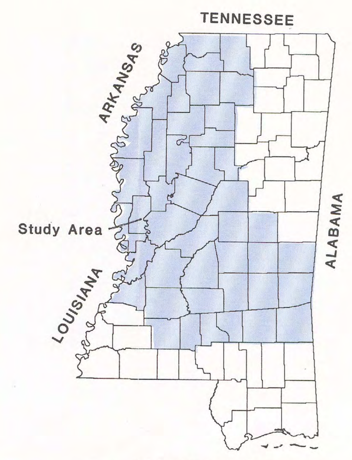
Prepared in cooperation with the
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF LAND AND WATER RESOURCES

WATER-RESOURCES INVESTIGATIONS REPORT 94-4048
Oakley, W.T. and Burt, D.E., Jr., 1994, Potentiometric-surface map of the Sparta aquifer in Mississippi, October through December 1989

INTRODUCTION

As part of a program to document and evaluate the potentiometric surface (water level) of the major aquifers in Mississippi, the U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, Office of Land and Water Resources, measures water levels at about 5-year intervals in wells completed in the Sparta aquifer. This report, the third in the series for the Sparta aquifer includes a potentiometric-surface map (fig. 1) based on water-level data collected in 133 wells in 23 counties during October through December 1989, and hydrographs of selected observation wells completed in the Sparta aquifer (fig. 2). Previously published potentiometric-surface maps of the Sparta aquifer were based on water-level measurements made in fall 1980 (Wasson, 1981) and in fall 1984 (Darden, 1987).



LOCATION MAP

HYDROGEOLOGY

The Sparta aquifer generally consists of two or more sand beds separated by discontinuous clay beds. The aquifer is in the Claiborne Group of Eocene age and massive beds of sand are common. The Sparta aquifer is overlain by the Cook Mountain Formation and underlain by the Zilpha Clay. Deposits of the Cook Mountain Formation and of the Zilpha Clay act as confining beds for water in the Sparta aquifer.

In Mississippi, the Sparta aquifer is exposed at the surface in a band extending from Clarke County (at the Mississippi-Alabama State boundary) northwestward through central Mississippi into southwestern Tennessee. The Sparta aquifer subcrops the Mississippi River alluvial aquifer in the northeastern part of the Mississippi River Alluvial Plain in Mississippi (Arthur and Taylor, 1991). The Sparta aquifer ranges in thickness from about 100 feet in the eastern part of the outcrop area to about 1,000 feet downdip near the limit of freshwater (water having less than 1,000 milligrams per liter dissolved solids) (Newcome, 1976). A detailed description of the hydrogeology of the Sparta aquifer is given by Newcome (1976).

WATER USE

The Sparta aquifer generally contains water acceptable for most uses and is a principal source of water in about 40 percent of Mississippi. The aquifer is a principal source of freshwater for a number of large public water suppliers in northwestern and central Mississippi. Total withdrawal from the aquifer in Mississippi during 1985 was about 64 million gallons per day (P.M. Johnson, U.S. Geological Survey, oral commun., 1993). The largest withdrawals from the aquifer were about 18 million gallons per day in the Jackson metropolitan area of Hinds, Madison, and Rankin Counties. Other major withdrawals were 10 million gallons per day at Yazoo City (Yazoo County), and more than 5 million gallons per day at Cleveland (Bolivar County), and at Clarksdale (Coahoma County).

WATER LEVELS

The potentiometric surface (fig. 1) indicates that over most of the study area, the regional ground-water flow in the Sparta aquifer generally is to the west and southwest, away from the outcrop area toward the heavily pumped Jackson metropolitan area and toward the regional discharge area under the Mississippi River Alluvial Plain. In the southern part of the study area near the Chickasawhay River, the flow is toward the river.

