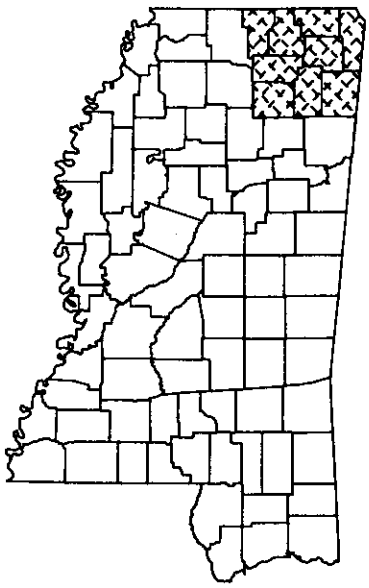
POTENTIOMETRIC MAP OF THE COFFEE SAND AQUIFER IN NORTHEASTERN MISSISSIPPI FALL AND WINTER, 1992

by

James H. Hoffmann and David L. Hardin

OLWR HYDROLOGIC MAP 93-2



MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

OFFICE OF LAND AND WATER RESOURCES

Charles T. Branch

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STATE OF MISSISSIPPI
DEPARTMENT OF ENVIRONMENTAL QUALITY
JAMES I. PALMER, JR.
EXECUTIVE DIRECTOR

LETTER OF TRANSMITTAL

Commission on Environmental Quality
of the State of Mississippi

To the Citizens of the State of Mississippi:

The Department of Environmental Quality, Office of Land and Water Resources, is pleased to transmit to you OLWR Map 93-2, entitled "Potentiometric Map of the Coffee Sand Aquifer in Northeastern Mississippi, Fall and Winter, 1992" by James H. Hoffmann and David L. Hardin.

The wise use of the ground-water resources of Mississippi is dependent upon the collection of water-level data. This report presents data and interpretations pertinent to that effort.

It is hoped that water-management agencies, municipalities, water associations, and the water development industry can utilize data from this report to the benefit of the citizens of the State of Mississippi.

Respectfully submitted,

R. B. Flowers

R. B. (Dick) Flowers
Chairman

CONTENTS

POTENTIOMETRIC MAP OF THE COFFEE SAND AQUIFER

IN NORTHEASTERN MISSISSIPPI,

FALL AND WINTER, 1992

INTRODUCTION

This potentiometric map of the Coffee Sand aquifer is one of a series of maps published by the Mississippi Department of Environmental Quality, Office of Land and Water Resources. The maps delineate the potentiometric surfaces of the major fresh-water aquifers in Mississippi at five-year intervals for the purpose of documenting changes in water levels. It should be noted that water levels may be highly variable seasonally or even daily, and therefore only long-term and regional trends should be interpreted from the data presented herein. This publication augments and updates water-level information previously published by the U. S. Geological Survey Water Resources Division in cooperation with the Mississippi Office of Land and Water Resources (Darden, 1985; Goldsmith, 1992; Wasson, 1980).

The map is based on water-level measurements made in 33 wells during the period from October, 1992 through January, 1993. Subsequent measurements were made in some wells completed in the Coffee Sand in June of 1993. These water-level measurements are included in Table 1 and Figures 1-3, but were not used to construct the potentiometric map (Plate 1).

Records of water wells screened in the Coffee Sand aquifer were evaluated to select candidates for water-level measurements. If a water-level measurement could be made in a well, the location was plotted at the site on a U. S. Geological Survey 7.5 Minute Series Topographic Map. The altitude of the land surface at the well was determined from the map, the measuring point on the well was described, and the height of the measuring point above land surface was noted. These plotted well locations were digitized and entered into a GIS database that was used to generate base maps for this study. After collecting the field data, the altitude of the screened interval of each well was checked on electric logs if available or compared with the structural altitude of the top and base of the Coffee Sand aquifer to ensure that each well was screened in the correct aquifer. Water levels that were below land surface were measured with a steel tape. Each measurement was recorded and at least one additional measurement was made to verify the validity of the first measurement. Flowing (artesian) wells were measured with a pressure gage.

