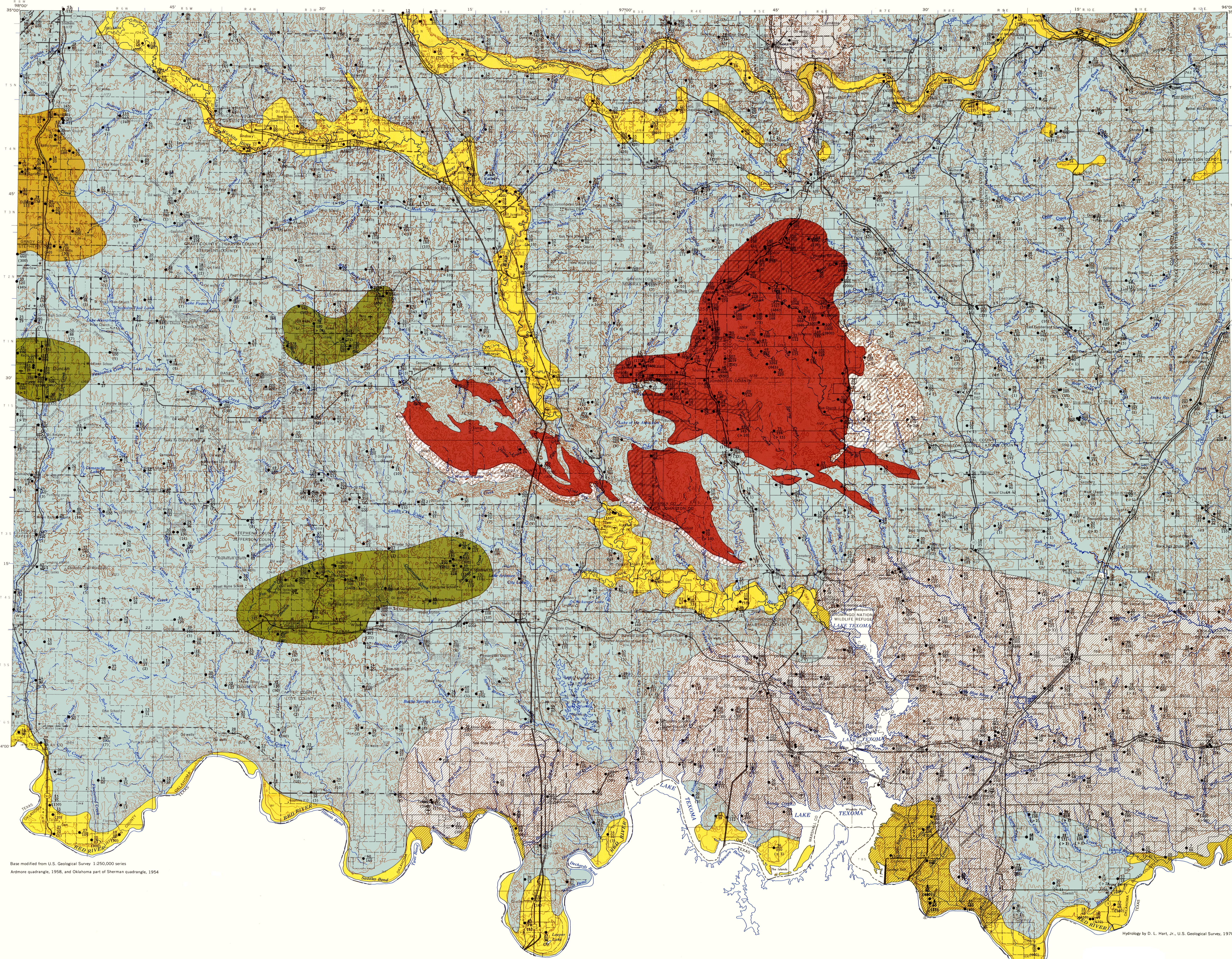


Base modified from U.S. Geological Survey 1:250,000 series
Ardmore quadrangle, 1958, and Oklahoma part of Sherman quadrangle, 1954

Hydrology by D. L. Hart, Jr., U.S. Geological Survey, 1970

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

CONTOUR INTERVAL 100 FEET
WITH SUPPLEMENTARY CONTOURS AT 50 FOOT INTERVALS

DATUM: MEAN SEA LEVEL

EXPLANATION

Areas Most Favorable For Development of Ground-Water Supplies

Alluvium and terrace deposits

Alluvium and terrace deposits along the Canadian River are as much as 50 feet thick. The upper part is generally silt and fine-grained sand, and the lower part may contain some gravel. Wells in some local areas are reported to yield as much as 1,200 gpm (gallons per minute), and yields of 50 to 250 gpm are common.

