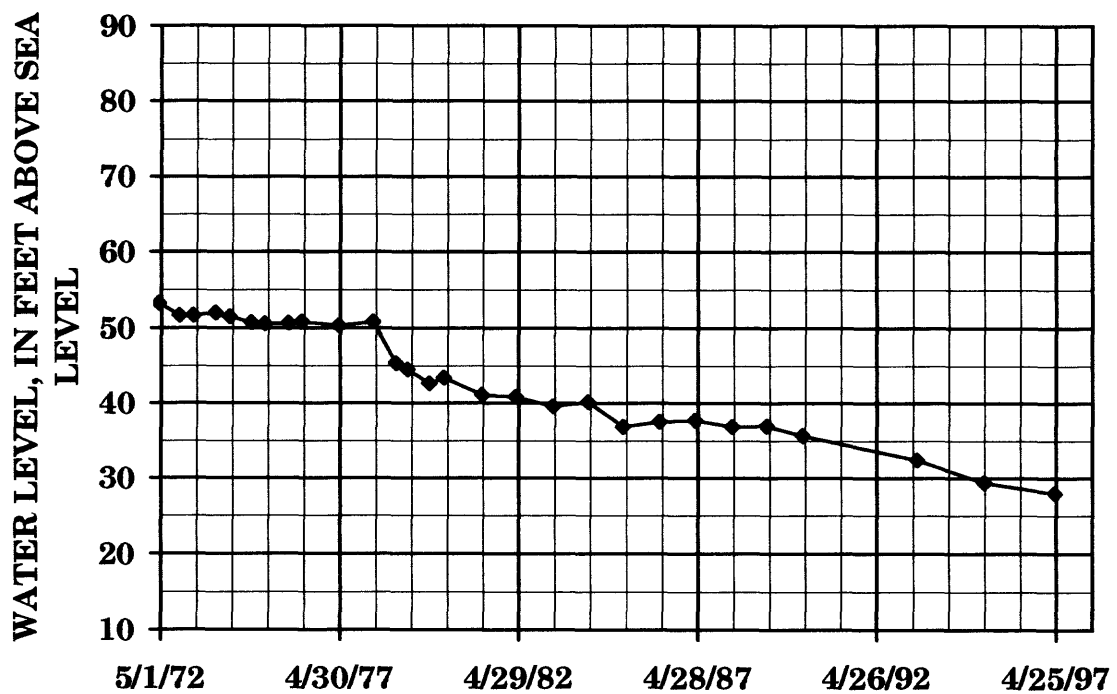
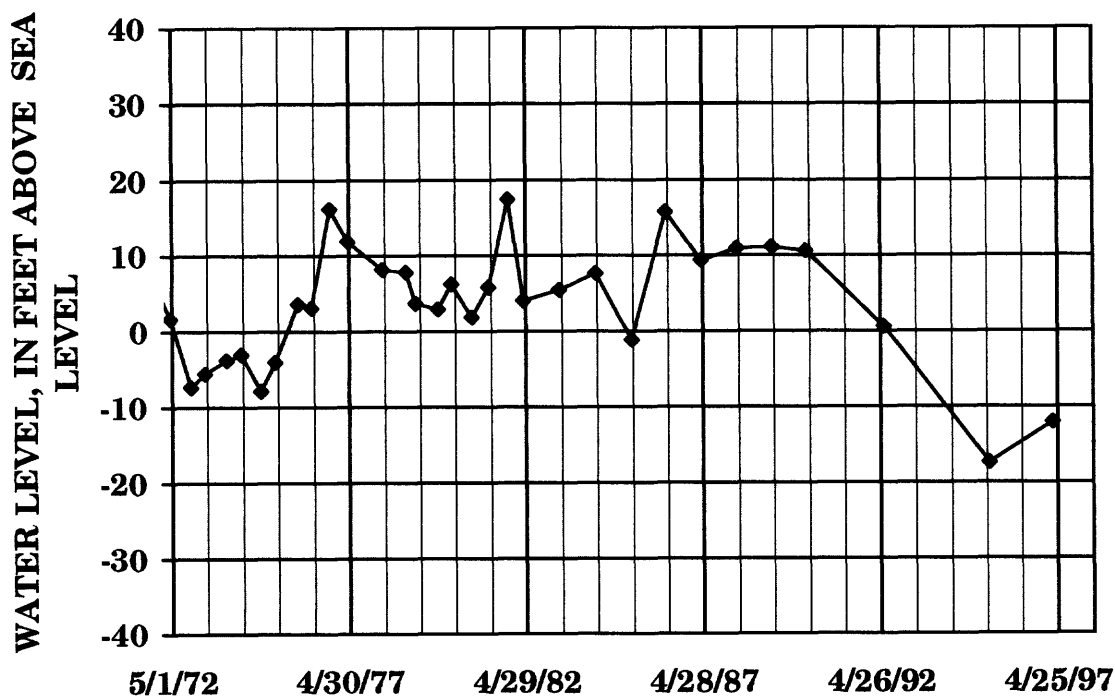


