EXPLANATION

Geologic formations and their water-bearing characteristics

UNCONSOLIDATED DEPOSITS

Recent dune sand and alluvium and undifferentiated Pleistocene and Pliocene deposits form a single hydrologic unit that functions as a huge ground-water reservoir. These deposits are the principal source of ground water in the county. The hydraulic connection between the geologic units is usually good

Recent dune sand

Fine to coarse windblown sand. Maximum thickness about 30 feet. Moderately to highly permeable but deposits are generally located above the water table and not saturated. Water is most likely to occur in this unit where it is underlain by relatively impermeable bedrock. Where saturated, yields water readily to domestic or stock wells but supply may not be permanent. Facilitates ground-water recharge by readily absorbing and transmitting precipitation and surface runoff downward to underlying deposits. Where water is available, it is suitable in quality for most uses

Recent alluvium

Sand, silt, clay, and gravel located in valleys of principal streams. Thickness not known but may exceed 100 feet in North Canadian River valley and may be 50 to 100 feet in lower parts of valleys of Coldwater and Palo Duro Creeks. Moderately permeable. The yield of wells is generally adequate for domestic or stock use, and where the thickness of saturated material is sufficient, yields are adequate for irrigation purposes. The alluvium absorbs part of the surface runoff and transmits the water downward to the saturated zone in the underlying deposits; or, especially in the larger stream valleys, the alluvium may function as a conduit which carries the underflow of streams. Water is of suitable quality for most uses although softening may be desirable for domestic use. In Palo Duro Creek drainage area, gypsum and possibly salt mixed with alluvium may cause water to taste "gyppy" or "salty"

Pleistocene and Pliocene deposits, undifferentiated

Interfingering beds, tongues, and lenses of sand, silt, clay, gravel, sandstone, caliche, limestone, conglomerate, and volcanic ash. Includes Ogallala and Laverne Formations of Pliocene age and younger deposits of Pleistocene age. Locally the units are tightly cemented by calcium carbonate; other places, they are very poorly consolidated and nearly free of cementing materials. Thickness ranges from 0 to about 800 feet. Moderately permeable. Principal source of ground water in the county. Where the thickness of saturated materials is sufficient, yield large quantities of water to irrigation, municipal, and industrial wells. Water is of suitable quality for most uses but softening may be required for special purposes

BEDROCK

Mesozoic and Permian rocks are referred to as bedrock in this atlas. At most places in the county, the bedrock is too fine grained and too well consolidated to transmit water at rates sufficient to supply irrigation wells. Its principal hydrologic function is to impede the downward movement of water from overlying water-bearing deposits. Thus, the concealed bedrock surface serves as the base of the principal ground-water reservoir. When water percolating downward through the overlying deposits reaches the bedrock surface, it tends to move laterally through more permeable beds toward areas of lower hydrostatic head. In this way, the percolating water fills troughs or depressions in the bedrock surface and thus forms a saturated zone of varying thickness in the ground-water reservoir

Mesozoic rocks, undifferentiated

Red shale containing thin layers of yellow and gray clay and indistinctly bedded fine-grained buff, red, white, and gray sandstone. May include beds of Cretaceous, Jurassic, and Triassic ages. At some places, Mesozoic rocks occur beneath unconsolidated deposits comprising the ground-water reservoir but their location, lateral extent, thickness, and water-yielding properties are little known. Their exposed thickness is less than 100 feet and their water-yielding capacity is low. Stock wells obtain meager water supplies from a zone of weathered material above the unaltered bedrock. Water generally of unsuitable quality for domestic use

Permian rocks, undifferentiated

Red to dark reddish-brown shale, sandstone, and siltstone. Gypsum occurs in all rock units as a cementing agent, as tiny flakes, as thin irregular veinlets, and as discontinuous beds ranging from less than an inch to more than 30 feet thick. At many places deep wells drilled in search of oil or gas penetrate beds of dolomite, limestone, gypsum, salt, and salt-impregnated shale. Permian rocks underlie all of the county, but crop out only in a small area in the southeast part. Maximum thickness exceeds 2,000 feet. Poorly permeable. Yields water in sufficient quantity to supply domestic and stock wells but generally too fine grained and too tightly consolidated to supply irrigation wells. Water normally high in dissolved solids, particularly sulfate and at some places chloride. Water generally of unsuitable quality for domestic use

