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OFFICE OF LAND AND WATER RESOURCES

WATER-RESOURCES INVESTIGATIONS REPORT 93-4174
Oakley, W.T., and others, 1993, Potentiometric-surface map of the lower Wilcox aquifer in Mississippi October through December 1988

POTENTIOMETRIC-SURFACE MAP OF THE LOWER WILCOX AQUIFER IN MISSISSIPPI, OCTOBER THROUGH DECEMBER 1988

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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 in wells statewide at about 5-year intervals. This report, the third in a series of map reports for the lower Wilcox aquifer, includes a potentiometric-surface map (fig. 1), based on water-level data collected in 69 wells in 28 counties during October through December 1988, and hydrographs of four selected observation wells screened in the aquifer (fig. 2). Previously published potentiometric-surface maps of the lower Wilcox aquifer were based on water-level measurements made in fall 1979 (Wasson, 1980) and in fall 1982 (Darden, 1986).

HYDROGEOLOGY

The lower Wilcox aquifer consists primarily of thick, interconnected sand beds and includes some interbedded layers of clay, silt, and lignite in the lower part of the Wilcox Group of Paleocene and Eocene age. The Wilcox Group also includes another major aquifer, the Meridian-upper Wilcox, which is underlain by the middle Wilcox. The Middle Wilcox, although not presently classified as a major aquifer, is of rapidly growing importance as a water supply source. The Meridian-upper Wilcox aquifer (the upper part of the Wilcox Group and lower part of the Claiborne Group) also consists of thick sand beds. In contrast, the middle Wilcox aquifer (the middle part of the Wilcox Group) consists of many irregular and discontinuous sand beds. In Mississippi, the lower Wilcox aquifer is separated from the deeper aquifers of Cretaceous age by thick and relatively impermeable confining units of the Midway and Selma Groups. Clay beds are common above the lower Wilcox aquifer and partially impede vertical flow between sands in the middle Wilcox aquifer and the lower Wilcox aquifer. The lower Wilcox aquifer dips about 20 feet per mile generally to the west in the northern part of the study area and about 50 feet per mile to the southwest in the southern part. The aquifer ranges in thickness from less than 50 feet in the central part of the study area to about 400 feet in the southern and about 350 feet in northern parts of the study area (Boswell, 1976).

The lower Wilcox aquifer crops out in a north to south arc, extending from Tippah County in the north to Lauderdale County in east-central Mississippi. Precipitation on the outcrop is the primary source of recharge to the aquifer. Ground water moves downgradient generally from the outcrop toward the west and southwest. The direction of movement is affected by local differences in hydraulic conductivity of the aquifer and by ground-water withdrawals (Boswell, 1976).

WATER USE

In Mississippi, the lower Wilcox aquifer is used for water supplies where the aquifer is thick and highly productive. The water quality commonly is suitable for most uses without treatment. Withdrawals from the lower Wilcox aquifer primarily are for public supply and industrial uses. Water-use data for the lower Wilcox were estimated for 1985 as part of the National Water Use Information Program of the U.S. Geological Survey. The following data were retrieved from the Mississippi Water-Use Data System for the counties in the study area. In 1985, Meridian, in Lauderdale County, had the largest withdrawal from the lower Wilcox aquifer, about 3.2 million gallons per day. Other major withdrawals, greater than 1 million gallons per day, from the aquifer are: 1.85 million gallons per day at Louisville (Winston County), 1.06 million gallons per day at Batesville (Panola County), 1.03 million gallons per day near Senatobia (Tate County), and 1.03 million gallons per day north of Waynesboro (Wayne County).

WATER LEVELS

The potentiometric surface shown on the accompanying map (fig. 1) represents the altitude of water levels during October through December 1988 in 69 wells completed in the lower Wilcox aquifer. Minor cones of depression in the potentiometric surface of the aquifer have developed as a result of withdrawals. The most notable cones of depression are near Sardis and Batesville in Panola County, and northwest of Grenada in Grenada County; smaller cones are present in parts of Choctaw and Webster Counties.

Water levels in the lower Wilcox aquifer generally decrease from the outcrop in the eastern part of the study area downgradient toward the west and southwest, in the direction of regional ground-water flow (fig. 1). In the confined part of the aquifer, the configuration of the potentiometric surface is affected by differences in the hydraulic conductivity of the aquifer and by withdrawals for public and industrial supplies. In the outcrop area, the potentiometric surface is affected by recharge from precipitation and discharge to local streams.

