

INTRODUCTION

The Sparta Sand and Memphis Sand aquifers (see location map) are a major source of water supply for much of eastern and south-central Arkansas. Major withdrawals occur from the aquifers for industrial and public supply, with generally lesser but locally significant amounts withdrawn for agricultural uses. Water-level data from wells tapping the Sparta Sand and Memphis Sand aquifers indicate steadily declining water levels in some areas where relatively large withdrawals occur. In addition, a simulation of water levels using projected withdrawals to the year 1990 (Reed, 1972) indicated increasing water-level declines in the aquifers. In parts of south-central Arkansas, simulated water levels actually declined to below the top of the aquifer, which would cause a reduction in the aquifer transmissivity. Declining water levels also increase the potential for saltwater contamination in the aquifers.

Because of the potential quantity and quality problems, the continual monitoring of water levels in the Sparta Sand and Memphis Sand aquifers is essential for proper aquifer management and the continuation of the use of the aquifer as a major source of water for much of eastern and south-central Arkansas.

The U.S. Geological Survey with the cooperation of the Arkansas Geological Commission has been monitoring water levels in the Sparta Sand and Memphis Sand aquifers annually throughout the aquifer's extent within the State of Arkansas. This report, prepared in cooperation with the Arkansas Geological Commission and the Arkansas Soil and Water Conservation Commission interprets water-level data through hydrologic maps of the potentiometric surface and water-level changes. The potentiometric surface map is based on water levels collected in the spring of 1983. The water-level change map is based on a comparison of water levels collected in the spring of 1982 and 1983. This report includes the Sparta Sand and most of the Memphis Sand aquifer within the State of Arkansas. Little or no data are available in the northeastern part of the State where limited withdrawals from the Memphis Sand aquifer occur.

AQUIFER DESCRIPTION

The Sparta Sand aquifer underlies the central and southern parts of the study area. The aquifer is underlain by the Cane River Formation and overlain by the Cook Mountain Formation; both confining units. In the northern part of the study area, the Cane River Formation changes facies from clay to sand, forming a single sand unit from the base of the Carrizo Sand, which underlies the Cane River Formation, to the top of the Sparta Sand. This unit is as much as 800 feet thick and is known as the Memphis Sand aquifer. Hosman and others (1968) show the facies change occurring near latitude 33° N. The Sparta Sand and Memphis Sand aquifers in Arkansas extend from the state boundaries on the south, east, and north to the outcrop areas on the west (see location map).

The Sparta Sand and Memphis Sand aquifers are generally confined, except over the outcrop areas. Recharge to the aquifers occurs chiefly through precipitation on the outcrops and through percolation of water from overlying alluvium where it covers the outcrops. Minor amounts of recharge probably also occur from leakage of water through confining beds above or below, where the beds are greater than the head in the Sparta and Memphis Sand aquifers. Discharge from the Sparta Sand and Memphis Sand aquifers occurs by withdrawal from wells and by natural discharge to beds above or below these units where conditions of head permit. A more detailed description of the Sparta Sand and Memphis Sand aquifers is given in Hosman and others (1968).