Contact

Irrigation well

Municipal well

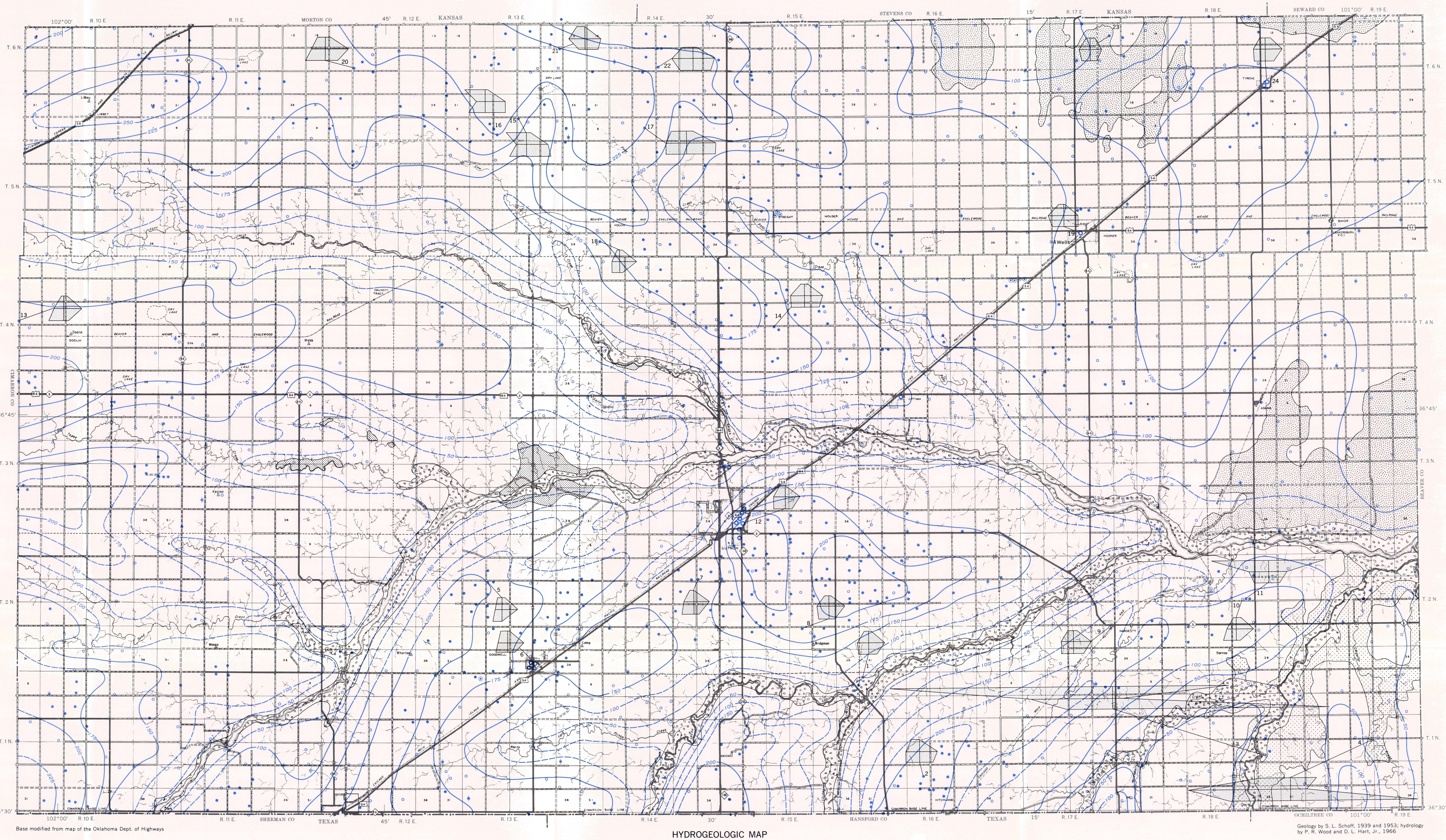
Industrial well

Domestic, stock, or unused well

Destroyed well

175

Line of equal depth to water, March, 1966
Dashed where inferred; interval 25 and 50 feet. Datum is land surface



Base modified from map of the Oklahoma Dept. of Highways

Geology by S. L. Schoff, 1939 and 1953; hydrology by P. R. Wood and D. L. Hart, Jr., 1966

HYDROGEOLOGIC MAP

SCALE 1:125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

INTRODUCTION

Texas County, in the Oklahoma Panhandle, depends chiefly on ground water for its water supply. Texas County and adjacent counties in the Panhandle comprise one of many areas in Oklahoma in which ground water is in limited supply. Because of the rapidly expanding use of water for irrigation in the Panhandle counties and in adjoining areas in Texas, Kansas, and Colorado, the Oklahoma Water Resources Board requested the U.S. Geological Survey to collect and analyze geologic, hydrologic, and engineering data needed to efficiently manage the Panhandle's ground-water resources. The first phase of a study of the Panhandle area was a reconnaissance of Texas County. This atlas presents general information on the ground-water resources obtained during the first phase and is intended as a convenient guide to the general availability of ground water in the county.