Alluvium and terrace deposits along the Washita River may be as thick as 85 feet and commonly have a basal gravel. The largest reported yield is 1,200 gpm near Pauls Valley, Garvin County. Wells upstream from Pauls Valley generally yield 50 to 200 gpm, and wells downstream yield 10 to 100 gpm.

Alluvium and terrace deposits along the Red River have not been adequately tested to determine their hydrologic properties, which should be similar to those of the deposits along the Washita River. Yields range from 50 to several hundred gallons per minute over much of the area.

The terrace deposits occurring as outliers south of the Canadian River have a maximum thickness of about 95 feet. Where they have not been extensively eroded they yield as much as 400 gpm to irrigation wells.

Rush Springs Sandstone

The Rush Springs Sandstone of Permian age crops out in southwestern Grady and northern Stephens Counties, where it is about 280 feet thick. This unit is generally composed of fine-grained, even to highly crossbedded sandstone. Wells are reported to yield 10 to 300 gpm from this unit.

Simpson Group

Sandstone of the Simpson Group of Middle Ordovician age is fine grained, loosely cemented, and friable, and where saturated it should yield water freely. In the northeastern part of the Arbuckle Plains, the sandstone is about 330 feet thick and the outcrop area about 60 square miles. The sandstones are much thicker in the southwestern part of the Arbuckle Plains, where they crop out in an area of about 20 square miles. Some wells completed short distances downdip from the outcrop areas flow. Yields of 100 to 200 gpm are common, and some wells are reported to yield as much as 400 gpm.

West Spring Creek, Kindblade, Cool Creek, and McKenzie Hill Formations

These Lower Ordovician units are mostly limestone and dolomite and have a maximum thickness of about 5,000 feet. Broad areas of limestone and dolomite crop out in the Arbuckle Hills and Arbuckle Plains areas. In southern Pontotoc, eastern Murray, and northern Johnston Counties, these aquifers produce large quantities of water. Yields of 200 to 500 gpm are common, and some wells 800 to 1,000 feet deep have produced as much as 2,800 gpm. A few wells have been completed at depths greater than 2,500 feet, and many wells around the perimeter of the outcrop area flow.

Areas Moderately Favorable for Development of Ground-Water Supplies

Antlers Sand

The Antlers Sand of Early Cretaceous age consists mostly of loosely cemented, fine-grained sand 200 to 700 feet thick. Well yields from the formation range widely, but yields of 10 to 50 gpm are common from wells penetrating most or all of the aquifer. Properly constructed wells at favorable sites may yield as much as 400 gpm.

Oscar Formation

The Oscar Formation of Pennsylvanian age is 300 to 500 feet thick and consists of shale, sandstone, and some limestone conglomerate near the Arbuckle Hills. In southern Carter and eastern Jefferson Counties, wells yield as much as 180 gpm; in the vicinity of Duncan in Stephens County, yields of 150 gpm are reported. In a small area in southwestern Garvin County, wells are reported to yield up to 60 gpm. Elsewhere this unit is either too thin or not sufficiently permeable to yield large quantities of water, or contains water of poor quality at shallow depths.

Vamoosa Formation

The Vamoosa Formation of Pennsylvanian age consists of alternating shale, sandstone, and conglomerate and has a maximum thickness of about 260 feet in southern Seminole County. The formation thins southward and is truncated a few miles north of Ada. The unit yields up to 50 gpm in the northern part of the area; yields generally decrease southward to only a few gallons per minute.