ACKNOWLEDGEMENTS

In the course of the field investigations, S. W. Bryant, J. F. Everett, P. E. Grantham, S. P. Jennings, L. A. May, P. A. Phillips, L. Stewart, and A. J. Warner were of great assistance in the collection of water-level data used in this study. E. H. Boswell made many helpful suggestions and reviewed the report. A. J. Warner was most helpful in providing information concerning water use from the Coffee Sand aquifer. P. A. Phillips rendered great service in preparation of all of the data for presentation in its final format through the use of a GIS data base.

HYDROGEOLOGY

The Coffee Sand is a part of the Selma Group of Late Cretaceous age. This formation crops out in Mississippi in a north-south trending belt from Tennessee into eastern Alcorn and western Tishomingo, central Prentiss, the northeastern quarter of Lee to just south of Tupelo, and the extreme northwestern corner of Itawamba County. From the outcrop area, the Coffee Sand dips westward into the subsurface beneath the Demopolis Chalk.

The southern boundary of the Coffee Sand is an arbitrary zone from central Lee County at approximately the latitude of Tupelo westward into the subsurface of Lee, central Pontotoc, and southern Lafayette Counties. In this area, the Coffee Sand changes laterally to the south into the more marine lithology of its equivalent units, the Mooreville Chalk and the lower part of the Demopolis Chalk. Boswell (1963) considered the southern limit of the Coffee Sand aquifer to be the zone where there is not sufficient sand to allow the construction of small capacity water wells in the unit.

From the vicinity of Tupelo northward to about the northern boundary of Lee County and westward into the subsurface, the Coffee Sand is underlain by the chalk and clay of the Mooreville Chalk. North of this area, the Coffee Sand is in direct contact with the underlying Eutaw Formation. In the areas to the north and west of the limits of occurrence of the Eutaw Formation in Marshall, DeSoto, and Benton Counties, the Coffee Sand rests directly upon rocks of Paleozoic age.

The Coffee Sand is composed of fine to medium-grained sand with zones of silty sand and clay and occasional thin beds of sandstone. Sand beds range from several inches to several feet in thickness and may be up to 30 feet thick in some places (Boswell, 1979). The overall thickness of the Coffee Sand varies in the subsurface. It is about 200 feet in northern Alcorn County, 250 feet in Tippah and northern Union Counties, 150 feet in Pontotoc County, and reaches a maximum thickness of 300 feet in northern Lee County (Boswell, 1963, p. 56).

AQUIFER DEVELOPMENT AND GROUND-WATER USE

The Coffee Sand aquifer is a source of freshwater for many public water supplies in several counties of northeastern Mississippi (Plate 1). From the outcrop area and about 20 miles westward, the aquifer is extensively utilized for domestic and stock water supplies (Boswell, 1979).

Springs and dug or bored wells in the Coffee Sand were sources of water for domestic and farm supplies in Alcorn, Prentiss, and Lee Counties in the late nineteenth and early twentieth centuries. Flowing wells were common, particularly in the Tuscumbia River valley in Alcorn County. Wells for public drinking water supplies were drilled early in this century. Stephenson, Logan, and Waring (1928) reported that a Coffee Sand well was developed by the City of Corinth in 1917. In 1939 another Coffee Sand well that reportedly pumped at a rate of 600 gallons per minute was drilled at Corinth. Both of these wells were eventually abandoned due to excessive concentrations of iron in the water that required treatment for public drinking water use. At Blue

Springs in Union County, a 400-foot Coffee Sand well was in use in the early years of the twentieth century and at New Albany a Coffee Sand well was drilled in 1920 to supply the town with drinking water.

In 1946 two Coffee Sand wells were drilled to supply the town of Ripley in Tippah County. By the early 1960's, two more wells were added at Ripley and a well was drilled at Blue Mountain. In Union County, several industries near New Albany were pumping water from the aquifer. At this time the Coffee Sand had also been developed as a source of water for domestic and farm supply in northern Pontotoc and southeastern Lafayette Counties.

The United States Geological Survey estimated total water use from the Coffee Sand aquifer in 1975 to be nearly 4 million gallons per day (Boswell, 1979). Industries and public water supplies withdrew approximately 2.8 million gallons per day in Tippah County at this time.