POTENTIOMETRIC SURFACE MAP

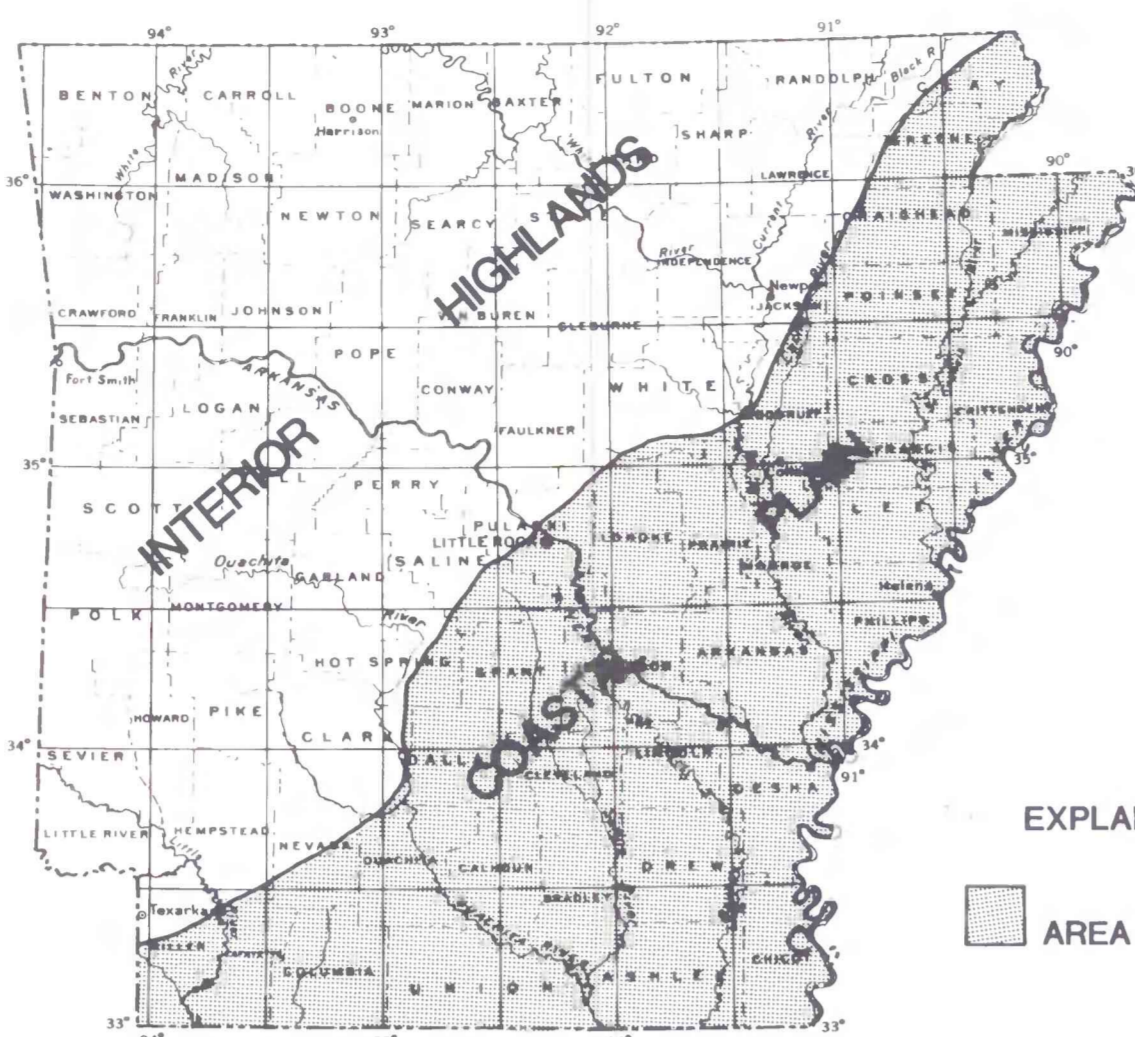
The potentiometric surface map indicates the altitude to which water would rise in tightly cased wells tapping the aquifers. The map is based on measurements made from March 14 to April 15, 1983 (Edds, 1983), prior to the beginning of the pumping season. The potentiometric contours indicate the general directional flow pattern or gradient in the aquifer, with movement being perpendicular to the contours.