Areas Least Favorable for Development of Ground-Water Supplies

These areas are generally underlain by shale, siltstone, tightly cemented sandstone, or other rock types that have a low permeability. Throughout most of the area, wells yield 1 or 2 gpm—enough water for minimum domestic needs. In a few small areas, wells yield moderate quantities of water. One of these areas is near Stonewall in Pontotoc County, where wells penetrating locally thick sandstone units flow as much as 65 gpm. Alluvium and terrace deposits that are mostly clay, silt, and fine-grained sand yield only small amounts of water, but local beds of coarse sand and gravel yield moderate to large quantities of water.

● 94/210 (> 2)

Well

The number above the line is depth to water below land surface, in feet; replacement of the number by the letter "F" shows the well to be flowing; the number below the line is the depth of the well, in feet; the lower number in parentheses is the estimated or reported yield of the well, in gallons per minute. Some yields are shown as "<" ("less than"), and others as ">" ("more than"), the specified number of gallons per minute.

(5)

Spring

Number in parentheses beside the spring symbol is the estimated or reported yield, in gallons per minute.

Area boundary; dashed where approximately located

AVAILABILITY OF GROUND WATER

Information used to determine the availability of ground water was obtained from data collected in the preparation of earlier reports, from the Oklahoma Water Resources Board, and from field inventory of wells. Information obtained in the field included depth of well, depth to water, and the well owner's estimate of the yield whenever possible. Records for about 900 wells and springs were used to determine the general hydrologic characteristics of the aquifers.

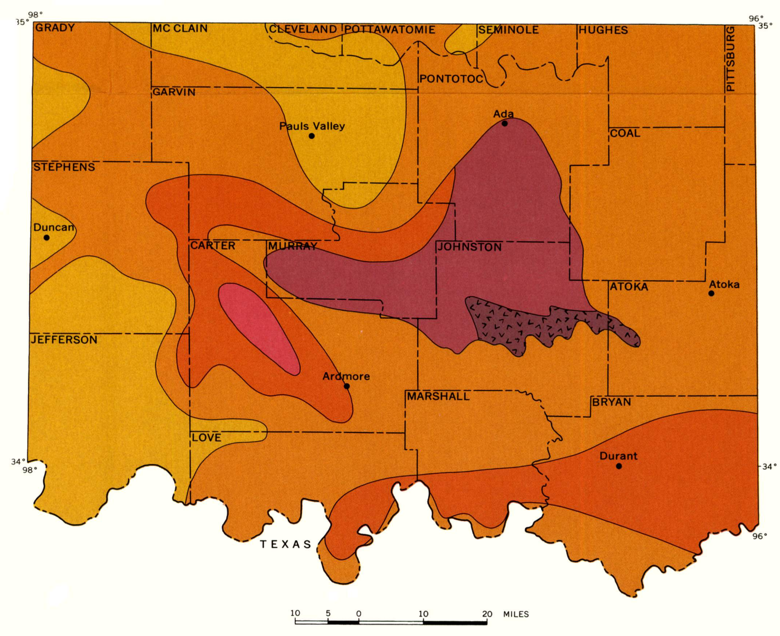
Ground water in the Ardmore and Sherman quadrangles is derived from precipitation falling directly upon the area. The average annual precipitation ranges from about 32 inches in the west to about 42 inches in the east and averages about 38 inches. Thus, the average amount of precipitation falling on any 1-square-mile area ranges from 1,700 to 2,220 acre-feet of water annually. Most of the water that falls is either evaporated directly back to the atmosphere, is trapped in the soil zone and transpired to the atmosphere by plants, or becomes surface runoff to streams and rivers. A very small part of the water trapped in the soil zone percolates downward to the ground-water aquifers.

Ground water in sufficient quantities for domestic use is available throughout most of the area. In many areas, yields of several hundred gallons per minute are common. In a few isolated localities, however, even small amounts of water of suitable quality are difficult to obtain. The amount and quality of water a well may yield are controlled mainly by the type of rock in which the well is completed. The thickness and permeability of the soil and the permeability and storage capacity of the underlying rocks are important factors controlling the amount of water entering the ground-water reservoir. In the areas where the soils are thin and the underlying rocks poorly permeable, little water is trapped and rainfall runs off quickly. Even in areas where soils are loose and coarse grained, the underlying rock may be able to store only small amounts of water, and wells completed in such units yield only small quantities of water. In general, the most favorable areas are the alluvium and terrace deposits along the major rivers and the thick, fractured and cavernous limestones in the Arbuckle Hills and Arbuckle Plains areas shown on the physiographic map (sheet 1). Poorly cemented sandstone of the Dissected Coastal Plain and Western Sandstone Hills provides moderate amounts of water to wells in many localities, whereas the tight limestone, cemented sandstone, siltstone, and shale of the Eastern Sandstone Cuesta Plains and Central Redbed Plains are usually the least favorable well sites.

