DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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

WATER-RESOURCES INVESTIGATIONS REPORT 89-4060

INTRODUCTION

The U.S. Geological Survey, in cooperation with the Mississippi Department of Environmental Quality, Bureau of Land and Water Resources, measures water levels in wells completed in the Gordo aquifer in a 20-county area in northeastern Mississippi at about 5-year intervals. Data are collected as part of a program to monitor and document the potentiometric surfaces (water levels) of the major aquifers in Mississippi. This potentiometric-surface map, the third in the series for the Gordo aquifer, is based on water-level data collected in 129 wells during August through December 1987. Two previously published potentiometric-surface maps for the Gordo aquifer were based on water-level measurements made during September through November 1978 (Wasson, 1980) and during November and December 1982 (Darden, 1984). Although contours were based on water-level measurements made during a 5-month period compared with previous measurements made in 1978 and in 1982, the contours are representative because small (less than 5 feet) seasonal changes occurred relative to overall changes.

HYDROGEOLOGY

The Gordo aquifer is in the lower part of the Gordo Formation of the Tuscaloosa Group of Cretaceous age. In Mississippi, the Gordo Formation crops out in a narrow north-to-south band in Tishomingo, Prentiss, Itawamba, and Monroe Counties (fig. 1). The formation dips to the west and southwest and generally consists of an upper clay unit and a lower sand and gravel unit that constitutes the Gordo aquifer. Sand beds in the aquifer are hydraulically connected in places with beds of sand in the underlying Coker aquifer in the Coker Formation of the Tuscaloosa Group. The Gordo aquifer, which comprises as much as one-half of the Gordo Formation, thickens from less than 50 feet in the northwestern part to about 400 feet in the southern part of the study area (Wasson, 1986). Precipitation on the outcrop areas is the primary source of recharge to the Gordo aquifer. Ground water generally moves downdip to the west and southwest from the outcrop area.

GROUND-WATER USE

The Gordo aquifer, which contains freshwater (dissolved-solids concentrations less than 1,000 milligrams per liter), was not used extensively in the past because the overlying Eutaw-McShan aquifer in the Cretaceous Eutaw and McShan Formations yielded enough water to meet most of the requirements for industrial and municipal water users (Boswell, 1978). Also, in the eastern part of the area, water from the Gordo aquifer contains larger concentrations of iron than water from the Eutaw-McShan aquifer and requires treatment for some uses. The Gordo aquifer is an important source of freshwater in the study area because the Eutaw-McShan aquifer generally can no longer supply the quantities of water needed in Clay, Lee, Lowndes, Monroe, and Oktibbeha Counties.

Water use from the Gordo aquifer in 1985 was estimated at 43.2 Mgal/d (million gallons per day). Withdrawals from this aquifer amounted to about 2.7 percent of the total ground water used in the State (J.A. Callahan, U.S. Geological Survey, oral commun., 1988). Withdrawals from the aquifer ranged from about 0.06 Mgal/d in Lafayette County to about 24.3 Mgal/d in Lowndes County. Major water withdrawals from the Gordo aquifer occur at or near the towns of Columbus, Fulton, New Hamilton, Pontotoc, Starkville, Tupelo, and West Point, Mississippi.

GROUND-WATER LEVELS

Potentiometric-surface elevations in the Gordo aquifer generally decrease from the outcrop areas in the northeast to the west and southwest, the direction of regional ground-water flow (fig. 1). The dominant features of the potentiometric surface are large cones of depression near Tupelo (Lee County) and several smaller cones of depression around major pumping centers in the southern part of the study area.

The cone of depression centered at Tupelo (fig. 1) is the result of large ground-water withdrawals in that area. Water levels in some wells in the Tupelo area in 1987 were as much as 250 feet below land surface and more than 200 feet lower than water levels in 1900 (Daphne Darden, U.S. Geological Survey, written commun., 1988). The cone extends areally into Pontotoc, Lafayette, Itawamba, and Chickasaw Counties. The smaller cones of depression in the potentiometric surface in Clay, Monroe, Oktibbeha, and Lowndes Counties (fig. 1) are centered around several municipal and industrial pumping centers.