Figure 2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 1 of 6).

C. COLUMBIA COUNTY 18S20W06DDC1



D. DESHA COUNTY 09S04W28DDD1SP

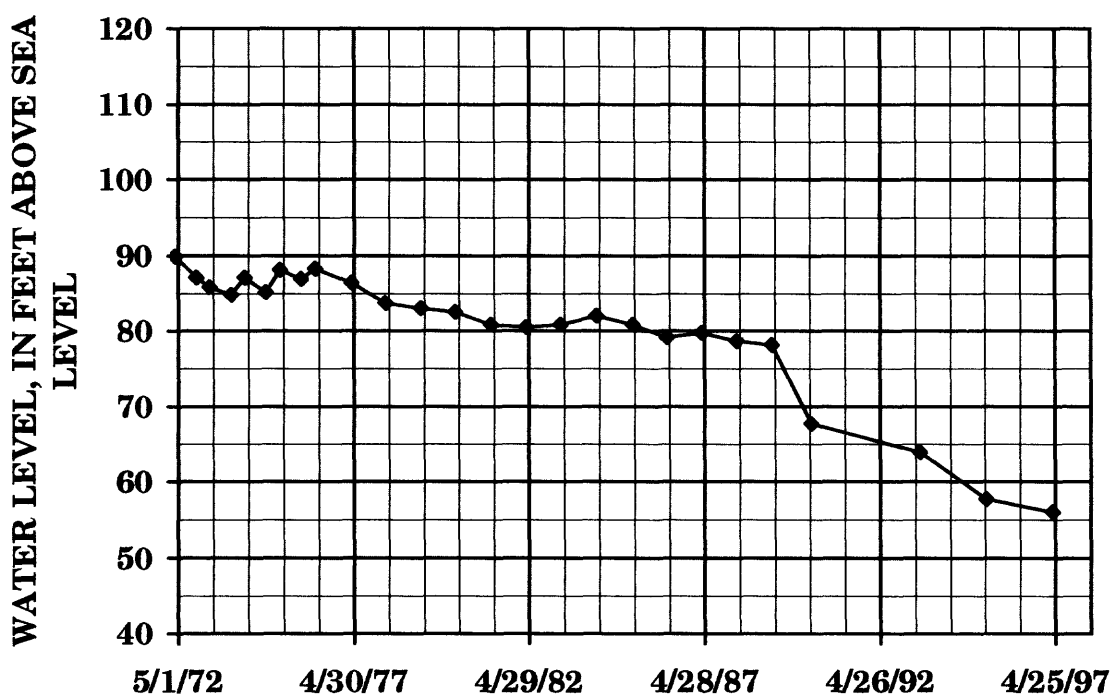
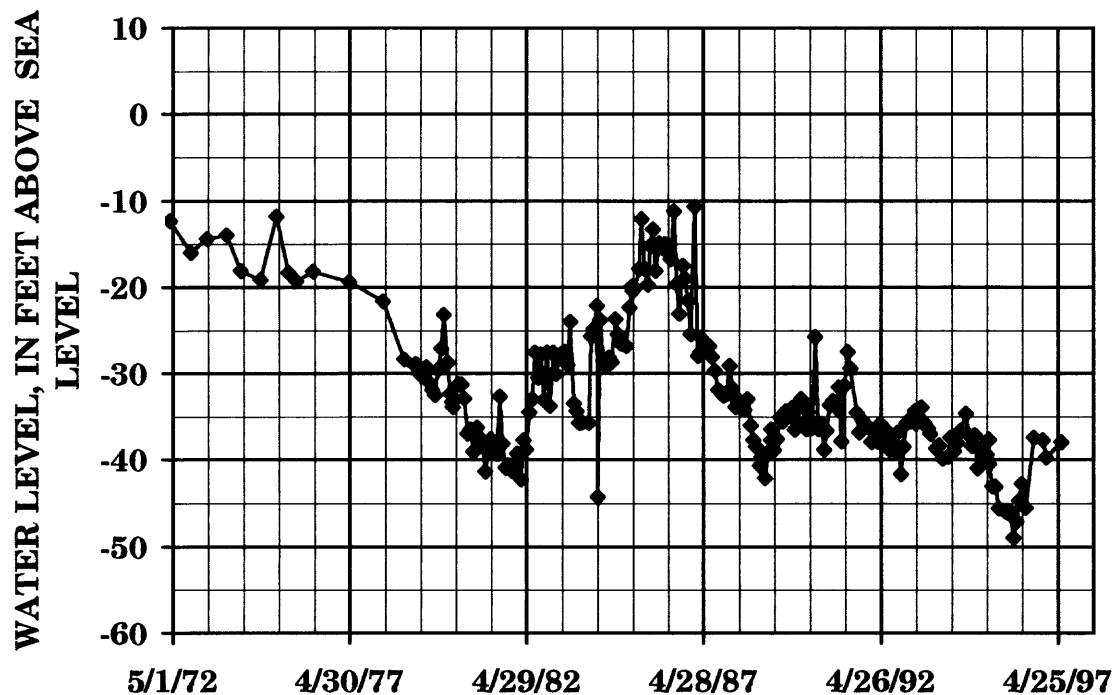