Estimated total withdrawals from the Coffee Sand in 1991 were more than 3 million gallons per day, of which 2.75 million gallons were pumped for public and industrial supplies. Approximately 1 million gallons of water per day are pumped from the Coffee Sand at Ripley. Other large withdrawals from the aquifer are in the area of New Albany, at Blue Mountain, Falkner, Walnut, and near Kossuth in Alcorn County. Several rural water systems, mainly in Tippah, Union, and western Alcorn Counties currently utilize the Coffee Sand as a source of water. Most Coffee Sand wells pump less than 300 gallons per minute but larger capacity wells of 400 to 500 gallons per minute have been constructed at Ripley in Tippah County and at Corinth and sites in western Alcorn County.

WATER LEVELS

Recharge to the Coffee Sand is primarily by precipitation on the outcrop where permeable sand units are exposed at the surface. Most of this water is discharged to streams and springs in and near the outcrop area, but some moves westward beneath the confining layers of the Demopolis Chalk. In the outcrop areas ground water is primarily under water-table conditions. Topography and discharge to streams and springs combined with seasonal climatic changes are principal influences upon water levels. Water levels in and near the outcrop areas of the Coffee Sand have shown little or no historical long-term change (Wasson, 1980).

In the areas to the west of the outcrop, the Coffee Sand aquifer is under artesian conditions and water moves in a general westward or southwestward direction. Water levels in this area are influenced by pumpage. This is evident in the cones of depression that have developed at Ripley and at other locations where significant amounts of water are being pumped (Plate 1). Where the Mooreville is very thin or missing, vertical movement of water between the Eutaw and Coffee Sand is possible.

A comparison of 1992 and 1993 water-level measurements with previous measurements in the same wells reveals that there has been a general decline in water levels in the downdip areas of the Coffee Sand aquifer (Table 1). The average annual rate of long-term decline varies through the area in which the aquifer has been developed. Water levels in western Alcorn County have been generally declining at a rate of less than 1 foot to as much as 2 feet per year while Tippah County levels have been declining from about 1.5 to 3 feet per year. The highest

rates of decline were observed in an area northeast of New Albany in Union County where water levels appear to be declining at least locally at rates of 2 to more than 4 feet per year. This decline is not in an area of particularly heavy withdrawals and may be attributed to a decrease in transmissivity in the aquifer because of reduced sand content in the formation. Water-level changes in the Coffee Sand aquifer through time are shown in Table 1 and on the hydrographs in Figures 1-3.

SELECTED REFERENCES

Bicker, A. R., 1969, Geologic map of Mississippi: Mississippi Geological Survey, scale 1:500,000, 1 sheet.

Boswell, E. H., 1963, Cretaceous aquifers of northeastern Mississippi: Mississippi Board of Water Commissioners Bulletin 63-10, 202 p.

---------, E. H., 1979, The Coffee Sand and Ripley aquifers in Mississippi: U. S. Geological Survey Water-Resources Investigations Report 78-114, 1 sheet.

Darden, D., 1985, Potentiometric map of the Coffee Sand aquifer in northeastern Mississippi, fall 1982: U. S. Geological Survey Water-Resources Investigations Report 85-4075, 1 sheet.

Goldsmith, G. D. S., 1992, Potentiometric-surface map of the Coffee Sand aquifer in northeastern Mississippi, August through December 1987: U. S. Geological Survey Water-Resources Investigations Report 91-4064, 1 sheet.

Oakley, W. T., and Burt, D. E., Jr., 1992, Records of public-supply wells in Mississippi, 1991: U. S. Geological Survey Open-File Report 92-82, 110 p.

Stephenson, L. W., Logan, W. N., and Waring, G. A., 1928, Ground-water resources of Mississippi, with discussions of the chemical character of the waters, by C. S. Howard: U.S. Geological Survey Water-Supply Paper 576, 515 p.

Wasson, B. E., 1980, Potentiometric map of the Coffee Sand aquifer in northeastern Mississippi, October and November 1978: U.S. Geological Survey Water-Resources Investigations Open-File Report 79-1587, 1 sheet.