WATER-LEVEL CHANGES

Changes in the potentiometric surface of the Gordo aquifer from 1978 to 1987 indicate that water levels in most wells in the downdip part of the aquifer were substantially lower during August through December (primarily August) 1987 than during September through November 1978. Water levels in wells measured in the Gordo aquifer in northeastern Mississippi declined at an average rate of 2 feet per year between 1978 and 1987. During this period, water-level declines exceeded 20 feet in many wells in and near areas of intensive municipal and industrial pumping. The heavy pumping in northeastern Mississippi is in areas in or near New Hamilton, Starkville, Tupelo, and West Point.

Changes in the potentiometric surface of the Gordo aquifer during the 9-year period, 1978 to 1987, are shown in figure 2. This change map is based not only on the changes in measured water levels in approximately 90 observation wells but also on a comparison of the potentiometric-surface map for 1987 (fig. 1) with the published potentiometric-surface map for 1978 (Wasson, 1980). The change contours on figure 2 were based, in part, on calculated changes at sites other than at observation wells--at points of intersecting contour lines derived by overlaying the two potentiometric-surface maps. For this reason, some of the water-level changes shown exceed those measured in the observation wells.

Interpretation of the change map in figure 2 indicates that the potentiometric surface of the Gordo aquifer has declined throughout most of the study area with the notable exception of an area in Lowndes County where a decrease in pumping from the aquifer has resulted in a recovery of more than 40 feet in water levels. Declines in the potentiometric surface generally were less than 20 feet except in several areas of large ground-water withdrawals where the potentiometric surface has declined between 40 and 100 feet during the 9-year period.

The most prominent area of relatively large declines (greater than 40 feet) is in the area of Tupelo, in Lee County. A comparison of the 1978 and 1987 potentiometric-surface maps indicates that declines of 40 to 100 feet occurred in a crescent-shaped area to the east of Tupelo. Although observation-well data are scarce in this area, the eastward extension of the cone of depression around Tupelo during the 9-year period, as indicated by the change map, appears reasonable.

Relatively large declines also occurred in an area extending from southern Monroe County to the area around West Point, in Clay County. These declines are due to industrial and municipal ground-water withdrawals. As with the area east of Tupelo, the area of large declines in Monroe and Clay Counties is based largely on a comparison of the 1978 and 1987 potentiometric-surface maps. There are few observation wells in the area.

Declines in excess of 40 feet occurred in a small area near Starkville--probably as a result of municipal and industrial pumping--and in another small area in Tishomingo County near the Tennessee-Tombigbee Waterway.

SELECTED REFERENCES

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

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

-----1977, The Eutaw-McShan aquifer in Mississippi: U.S. Geological Survey Water-Resources Investigations 76-134, map.

Darden, Daphne, 1984, Potentiometric map of the Gordo aquifer in northeastern Mississippi, November and December 1982: U.S. Geological Survey Water-Resources Investigations Report 83-4254, map.

Wasson, B.E., 1980, Potentiometric map of the Gordo aquifer in northeastern Mississippi, September, October, and November 1978: U.S. Geological Survey Water-Resources Investigations Open-File Report 79-1586, map.

-----1986 (Revised), Sources for water supplies in Mississippi: Mississippi Research and Development Center Bulletin, 112 p.

Wasson, B.E., Golden, H.G., and Gaydos, M.W., 1965, Available water for industry--Clay, Lowndes, Monroe, and Oktibbeha Counties, Mississippi: Mississippi Research and Development Center Bulletin, 39 p.

Wasson, B.E., and Tharpe, E.J., 1975, Water for industrial development in Alcorn, Itawamba, Prentiss and Tishomingo Counties, Mississippi: Mississippi Research and Development Bulletin, 60 p.

Wasson, B.E., and Thomson, F.H., 1970, Water resources of Lee County, Mississippi: U.S. Geological Survey Water-Supply Paper 1899-B, 63 p.

To convert inch-pound units to metric (International System) units:

Multiply inch-pound unit	by	To obtain metric unit
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

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 nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