Figure 2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 2 of 6).

E. JEFFERSON COUNTY 06S08W16CCC1



F. PHILLIPS COUNTY 01S02E32DDC1

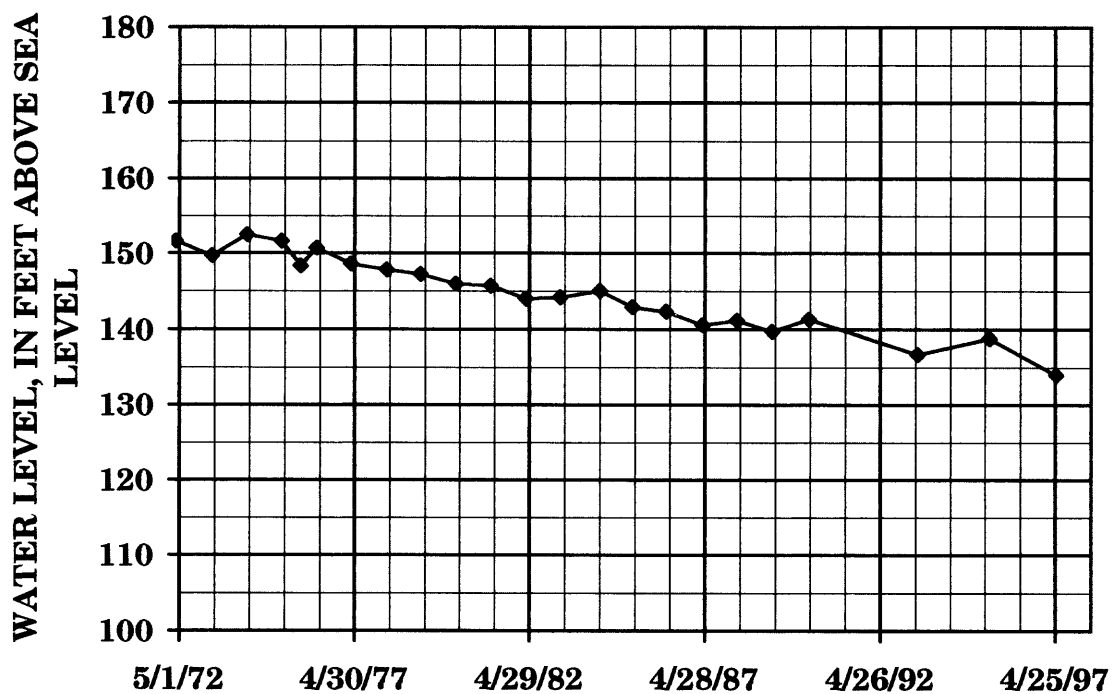
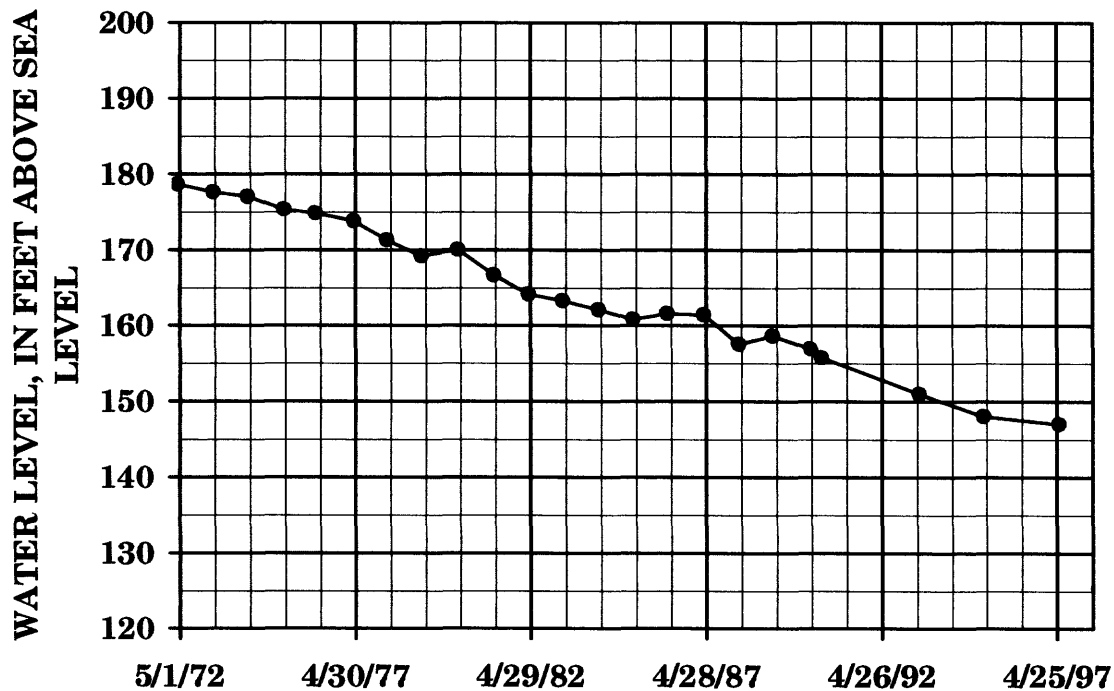


Figure 2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 3 of 6).