Potential for development of water supplies in the report area is good. Several major aquifers are capable of producing much larger quantities of water than are presently being pumped, and the development of springs could provide additional water supplies. Detailed hydrologic studies of these aquifers are needed to determine their hydrologic characteristics and potential supply of water more accurately.

Reports describing ground-water conditions in parts of the Ardmore and Sherman quadrangles, Oklahoma, are listed below; page numbers refer to the portions of the reports that are pertinent to this area.

Davis, L. V., 1955, Geology and ground water resources of Grady and northern Stephens Counties, Oklahoma: Oklahoma Geol. Survey Bull. 73, p. 31–154.
Hart, D. L., Jr., 1966, Base of fresh ground water in southern Oklahoma: U.S. Geol. Survey Hydrol. Inv. Atlas HA-223, 2 sheets, scale 1:250,000.
Oklahoma Water Resources Board, 1966, Ground water in the northern part of the Arbuckle Mountains: Oklahoma Water Resources Board Pub. 12, 8 p.
______1968, Appraisal of the water and related land resources of Oklahoma—Region Two: Oklahoma Water Resources Board Pub. 19, p. 87–88.
______1968, Appraisal of the water and related land resources of Oklahoma—Region Three: Oklahoma Water Resources Board Pub. 23, p. 93–94.
______1969, Appraisal of the water and related land resources of Oklahoma—Regions Five and Six: Oklahoma Water Resources Board Pub. 27, p. 108–110.
Wood, P. R., and Burton, L. C., 1968, Ground-water resources in Cleveland and Oklahoma Counties, Oklahoma: Oklahoma Geol. Survey Circ. 71, p. 29–75.