Future investigations will include reconnaissance studies of adjacent counties and a comprehensive study of the irrigated areas in the entire Panhandle to determine the annual change in water levels, the rate of decline in heavily pumped areas, the volume of water stored in the ground-water reservoir, and the total quantity of water that may be safely withdrawn in any given area.

The illustrations and the text accompanying the illustrations outline geologic and hydrologic conditions that govern the general availability of ground water in the county. The hydrogeologic map shows (1) the areal distribution of the principal geologic units that control the occurrence and availability of ground water, (2) the approximate depth to water, and (3) the chemical character of ground water. Explanatory material accompanying the map outlines geologic characteristics and hydrologic properties of the rocks likely to be penetrated during the drilling of wells. Diagrams on the map illustrate the concentration of selected chemical constituents of ground water in the county.

The map on sheet 2 shows (1) the approximate thickness of the unconsolidated deposits in Texas County, (2) the approximate thickness of the saturated material within this unit, and (3) a generalized section showing the relation of the unconsolidated deposits, the bedrock, and the water table.

The maps on sheet 3 show (1) areas irrigated by ground water as of January 1966, (2) areas favorable for irrigation development, and (3) areas where ground-water levels measured in 1966 have changed significantly from levels recorded in 1938. Water-level hydrographs and precipitation graphs illustrate the long-term effects of natural recharge and discharge and depletion by ground-water pumping.

The data used in compiling maps for this report were obtained from many sources. Although the maps show approximate conditions only, they will be of use to those who wish to plan and develop ground-water supplies in the county

FOR MORE INFORMATION ABOUT—

Basic Water Facts, Principles, and Problems:

A primer on water, by L. B. Leopold and W. B. Langbein: U.S. Geological Survey Miscellaneous Report, 50 pages, U.S. Government Printing Office, Washington, D. C., 1960.

A primer on ground water, by H. L. Baldwin and C. L. McGuinness: U.S. Geological Survey Miscellaneous Report, 26 pages, U.S. Government Printing Office, Washington, D. C., 1963.

A primer on water quality, by H. A. Swenson and H. L. Baldwin: U.S. Geological Survey Miscellaneous Report, 27 pages, U.S. Government Printing Office, Washington, D. C., 1965.

Water: U.S. Dept. of Agriculture Yearbook of Agriculture for 1955, 751 pages, U.S. Government Printing Office, Washington, D. C., 1955.

The Technical and Scientific Background:

Geology and ground-water resources of Texas County, Oklahoma, by S. L. Schoff: Oklahoma Geological Survey Bulletin 59, 248 pages, Norman, Okla., 1939.

Triassic rocks on Goff Creek, Texas County, Oklahoma, by S. L. Schoff: Proceedings of the Oklahoma Academy of Sciences, volume 34, pages 149–159, 1953.

Ground-water levels in observation wells in Oklahoma, 1956–60, by D. L. Hart, Jr.: Oklahoma Water Resources Board, 196 pages, Oklahoma City, Okla., 1963. (Ground-water levels in Texas County listed on pages 146–159.)

Ground-water levels in observation wells in Oklahoma, 1961–62, by P. R. Wood and M. D. Moeller: Oklahoma Water Resources Board, 119 pages, Oklahoma City, Okla., 1964. (Ground-water levels in Texas County listed on pages 85–90.)

Ground-water levels in observation wells in Oklahoma 1963–64, by P. R. Wood: Oklahoma Water Resources Board, 82 pages, Oklahoma City, Okla., 1965. (Ground-water levels in Texas County listed on pages 60–66.)

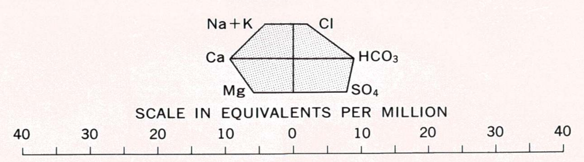
Correlation of water-level fluctuations with climatic cycles in the Oklahoma Panhandle, by I. W. Marine: U.S. Geological Survey Water-Supply Paper 1669-K, 10 pages, U.S. Government Printing Office, Washington, D. C., 1963.