The largest cone of depression in the potentiometric surface (fig. 1) was in the Jackson metropolitan area (Hinds, Madison, and Rankin Counties), where large withdrawals are made from the Sparta aquifer for industrial and public supplies. The potentiometric surface of the Sparta aquifer fluctuates seasonally in response to natural variations in recharge and discharge and to pumping from nearby wells. Water-table conditions exist in the outcrop area, and artesian conditions exist in the confined part of the aquifer. Ground-water levels in or near the outcrop area generally fluctuate only a few feet seasonally and show no long-term changes. Wells completed in the confined part of the aquifer show long-term declines in water levels as a result of pumping.

During 1980-89, water levels in the confined part of the Sparta aquifer, in areas distant from heavy pumping, generally declined less than 1 foot per year. During that period, water-level declines of more than 20 feet were measured at sites in Jasper, Madison, Rankin, and Sunflower Counties. Measured water-level changes during 1980-89 in 109 wells are listed in table 1.

HYDROGRAPHS

Water-level trends in the Sparta aquifer are evident from long-term records of water levels in two observation wells (fig. 2). Water levels in many wells completed in the aquifer had a downward trend, but some seasonal variations in water levels occurred in wells near pumping centers. Two typical hydrographs for wells completed in the Sparta aquifer show water-level trends for the period 1970-89. For example, the water-level hydrograph for well G125 in Hinds County shows a downward trend with relatively large yearly fluctuations attributed to pumping in the area. The water-level hydrograph for well L1 in Simpson County shows a relatively stable downward trend with small seasonal fluctuations.

REFERENCES

Arthur, J.K., and Taylor, R.E., 1991, Ground-water flow analysis of the Mississippi embayment aquifer system, south-central United States: U.S. Geological Survey Open-File Report 91-451, 105 p.

Belt, W.E., and others, 1945, Geologic map of Mississippi: Mississippi Geological Society, Jackson, Mississippi, 1 sheet.

Darden, Daphne, 1987, Potentiometric-surface map of the Sparta aquifer in Mississippi, fall 1984: U.S. Geological Survey Water-Resources Investigations Report 86-4206, 1 sheet.

Newcome, Roy, Jr., 1976, The Sparta aquifer system in Mississippi: U.S. Geological Survey Water-Resources Investigations Report 76-7, 3 sheets.

Wasson, B.E., 1981, Potentiometric map of the Sparta aquifer in Mississippi, fall 1980: U.S. Geological Survey Water-Resources Investigations Report 81-1051, 1 sheet.

ADDITIONAL INFORMATION

Data describing the individual wells used in this study may be obtained from the following:

Director
Mississippi Department of Environmental Quality
Office of Land and Water Resources
P.O. Box 10631
Jackson, Mississippi 39209

District Chief
U.S. Geological Survey
Water Resources Division
100 West Capitol Street, Suite 710
Jackson, Mississippi 39269

Copies of this report can be purchased from:

U.S. Geological Survey
Earth Science Information Center
Open-File Reports Section
Box 25286, MS 517, Federal Center
Denver, Colorado 80225

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
foot	0.3048	meter
mile	1.609	kilometer
million gallons per day	0.04381	cubic meter per second