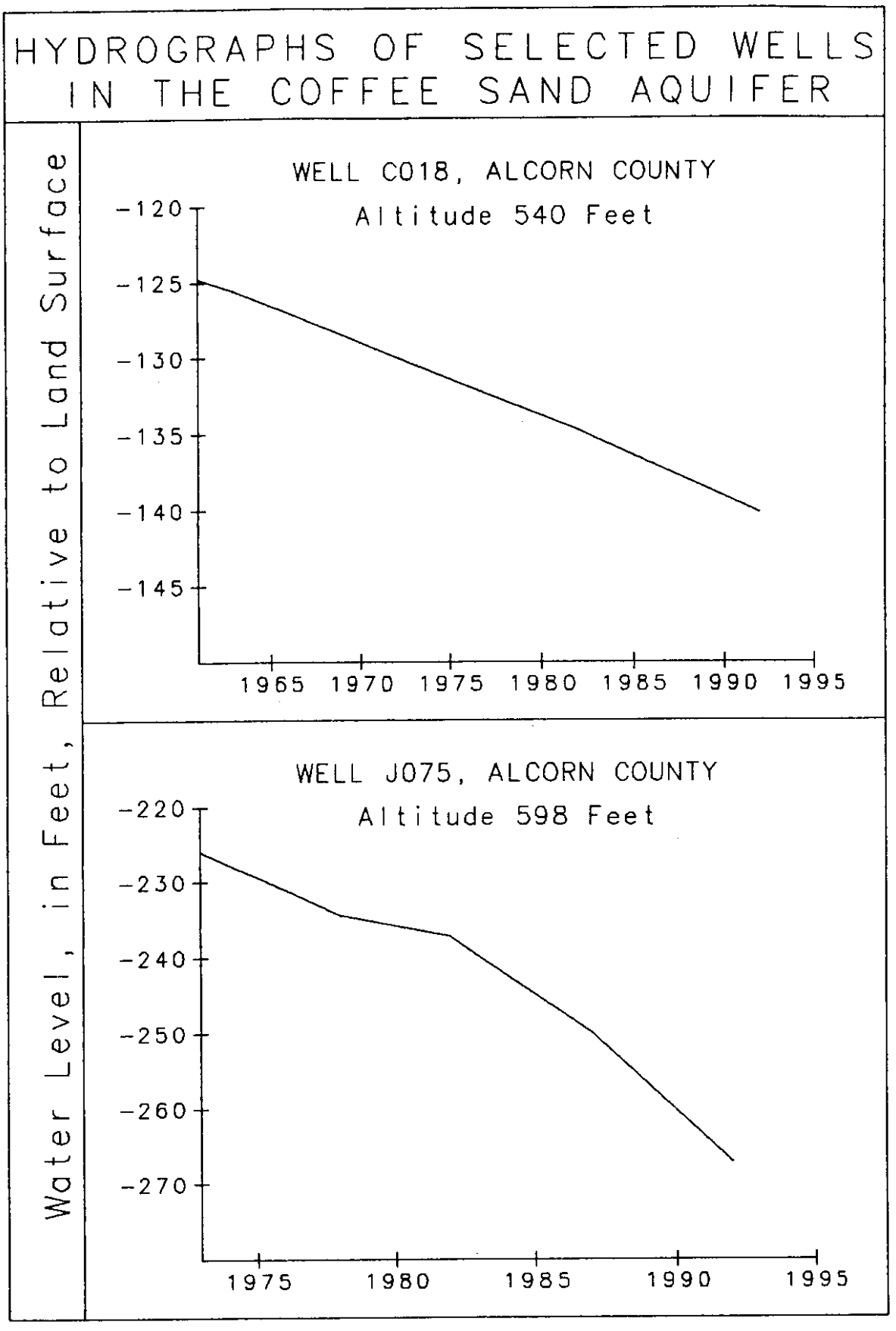
HYDROGRAPHS OF SELECTED WELLS IN THE COFFEE SAND AQUIFER
Water Level, in Feet, Relative to Land Surface
WELL C018, ALCORN COUNTY
Altitude 540 Feet
-120
-125
-130
-135
-140
-145
1965
1970
1975
1980
1985
1990
1995
WELL J075, ALCORN COUNTY
Altitude 598 Feet
-220
-230
-240
-250
-260
-270
1975
1980
1985
1990
1995