ADDITIONAL INFORMATION

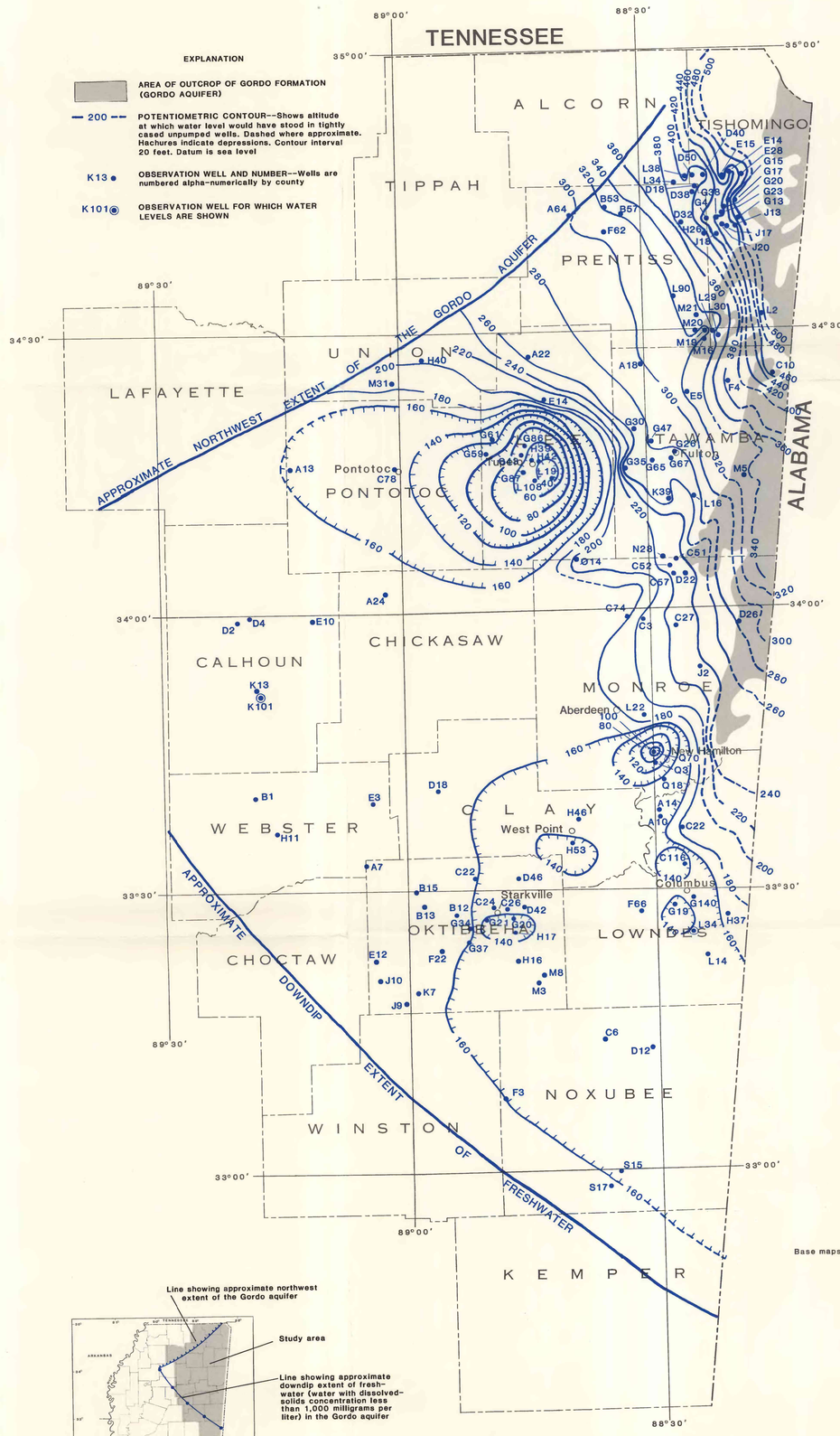
Data describing the individual wells used in this study may be obtained from the following:

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

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

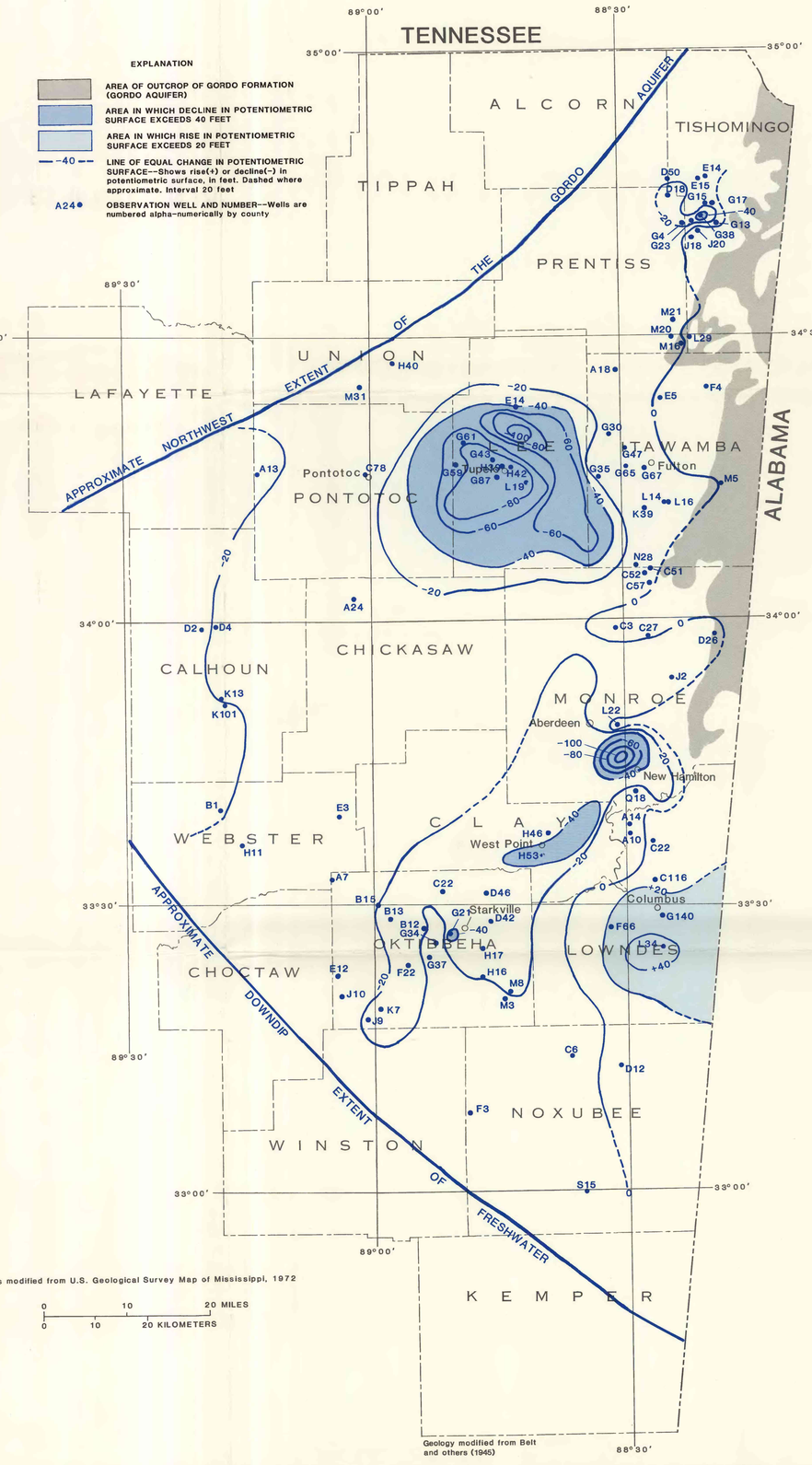
Copies of this report can be purchased from:

U.S. Geological Survey
Books and Open-File Reports Section
Building 810
Box 25425, Federal Center
Denver, Colorado 80225



LOCATION OF STUDY AREA

Figure 1.--Potentiometric surface of the Gordo aquifer, August through December 1987.



Base maps modified from U.S. Geological Survey Map of Mississippi, 1972

0 10 20 MILES
0 10 20 KILOMETERS

Geology modified from Belt and others (1945)

Figure 2.--Changes in the potentiometric surface of the Gordo aquifer from September through November 1978 to August through December 1987.

POTENTIOMETRIC-SURFACE MAP OF THE GORDO AQUIFER IN NORTHEASTERN MISSISSIPPI, AUGUST THROUGH DECEMBER 1987

BY

GALA D.S. GOLDSMITH

1990

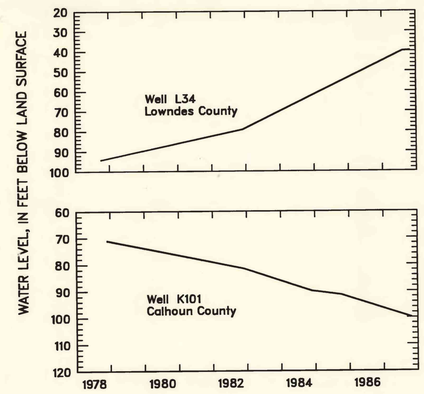


Figure 3.--Water levels in selected wells completed in the Gordo aquifer, 1978-87.

JACKSON, MISSISSIPPI