From 1979 to 1988, large water-level declines (equal to or greater than 20 feet) in the lower Wilcox aquifer were observed in Panola, Tunica, and Yalobusha Counties (table 1). Smaller declines (greater than 10 feet) were measured near pumping centers in Carroll, Clarke, Coahoma, Lauderdale, Quitman, and Tate Counties. Although water levels have declined in the study area, large recoveries (greater than 20 feet) have resulted from the redistribution of pumping at Marks in Quitman County. Since 1979, Marks has developed a shallower aquifer (the Meridian-upper Wilcox) containing water suitable for most uses. Although significant water-level declines occurred between 1979 and 1989 at a number of pumping centers in the study area, the average long-term rate of decline in wells completed in the lower Wilcox aquifer is about one foot per year, based on water-level changes in 43 observation wells.

HYDROGRAPHS

Water-level trends in the lower Wilcox aquifer are evident from hydrographs showing long-term records. Hydrographs (fig. 2) for four wells completed in the aquifer show water-level trends between 1979 and 1988. Water levels in many wells completed in the aquifer had a slight downward trend overall, with seasonal variations from the overall trend in some wells as a result of their being located near pumping centers. For example, the water levels in well C111 in Coahoma County had a general downward trend with some small, seasonal fluctuations during the 9-year period. During the same period, the water levels in well B1 in Lafayette County had a slight upward trend when nearby pumping was discontinued, then a downward trend with seasonal fluctuations. Water levels in well M25 in Webster County had a downward trend with seasonal fluctuations. Water levels in well M3 in Lauderdale County had a downward trend with relatively large, seasonal fluctuations attributed to nearby pumping.

REFERENCES

Boswell, E.H., 1976, The lower Wilcox aquifer in Mississippi: U.S. Geological Survey Water-Resources Investigations Report 60-75, 1 sheet.

Darden, Daphne, 1986, Potentiomeric map of the lower Wilcox aquifer in Mississippi, fall 1982: U.S. Geological Survey Water-Resources Investigations Report 85-4059, 1 sheet.

Wasson, B.E., 1980, Potentiometric map of the lower Wilcox aquifer in Mississippi, fall 1979: U.S. Geological Survey Water-Resources Investigations Report 80-597, 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
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 25285, MS 517
Denver 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 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first order level net of both the United States and Canada, formerly called Sea Level Datum of 1929.