G. POINSETT COUNTY 10N01E15DBB1



H. UNION COUNTY 16S16W02ABC1

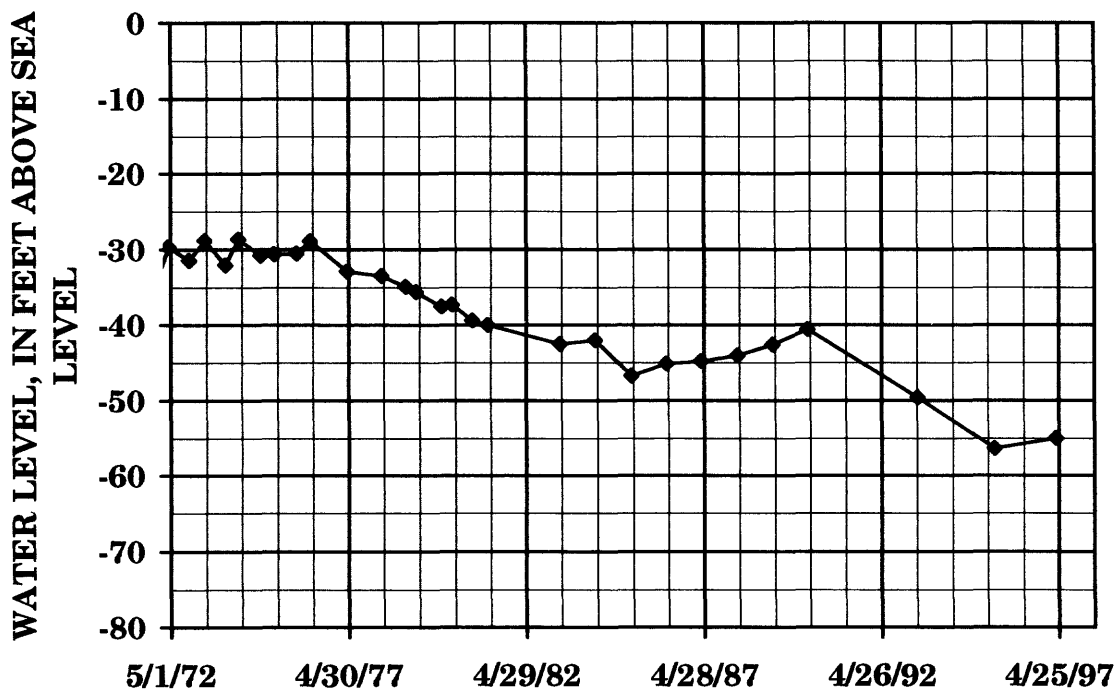
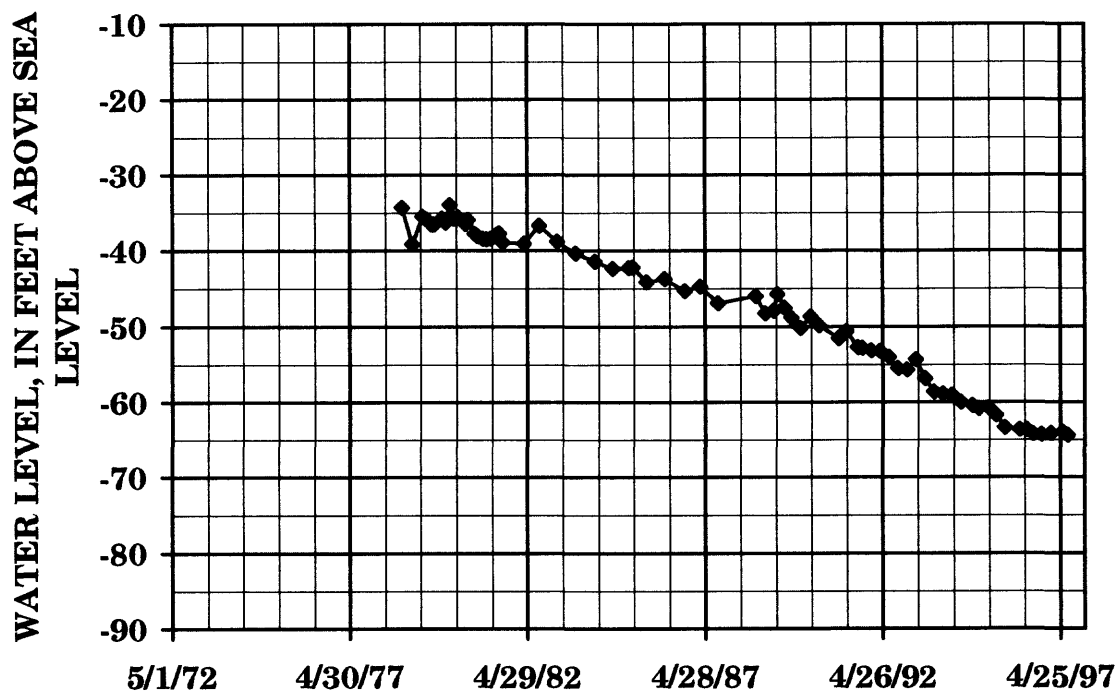