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

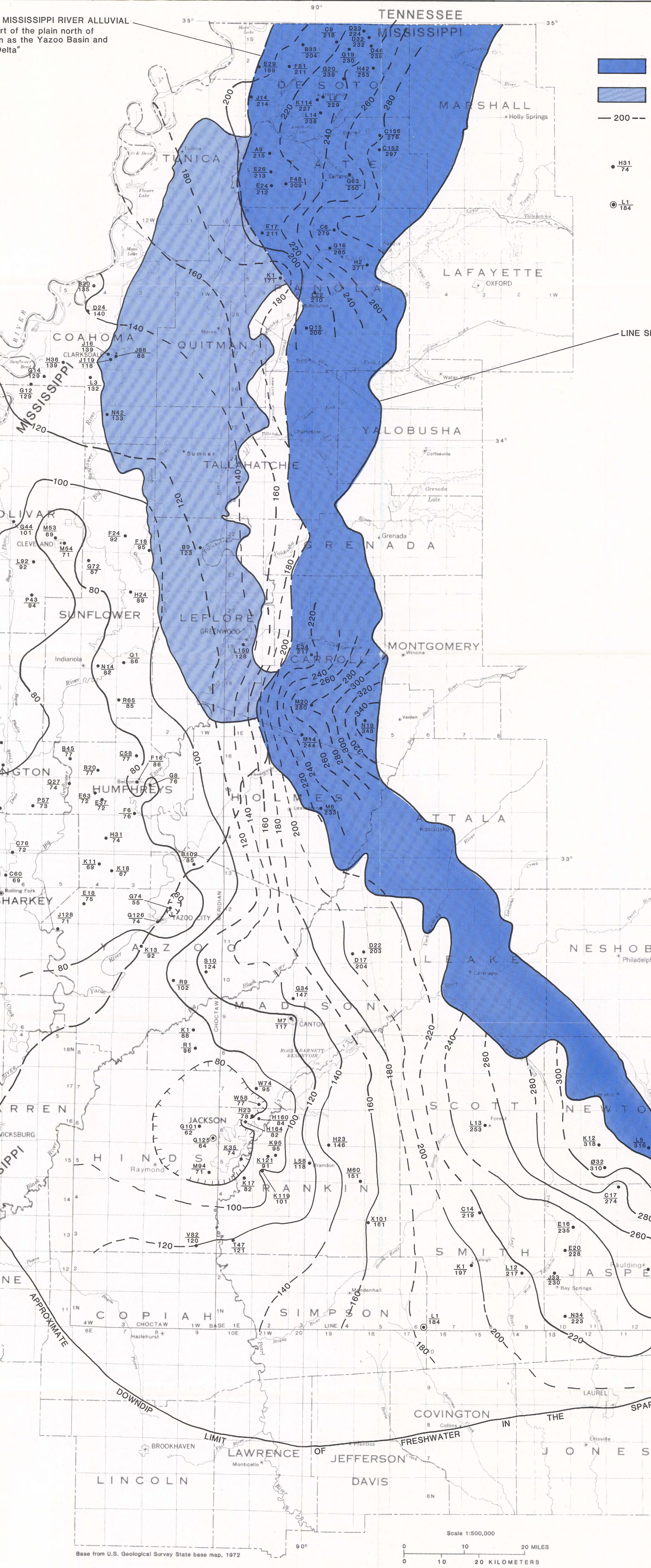


Figure 1.--Potentiometric surface of the Sparta aquifer, October through December 1989.

EXPLANATION

OUTCROP AREA OF SPARTA SAND IN MISSISSIPPI--Generalized from Newcome (1976) and from Belt and others (1945)

SUBCROP AREA OF SPARTA SAND BENEATH THE MISSISSIPPI RIVER ALLUVIAL--Generalized from Newcome (1976)

— 200 – – POTENTIOMETRIC CONTOUR--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Hachures indicate depressions. Contour interval 20 feet. Datum is sea level

• H31/74 OBSERVATION WELL--Upper number is well number, which is alpha-numerical by county. Lower number is altitude of water surface, in feet above sea level

◉ L1/184 OBSERVATION WELL FOR WHICH HYDROGRAPH IS SHOWN--Upper number is well number which is alpha-numerical by county. Lower number is altitude of water surface, in feet above sea level