The potentiometric surface gradient is generally towards the south except where significant pumping has caused cones of depression. In these places, the gradient is towards the zone of heaviest withdrawal. These cones of depression resulting from relatively large aquifer withdrawals are centered in Columbia, Ithion and Jefferson Counties. Based on water-use estimates for 1980 (Holland and Ludwig, 1981), the largest pumpage levels occurred in Jefferson County where an average of about 71 Mgal/d were withdrawn with over half of the water used for public supply and industry. In Union County a total of about 16 Mgal/d was withdrawn with about 94 percent of that utilized for public supply and industry. In Columbia County a total of about 7.2 Mgal/d was withdrawn with 65 percent used for public supply and industry. Relatively large withdrawals also occurred in Arkansas County (37.0 Mgal/d). The effect of these withdrawals is reflected in the elongation of the cone of depression at Pine Bluff toward Arkansas County. The actual magnitude of decline in the Sparta Sand in Arkansas County at other times of the year may be greater than that indicated because approximately 90 percent of this pumpage is withdrawn during the summer months for irrigation, and the time lapse between the end of the pumping season and the spring measurements is sufficient to allow for recovery of the potentiometric surface in Arkansas County.

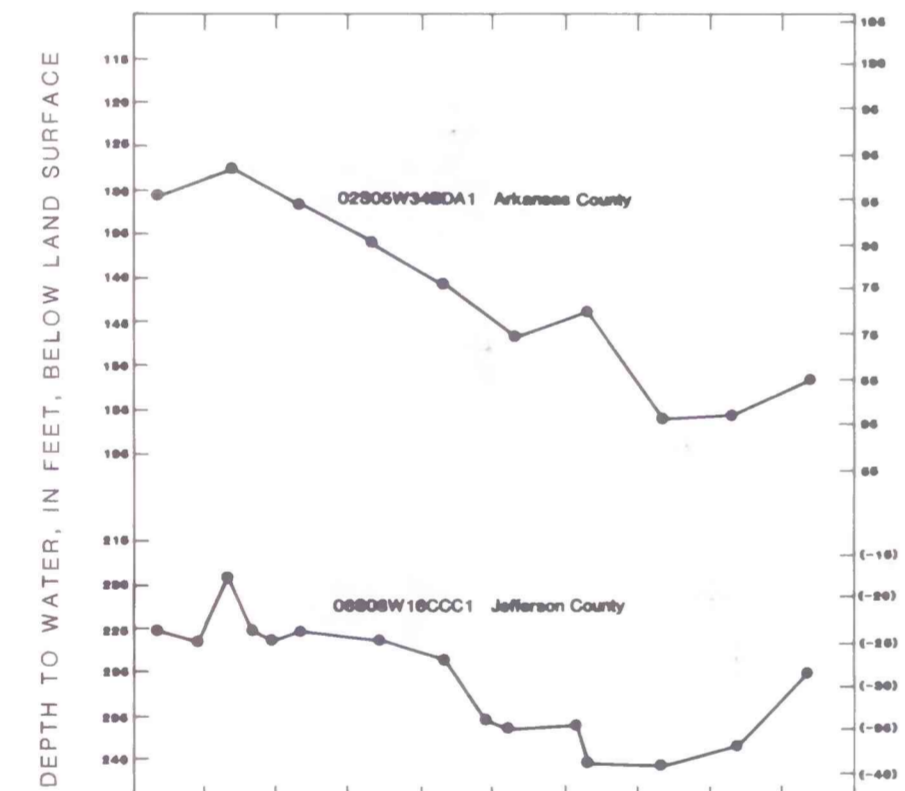
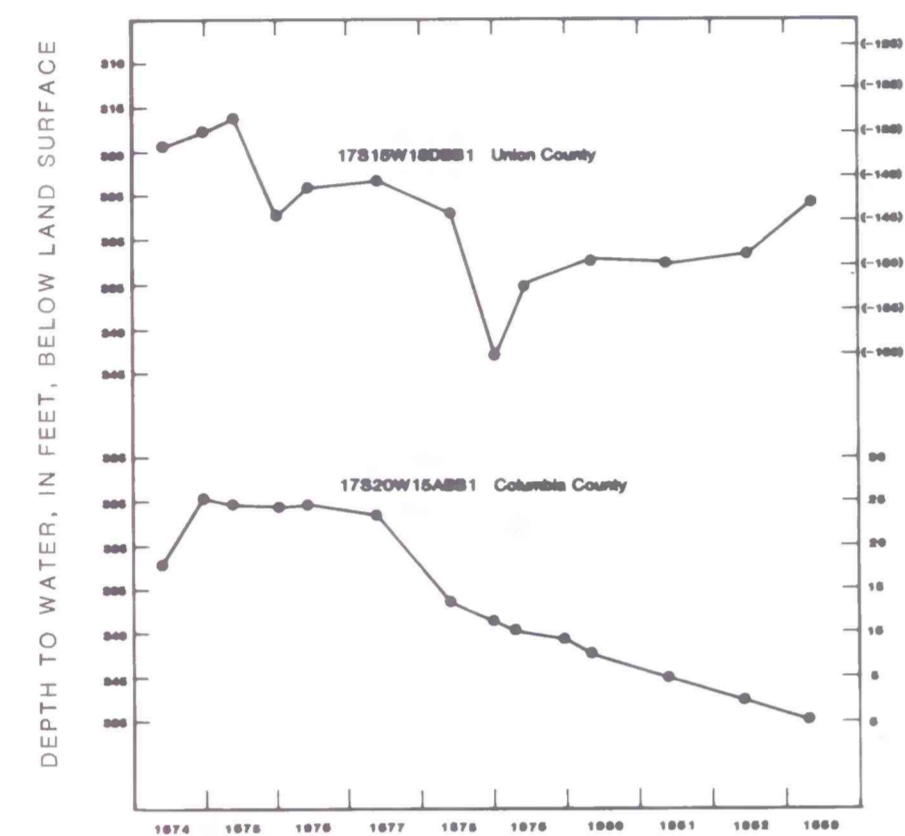
WATER-LEVEL CHANGE MAP