Figure 2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 4 of 6).

I. CLAIBORNE PARISH CI-149



J. LINCOLN PARISH L-26

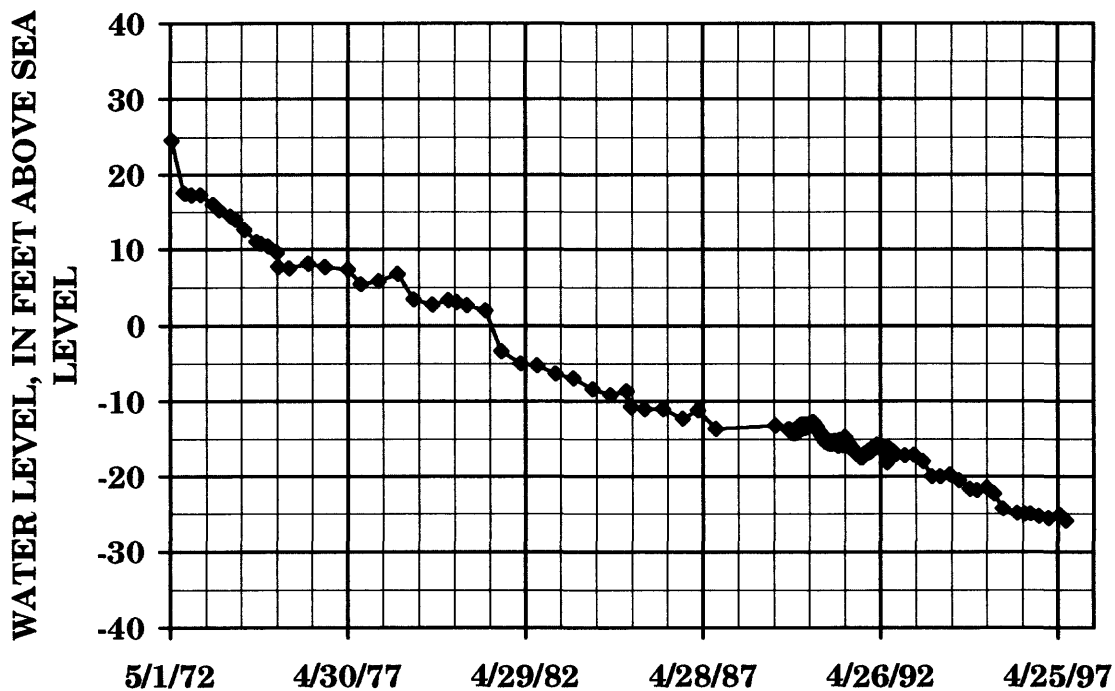
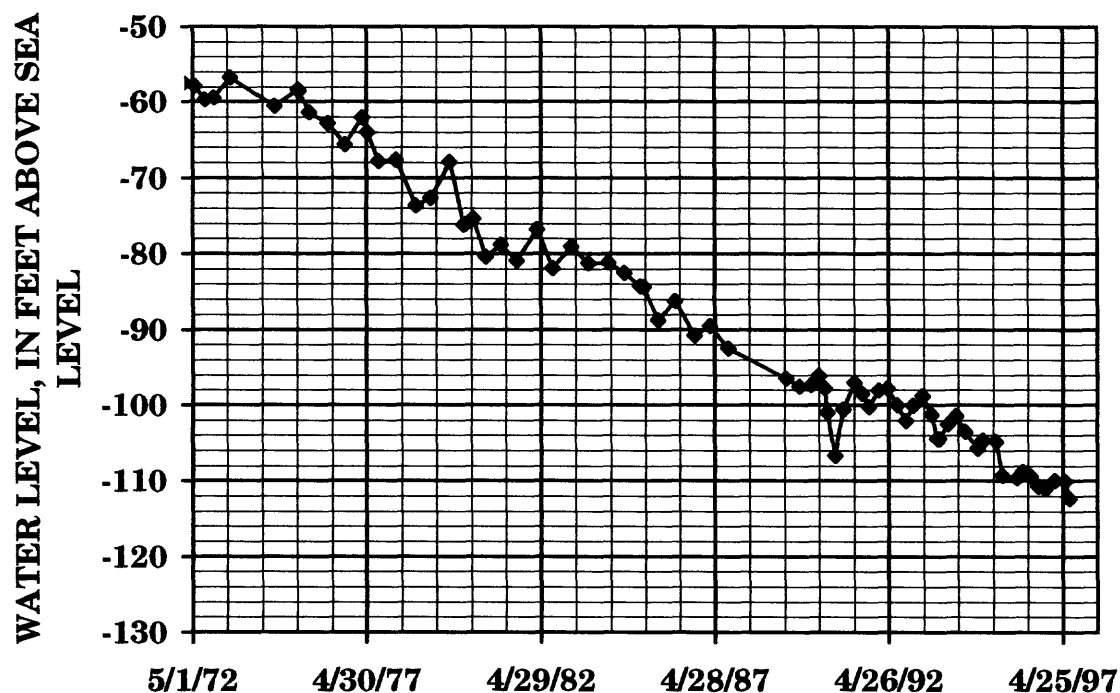