FIGURE 1

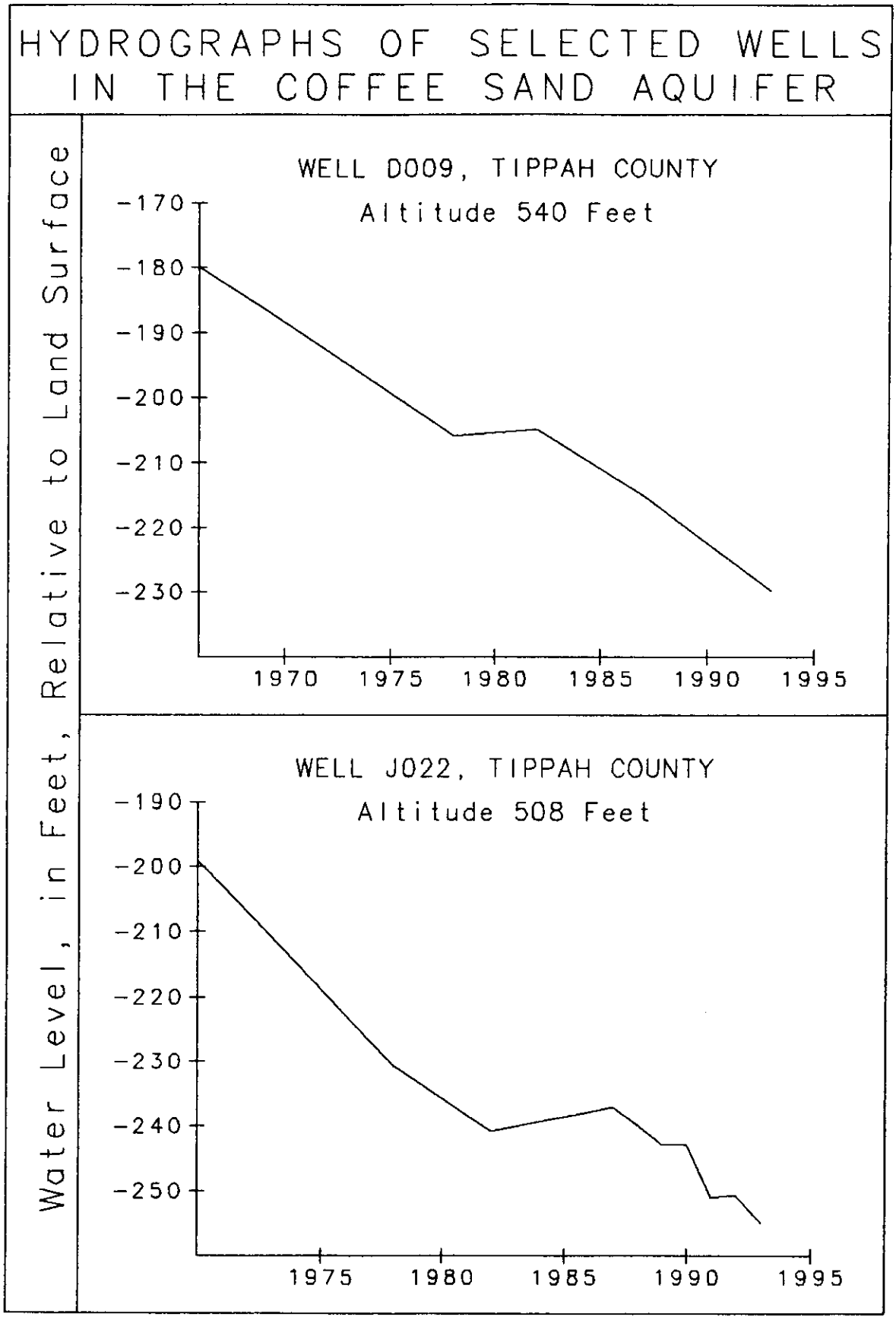
HYDROGRAPHS OF SELECTED WELLS IN THE COFFEE SAND AQUIFER
Water Level, in Feet, Relative to Land Surface
WELL D009, TIPPAH COUNTY
Altitude 540 Feet
-170
-180
-190
-200
-210
-220
-230
1970
1975
1980
1985
1990
1995
WELL J022, TIPPAH COUNTY
Altitude 508 Feet
-190
-200
-210
-220
-230
-240
-250
1975
1980
1985
1990
1995