The net changes in ground-water levels in the Sparta Sand and Memphis Sand aquifers between spring 1982 and spring 1983 based on water-level measurements in each of the two years (Edds, 1982; Edds, 1983), are illustrated by the water-level change map. Of the 188 wells monitored, 130 showed a net increase, while 58 wells showed a net decrease. Increases generally occurred within the cone of depression in Jefferson and Ithion Counties. Levels generally decreased within the cone of depression centered in Columbia County.

In much of the study area water levels have been generally declining for several years. The hydrographs show this trend for four wells completed in the Sparta Sand aquifer in Jefferson, Arkansas, Ithion and Columbia Counties.



LOCATION MAP



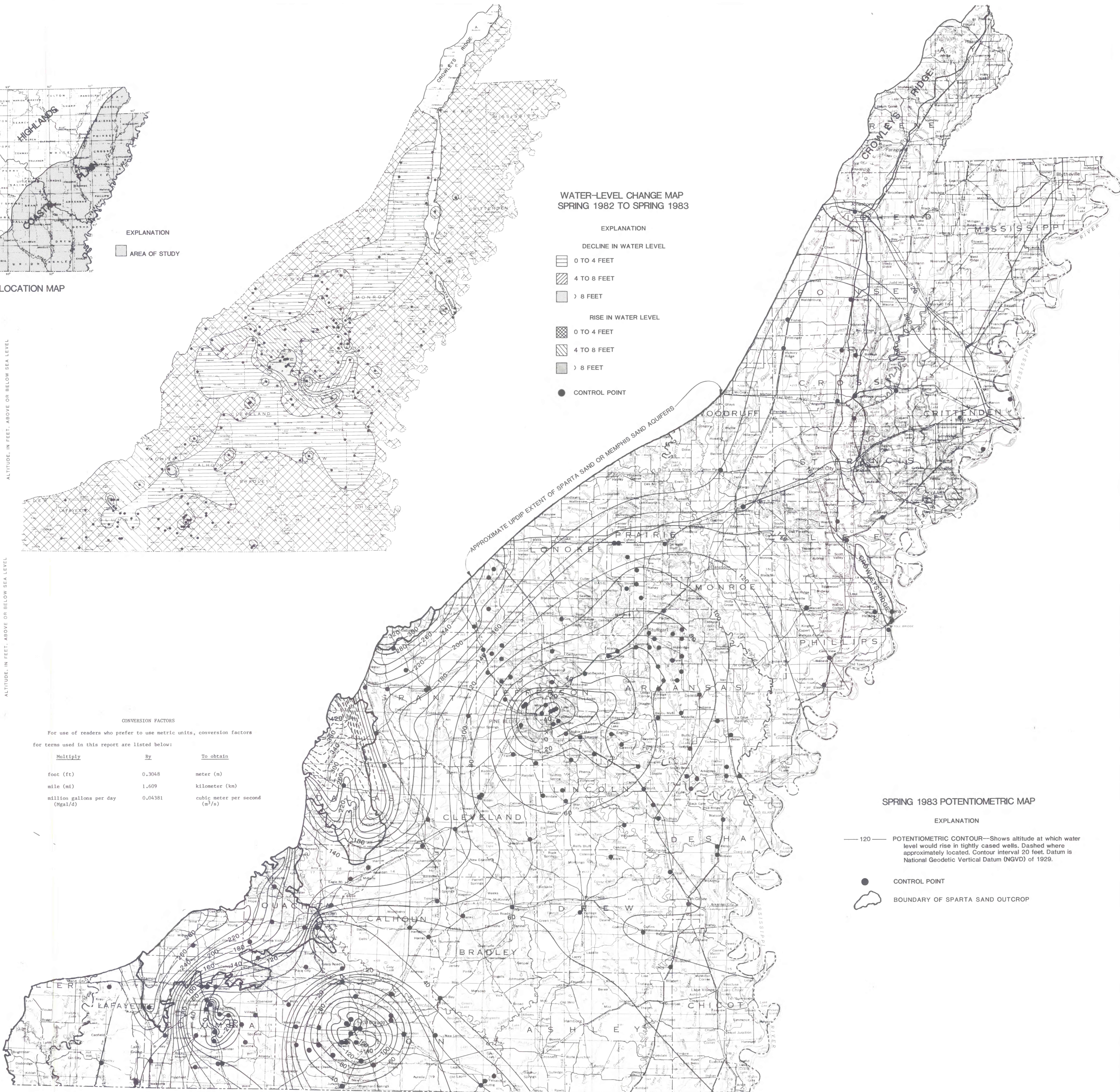
SELECTED REFERENCES

Edds, Joe, 1982, Ground-water levels in Arkansas, spring 1982: U.S. Geological Survey Open-File Report 82-852, 51 p.
 ———, 1983, Ground-water levels in Arkansas, spring 1983: U.S. Geological Survey Open-File Report 83-268, 49 p.
 Holland, Terrance W., and Ludwig, A. H., 1981, Use of water in Arkansas, 1980: Water Resources Summary Number 14, 30 p.
 Hosman, R. L., Long, A. T., Lambert, T. W., and others, 1968, Tertiary aquifers in the Mississippi Embayment: U.S. Geological Survey Professional Paper 448-B, 29 p.
 Reed, J. E., 1972, Analog simulation of water-level declines in the Sparta Sand, Mississippi Embayment: U.S. Geological Survey Hydrologic Investigations Atlas H-434.

CONVERSION FACTORS

For use of readers who prefer to use metric units, conversion factors for terms used in this report are listed below:

Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m ³ /s)



SPRING 1983 POTENTIOMETRIC MAP

EXPLANATION

- 120 — POTENTIOMETRIC CONTOUR—Shows altitude at which water level would rise in tightly cased wells. Dashed where approximately located. Contour interval 20 feet. Datum is National Geodetic Vertical Datum (NGVD) of 1929.
- CONTROL POINT
- BOUNDARY OF SPARTA SAND OUTCROP

MAPS SHOWING ALTITUDE OF THE POTENTIOMETRIC SURFACE AND CHANGES IN WATER LEVEL OF THE SPARTA SAND AND MEMPHIS SAND AQUIFERS IN EASTERN ARKANSAS, SPRING 1983

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