Figure 2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 5 of 6).

K. OUACHITA PARISH Ou-444



L. WEBSTER PARISH Wb-399

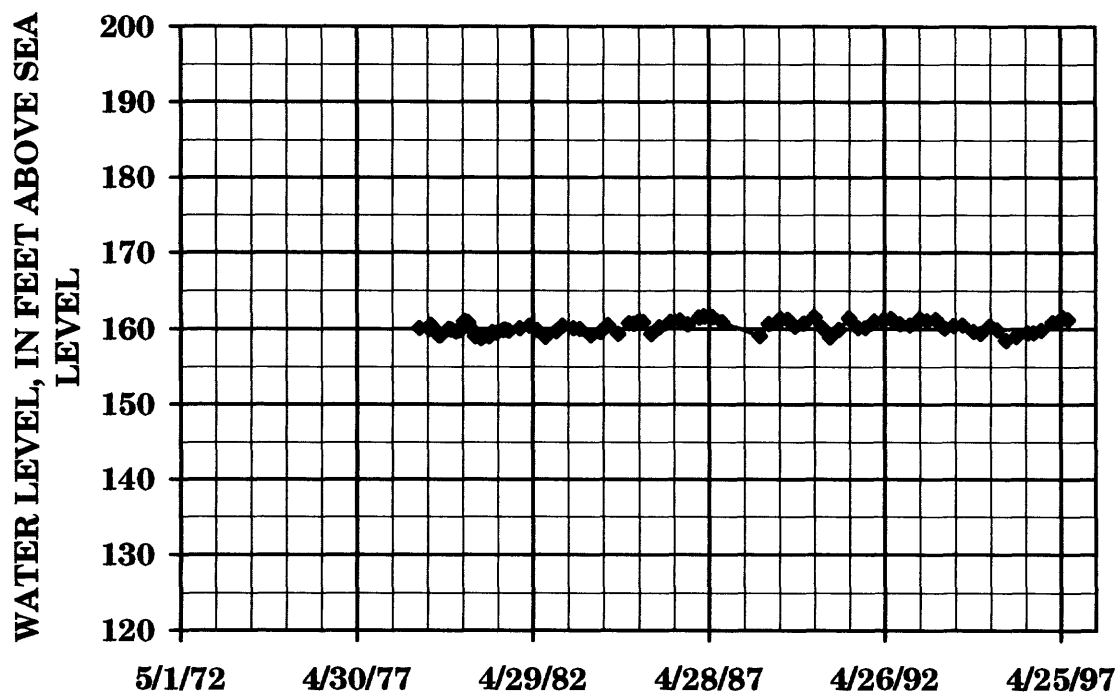


Figure 2. Water-level hydrographs for selected wells completed in the Sparta and Memphis aquifers (page 6 of 6).

SUMMARY

During the 1997 water year, the water level in the Sparta and Memphis aquifers was measured in about 274 wells in Arkansas, and the water level in the Sparta aquifer was measured in about 55 wells in Louisiana by the U.S. Geological Survey in cooperation with the Arkansas Soil and Water Conservation Commission, the Arkansas Geological Commission, and the Louisiana Department of Transportation and Development. In Arkansas, an estimated 284 Mgal/d was withdrawn from the Sparta and Memphis aquifers in 1995, an increase of about 61 Mgal/d from 1990. In Louisiana, an estimated 71 Mgal/d was withdrawn from the Sparta aquifer in 1995, an increase of about 7 Mgal/d from 1990.

The general direction of ground-water flow in the Sparta and Memphis aquifers is from the west to the east and southeast. The regional direction of ground-water flow in Arkansas is from the north and west to the south and east, away from the recharge zone of the outcrop and subcrop area, except near areas affected by intense ground-water withdrawals; such areas are manifested by large cones of depression centered in Columbia, Jefferson, and Union Counties. The regional ground-water flow in the Sparta aquifer in north-central Louisiana generally is downdip in an easterly direction from the recharge zone of the outcrop and subcrop area in the west toward