FIGURE 2

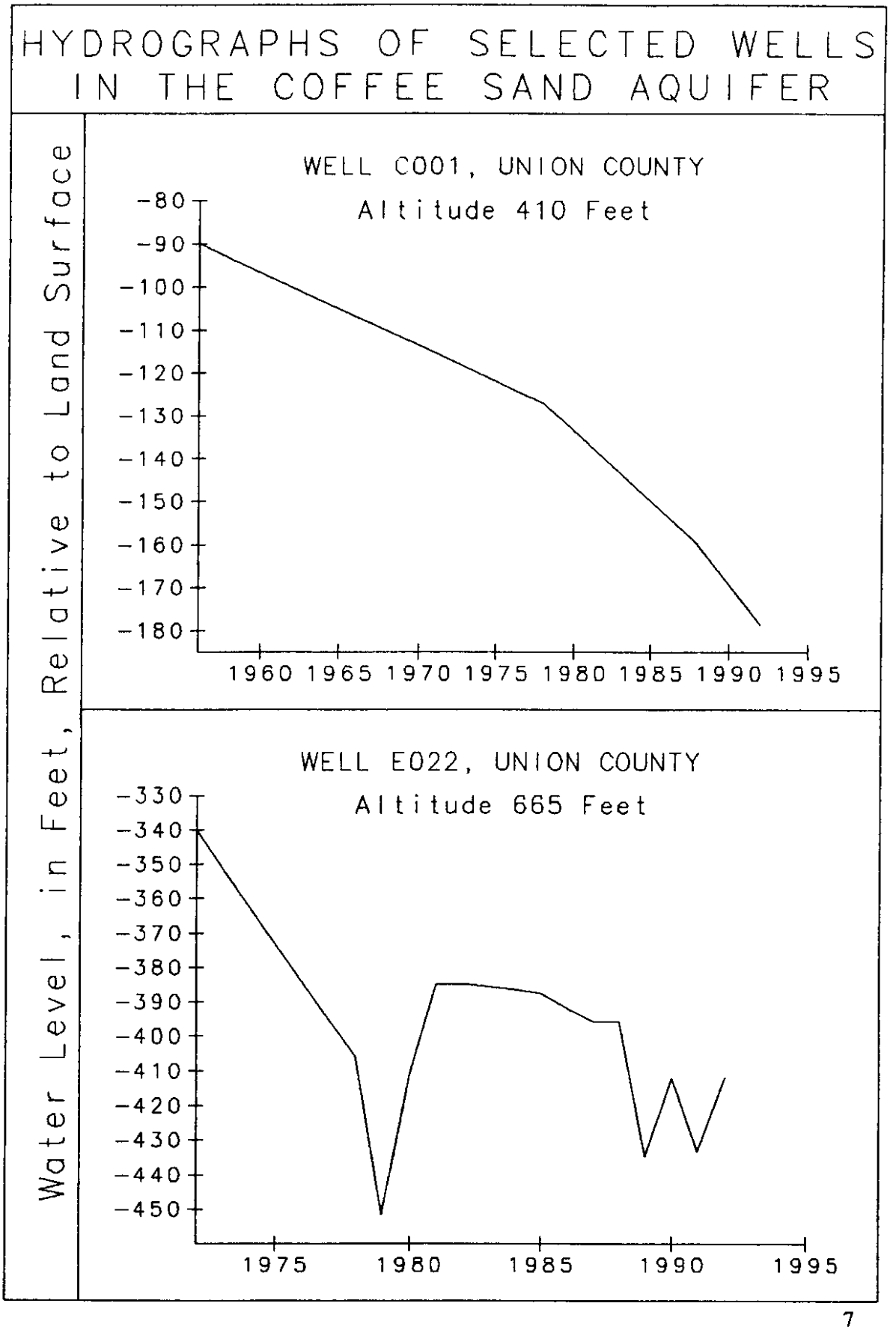
HYDROGRAPHS OF SELECTED WELLS IN THE COFFEE SAND AQUIFER
Water Level, in Feet, Relative to Land Surface
WELL C001, UNION COUNTY
Altitude 410 Feet
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
1960 1965 1970 1975 1980 1985 1990 1995
WELL E022, UNION COUNTY
Altitude 665 Feet
-330
-340
-350
-360
-370
-380
-390
-400
-410
-420
-430
-440
-450
1975 1980 1985 1990 1995