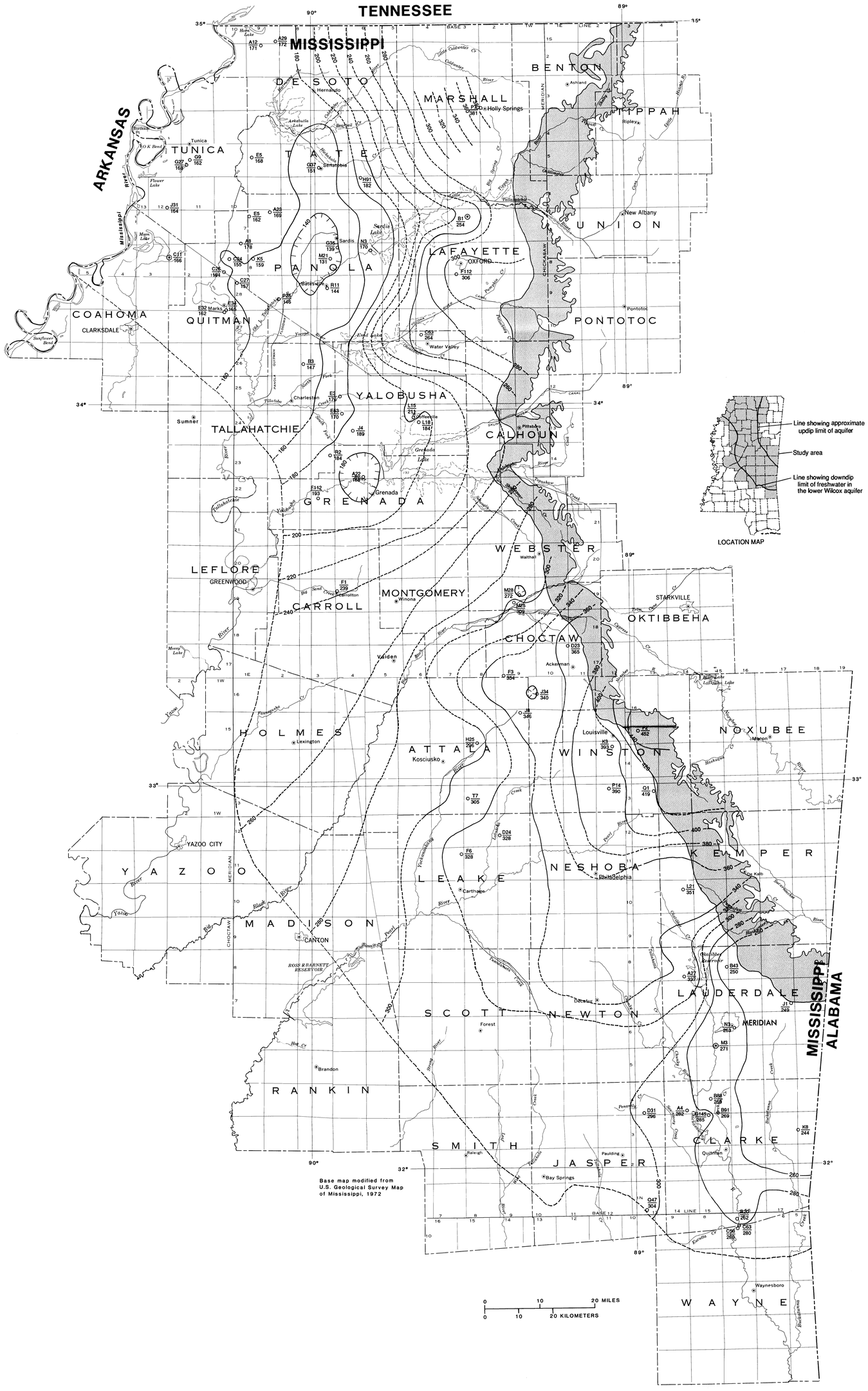

Figure 1.--Potentiometric surface of the lower Wilcox aquifer, October through December 1988.

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

County	Local well number	Measured water-level change from 1979 to 1988 (in feet)	County	Local well number	Measured water-level change from 1979 to 1988 (in feet)
Attala	H25	--	Panola	A23	--
	J8	--		E5	--
	T7	-5		G35	--
				K5	--
Carroll	F1	-11		M21	--
				N3	-21
Choctaw	D23	-5		P25	-16
	F3	5		R11	--
	J34	--			
			Quitman	A8	-15
Clarke	A4	-3		C24	-14
	A5	-11		C26	-6
	B88	-7		C27	--
	B91	--		E32	42
	G145	-8		E34	--
	K8	--			
	R20	--	Tallahatchie	B3	-3
				R2	-6
Coahoma	C111	-12			
			Tate	E5	-12
Desoto	A12	-10		G37	-15
	A29	-9		H91	-5
Grenada	A22	--	Tunica	G9	-11
	F112	-2		G27	-11
				J31	-20
Jasper	D31	--			
	Q47	--	Wayne	C58	--
				C63	--
Kemper	L21	--			
			Webster	A10	-8
Lafayette	B1	2		M25	-10
	F112	-7		M28	--
Lauderdale	A27	--	Winston	F2	-1
	B43	--		K3	-5
	J1	-3		P14	--
	M3	-8		Q1	-3
	N3	-11			
			Yalobusha	C63	--
Leake	D24	-6		E3	-13
	F6	-3		E53	--
				J4	-53
Marshall	P72	1		L15	-7
				L18	-11

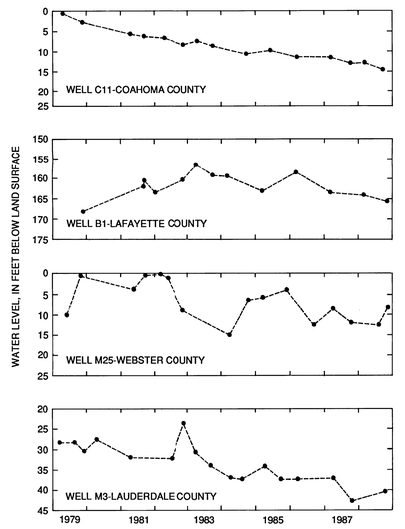

Figure 2.--Water levels in selected observation wells completed in the lower Wilcox aquifer, 1979-88.

EXPLANATION

- OUTCROP AREA OF LOWER WILCOX AQUIFER IN MISSISSIPPI (BOSWELL, 1976)
- 280 -- POTENTIOMETRIC CONTOUR--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Hachures indicate depression. Contour interval 20 feet. Datum is sea level
- F3 / 354 OBSERVATION WELL--Upper number is well number, which is alpha-numerical by county. Lower number is altitude of water surface, in feet
- M3 / 271 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