the Mississippi Alluvial Plain. Major recharge areas in Arkansas exhibit potentiometric highs greater than 200 feet above sea level along the recharge zone of the outcrop and subcrop areas on the southern one-third of the western boundary and the northern portion of the study area in the State. The major recharge areas of Louisiana also exhibit potentiometric highs greater than 200 feet above sea level along the western boundary of the study area. In Arkansas, the potentiometric surface of the Sparta and Memphis aquifers exhibits cones of depression descending below sea level in the central and southern parts of the State. Comparison of potentiometric surface maps through time shows that the cones of depression in Columbia and Union Counties are coalescing at or near the Columbia and Union County line. In Louisiana, the potentiometric surface of the Sparta aquifer contains a cone of depression descending below sea level in the north-central parts of the State. However, the general direction of ground-water movement indicates that heavy pumpage locally has altered or reversed the natural direction of flow in some areas.

Flow in these areas is toward the cones of depression at the center of pumping.

Long-term hydrographs of 10 wells indicate trends of water-level decline over a 25-year history. During the period 1972-1997, water-level declines were less than 0.8 ft/yr in Columbia and Phillips Counties, between 1.0 and 1.5 ft/yr in Arkansas, Bradley, Desha, Jefferson, Poinsett, and Union Counties, and more than 2.0 ft/yr in Lincoln and Ouachita Parishes.

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