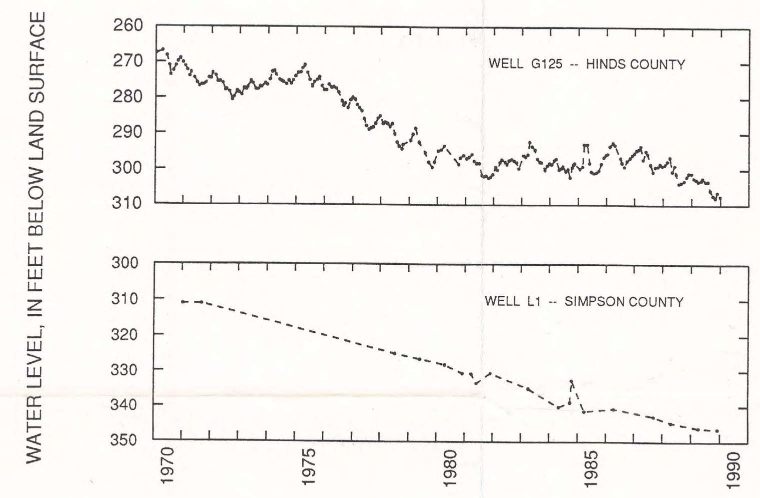


Figure 2.--Water levels in selected observation wells completed in the Sparta aquifer, 1970-89.

Table 1.--Water-level changes for wells completed in the Sparta aquifer
[--, insufficient data to compute value; negative value indicates a decrease in water level]

County	Local well number	Measured water-level change from 1980 to 1989 (in feet)
Bolivar	G44	-7
	J8	-6
	L92	--
	M53	-17
	M54	-7
	N51	-8
	P43	-6
Carroll	E34	-3
	M14	2
	M20	-1
	N19	-3
Clarke	H4	-7
	M3	3
	M6	-1
	M36	-17
	R1	0
Coahoma	B20	-4
	D24	-5
	G12	-2
	G14	-5
	H36	-2
	J16	3
	J68	-12
	J119	-3
	L3	-3
	N42	4
DeSoto	B33	--
	C9	--
	D32	-4
	D33	-6
	D46	-16
	E29	-6
	F81	--
	G19	--
	G20	--
	H42	--
	J14	--
	K114	7
	L2	--
	L14	--
Hinds	G101	--
	G125	-11
	H23	-8
	H160	-12
	H164	-4
	M94	-15
	V82	-12
Holmes	M6	1
Humphreys	B20	-12
	B45	-7
	C58	-10
	E37	-9
	E63	-11
	F6	-12
	F16	-4
	G8	-11
	H31	-12
	K11	-13
	K18	-12
Issaquena	B4	-6
Jasper	C17	-27
	E16	-10
	E20	-23
	J33	-19
	L4	-8
	N34	-15
Leflore	B9	-1
	L150	--

County	Local well number	Measured water--level change from 1980 to 1989 (in feet)
Madison	D17	-5
	D22	-15
	G34	-14
	K1	-15
	M7	-24
	R1	-13
	W58	-4
	W74	--
Newton	K12	-6
	L5	1
	Ø32	-7
Panola	C6	--
	E17	3
	G16	3
	H2	--
	K1	-1
	L22	2
	Q15	--
Rankin	H23	-19
	K17	-19
	K35	--
	K95	-17
	K119	-7
	K121	-9
	L58	-17
	M60	--
	T47	-5
	X101	-21
Scott	L13	-12
Sharkey	C60	-8
	C76	-8
Simpson	L1	-16
Smith	C14	-15
	K1	-12
	L12	-15
Sunflower	F18	-9
	F24	-9
	G72	-21
	H24	-9
	N14	-13
	Ø1	--
	R65	-10
Tate	A9	-8
	C152	--
	C156	--
	E24	-1
	E26	--
	F48	--
	G63	1
Washington	L19	-2
	L70	-6
	N36	-5
	Ø41	-5
	P57	-9
	Q27	-3
	S64	-7
	S96	-7
Yazoo	B102	-11
	E18	-5
	G74	-19
	G126	--
	J128	-11
	K13	11
	R9	6
	S10	17

POTENTIOMETRIC-SURFACE MAP OF THE SPARTA AQUIFER IN MISSISSIPPI, OCTOBER THROUGH DECEMBER 1989

By William T. Oakley and David E. Burt, Jr.

1994