Map Showing Approximate Depth to Base of Fresh Water

EXPLANATION

Depth, in Feet Below Land Surface

0–200

200–500

500–1,000

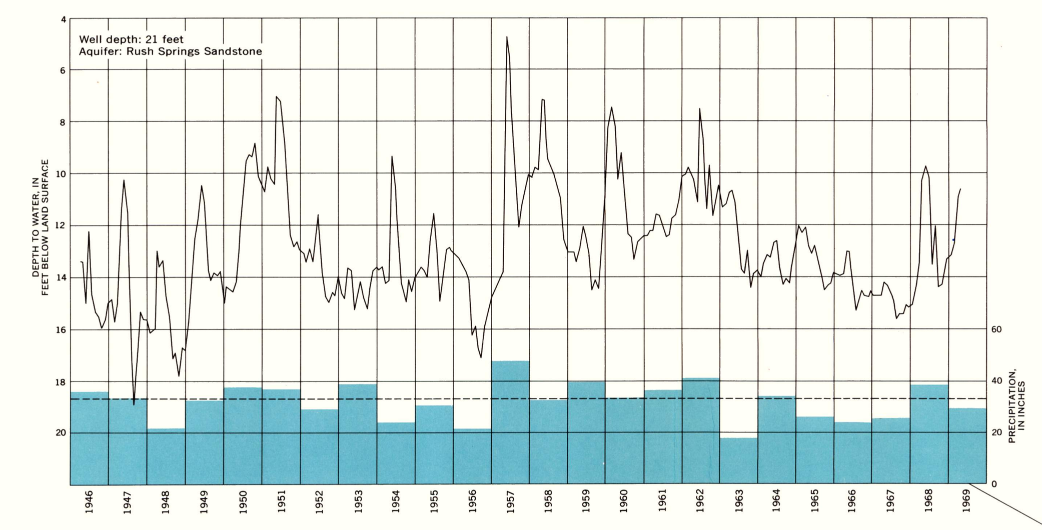
1,000–1,500

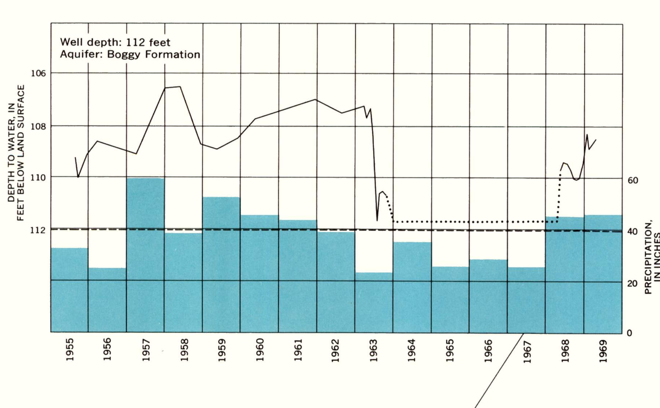
1,500–3,000

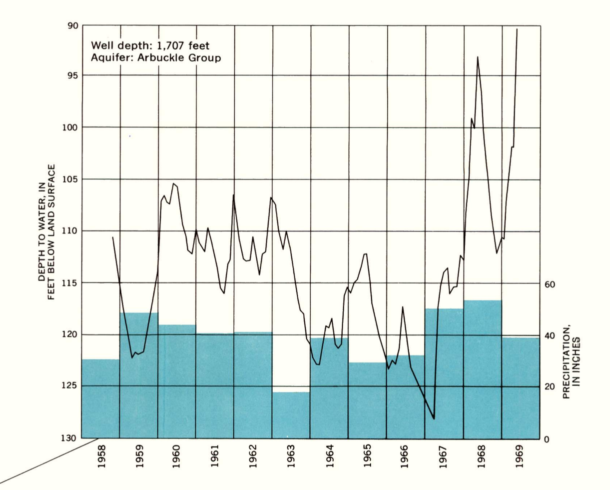
Igneous rock: little or no saline water; fresh water at shallow depths

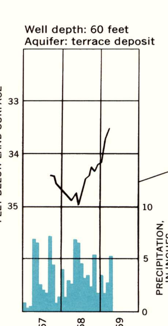
This map shows the approximate depth to which fresh water extends below the land surface. The term "fresh water" as used in this text includes waters that are either fresh or slightly brackish but contain total dissolved solids of about 5,000 mg/l (milligrams per liter) or less. The depth to the base of fresh water in a particular formation depends on the dip of the beds, the permeability and solubility of the rocks, the extent of the recharge areas, the source of recharge, and possible contamination from local sources. Areas of deepest fresh water usually occur in moderately to steeply dipping permeable rocks having large recharge capabilities. Where the fresh-water body is underlain by poorly permeable rocks, the boundary of the base of fresh water is quite distinct; however, where the rocks in the boundary area are highly permeable, the contact of the fresh and saline water may be gradational through an interval of several hundred feet. In a few isolated places, saline water occurs in zones above the lowermost fresh water.

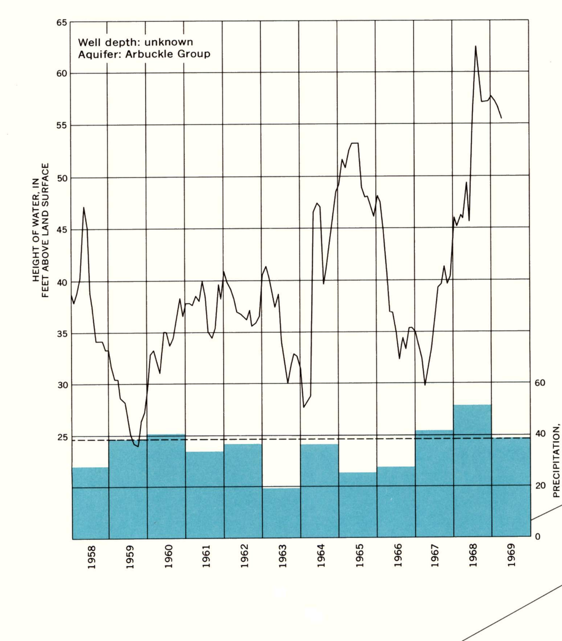
The rocks below the fresh-water body contain saline water that is unsuitable for most uses, or else they are so poorly permeable that they contain little or no recoverable water. However, the zones containing slightly saline water may become significant in the future in the event of improved desalinization methods or greater demand for water.