FIGURE 3

TABLE 1: WATER LEVEL RECORDS OF WELLS SCREENED IN THE COFFEE SAND AQUIFER

COUNTY	U.S.G.S. WELL NUMBER	ALTITUDE IN FEET RELATIVE TO MSL	1992 HEAD VALUES IN FEET RELATIVE TO MSL	1992 WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	PREVIOUS WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	AVERAGE CHANGE IN WATER LEVEL RISE (+) OR DECLINE (-) IN FEET PER YEAR
ALCORN	A020	670	340.90	329.10	309.00 (1974)	- 1.12
	C018	540	399.80	140.20	124.80 (1961)	- 0.50
	C074	540	404.90	135.10	130.00 (1973)	- 0.27
	D025	510	442.70	67.30	63.00 (1978)	- 0.31
	E020	660	328.10	331.90	315.00 (1974)	- 0.94
	F070	455	346.40	108.60	90.00 (1981)	- 1.55
	F074	422	363.70	58.30	----------.----------	----------.----
	J075	598	330.85	267.15	226.00 (1973)	- 2.06
	L011	495	427.30	67.70	74.30 (1988)	+ 1.32
LEE	B023	380	350.10	29.90	42.40 (1967)	+ 0.50
	E024	360	316.70	43.30	45.00 (1965)	+ 0.06
	G089	310	284.20	25.80	31.80 (1978)	+ 0.43
	G090	340	270.90	69.10	78.00 (1978)	+ 0.64
PRENTISS	B003	525	476.80	48.20	51.30 (1978)	+ 0.22
	F030	505	443.50	61.50	62.00 (1978)	0.04
	J010	430	329.20	100.80	90.00 (1956)	- 0.30
	J030	464	333.20	130.80	115.00 (1978)	- 1.13
TIPPAH	A034	666	304.80	361.20	336.30 (1978)	- 1.66
	A035	700	291.70	408.30	391.00 (1986)	- 2.47
	B011	530	302.35	227.65	186.00 (1970)	- 1.81
	D009	540	310.10	229.90	180.00 (1966)	- 1.85
	E013	465	278.93	186.07	128.00 (1968)	- 2.32
	E027	465	269.60	195.40	----------.----------	----------.----
	H016	502	267.12	234.88	218.00 (1986)	- 2.41
	J022	508	253.07	254.93	199.00 (1970)	- 2.43
	J076	485	249.28	235.72	220.00 (1987)	- 2.62
	L006	625	276.20	348.80	285.00 (1969)	- 2.66
	N012	456	261.17	194.83	115.00 (1961)	- 2.49
	P018	650	263.70	386.30	323.00 (1975)	- 3.52

COUNTY	U.S.G.S. WELL NUMBER	ALTITUDE IN FEET RELATIVE TO MSL	1992 HEAD VALUES IN FEET RELATIVE TO MSL	1992 WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	PREVIOUS WATER LEVELS IN FEET RELATIVE TO LAND SURFACE	AVERAGE CHANGE IN WATER LEVEL RISE (+) OR DECLINE (-) IN FEET PER YEAR
UNION	B003	365	178.23	186.77	80.00 (1959)	- 3.14
	C001	410	231.34	178.66	90.00 (1956)	- 2.40
	D024	418	236.05	181.95	127.00 (1981)	- 4.58
	E022	665	253.60	411.40	340.00 (1972)	- 3.40
	E024	665	260.68	404.32	325.00 (1973)	- 3.97
	N012	460	270.75	189.25	187.00 (1970)	- 0.10