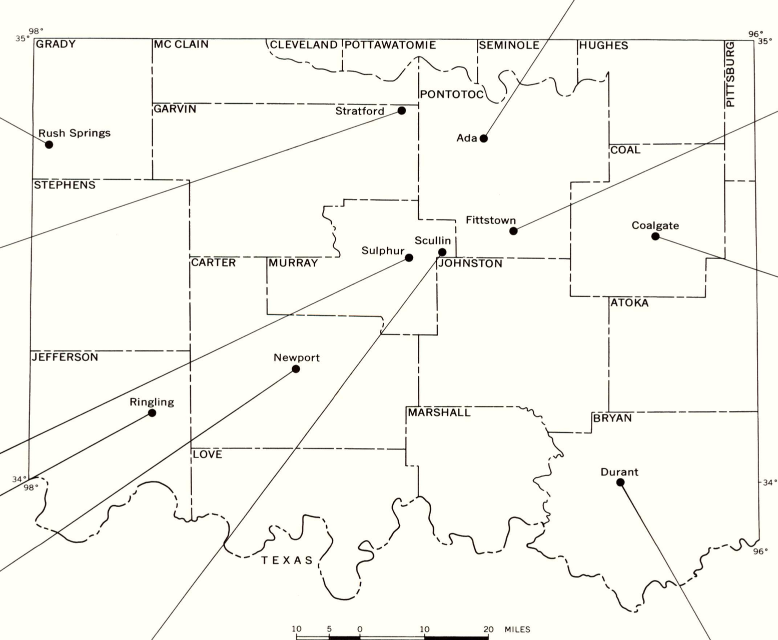




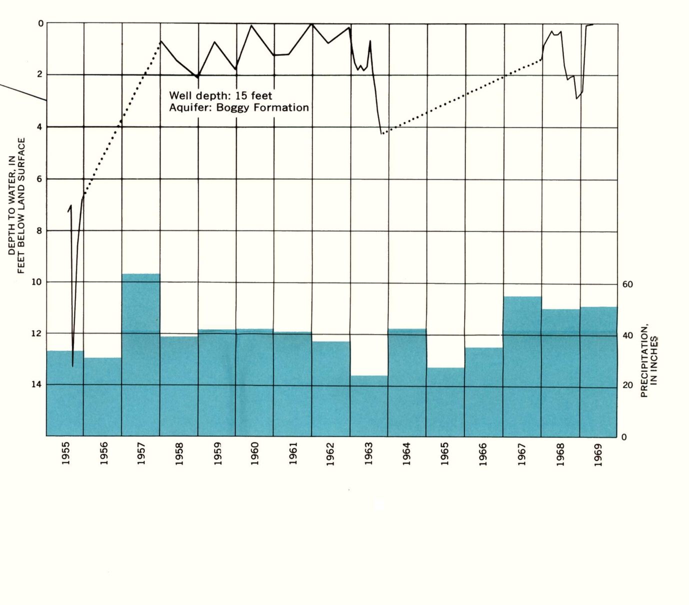


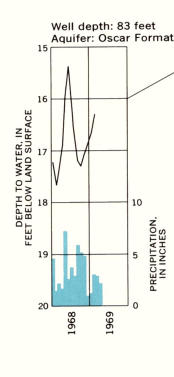


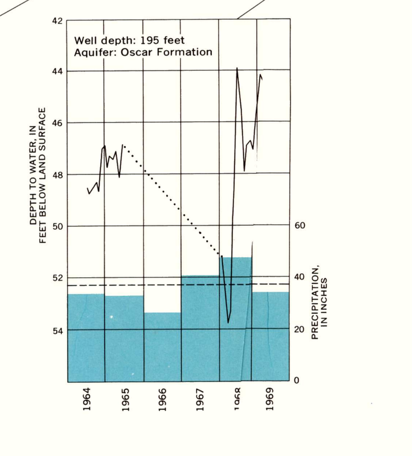


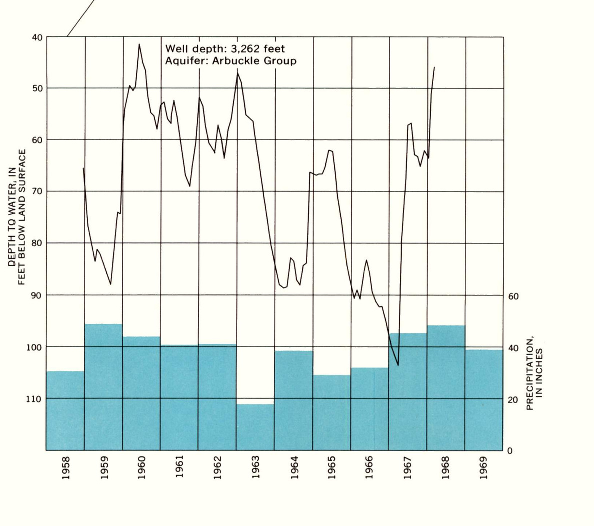


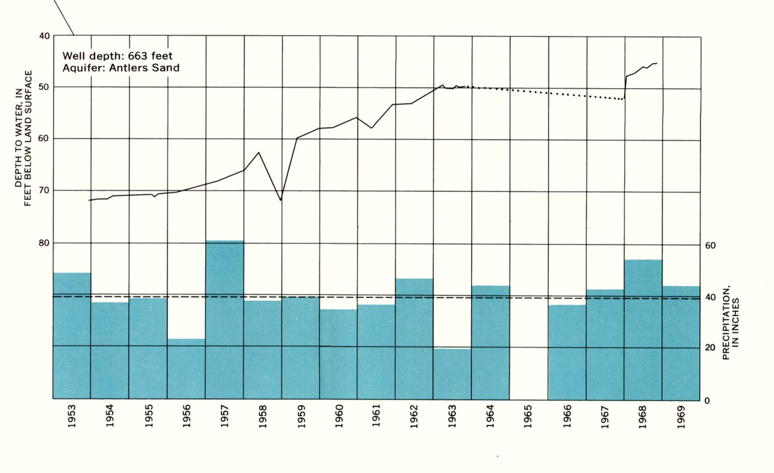
Location of Observation Wells











Hydrographs Show Change in Ground-Water Storage

The water table, or potentiometric surface, is not plane or level but is an irregular sloping surface. Water entering an aquifer moves from points of recharge toward points of discharge. Although pressure changes in an aquifer may account for small fluctuations in water level, major fluctuations reflect changes in the amount of water in storage. In general, the water level rises when recharge exceeds discharge, and, conversely, the water level declines when the discharge (by natural or artificial means) exceeds recharge. Thus, the fluctuations of water levels in wells are an index to the inflow and outflow of water from the ground-water reservoir and indicate changes in the amount of water in storage.

The solid lines on the hydrographs show the depth to water below the land surface; the bar graphs show the annual precipitation where water-level records have been collected for several years or the monthly precipitation where water levels have been measured for only short periods; and the horizontal straight dashed lines show the average annual precipitation in localities where sufficient precipitation records are available to establish an average.

The hydrographs show the water-level changes associated with above- and below-average precipitation. For example, the hydrograph of well 1 shows a general downward trend from 1946 through 1948, from 1951 through 1952, during 1956, during 1958, and from 1962 through 1967. Precipitation during the corresponding periods is either below average or on a declining trend, resulting in a reduction in recharge and a decline in water level. The periods from 1949 through 1950, during 1957, from 1959 through 1960, during 1961, and during 1968 show a general rise in level, as precipitation in those years was near or above average.

Water levels in the sandstone and unconsolidated aquifers, shown by the hydrographs of wells 1–3 and 7–10, generally respond more slowly and with less magnitude than those in limestone aquifers. Water levels in wells 4–6, which are completed in limestone, show rapid response to precipitation or lack of precipitation; fluctuations of 10 to 20 feet per year are not unusual.

RECONNAISSANCE OF THE WATER RESOURCES OF THE ARDMORE AND SHERMAN QUADRANGLES SOUTHERN OKLAHOMA

By

Donald L. Hart, Jr.
U.S. Geological Survey

1974

Cartographers: David M. Deering and Sondra Underwood