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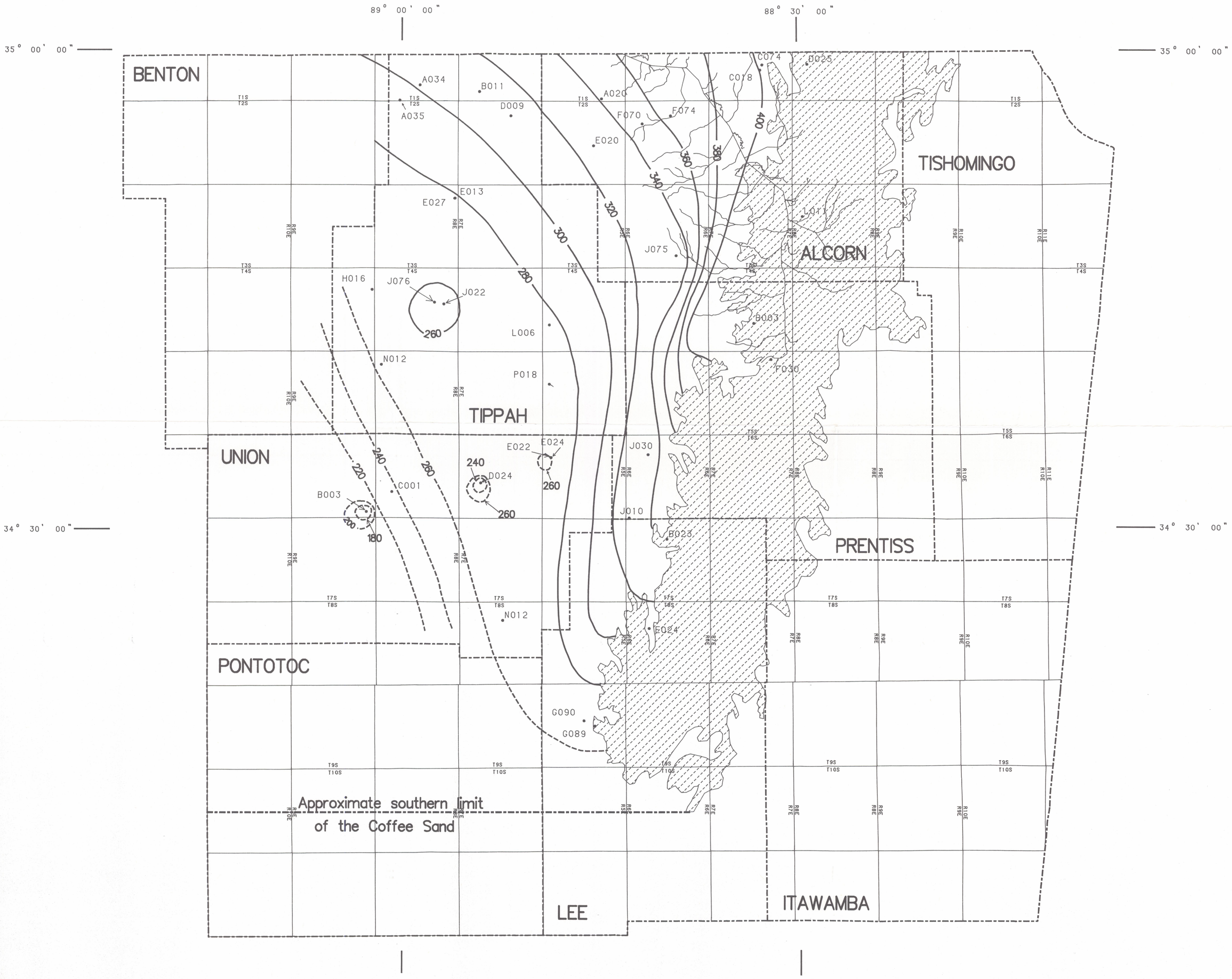
OLWR Hydrologic Map 93-2

Plate 1



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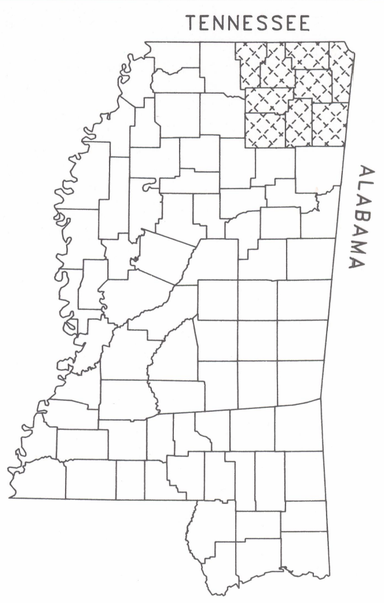

Location of Study Area

EXPLANATION

260 — POTENTIOMETRIC CONTOUR : Contour interval 20 feet. Datum is sea level.

OUTCROP AREA OF THE COFFEE SAND FORMATION IN MISSISSIPPI

A046 OBSERVATION WELL AND NUMBER

SCALE 1:260000

5 0 5 10

MILES