Soil survey of Texas County, Oklahoma, by H. C. Meinders and others: U.S. Dept. of Agriculture, series 1958, no. 6, 60 pages, U.S. Government Printing Office, Washington, D. C., 1961.

WATER-QUALITY DIAGRAMS

Diagrams show general chemical character of ground water and are based on analyses of water from wells at indicated points. The ionic concentrations, are plotted for calcium (Ca), magnesium (Mg), sodium and potassium (Na + K), sulfate (SO_4), bicarbonate (HCO_3), and chloride (Cl). Anions (negatively charged ions) are plotted to the right of the center line and cations (positively charged ions) to the left. The area of a diagram is an indication of dissolved-solids content—larger areas reflect greater dissolved-solids content. Changes in configuration reflect changes in chemical character.

22
Well
Number refers to sample analysis shown in table



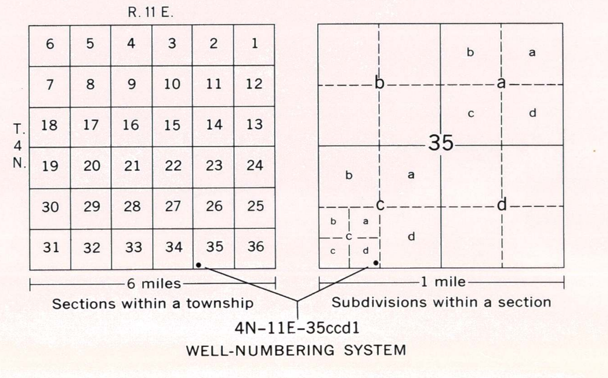
The analyses of waters in the Pliocene and Pleistocene deposits indicate the water is fairly uniform in chemical character throughout the county. The water is generally hard, calcium-magnesium-bicarbonate type, with moderate to low amounts of sulfate and chloride. Examples of this type are shown by diagrams number 1 and 2.

The analyses of waters from the bedrock are likely to range more widely in chemical character. The water is generally very hard, and contains considerable sulfate and chloride. Diagrams number 3 and 4, in the southeastern part of the county, illustrate the chemical character of water from the bedrock.

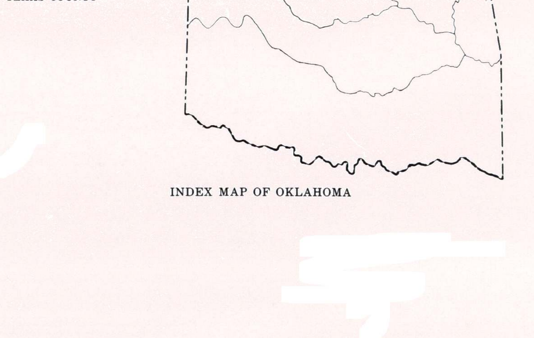
ANALYSES OF WATER QUALITY

Sample Number	Well number	Depth (feet)	Date sampled	Dissolved solids (ppm)	Geologic source[1]
1	1N-16E-6bbc1	215	3-17-52	338	QT
2	1N-16E-28acd1	342	12-10-51	439	QT
3	1N-18E-24cba1	207	5- -61	5,060	MzP
4	1N-19E-22aab1	45(?)	1- 2-57	2,600	MzP
5	2N-13E-16bbb1	320	9-17-59	291	QT
6	2N-13E-35cbb2	188	11-19-52	325	QT
7	2N-14E-12ccc1	355	12-18-58	316	QT
8	2N-15E-27abb1	405	11- 3-58	340	QT
9	2N-17E-26aba1	437	11-20-57	416	QT
10	2N-18E-14cdd1	170	2- 3-59	357	QT
11	2N-18E-14dcc1	330	6- 3-59	1,100	QT, MzP
12	3N-15E-31dab2	306	11-20-51	330	QT
13	4N-10E-18ccb1	317	7-30-59	375	QT
14	4N-15E-21abc1	405	9-15-59	483	QT
15	5N-13E- 3bbb1	370	3-17-59	736	QT, MzP(?)
16	5N-13E- 4cbb1	297	3-17-59	680	QT, MzP(?)
17	5N-14E- 4bdd1	510	4-24-59	773	QT, MzP(?)
18	5N-14E-31acc1	367	11- 2-64	246	QT
19	5N-17E-34bbd1	260	11-19-51	422	QT
20	6N-12E-21ccc1	360	4-24-59	482	QT
21	6N-13E-23aaa1	430	9-28-59	360	QT
22	6N-14E-22ccc1	485	6-30-59	557	QT
23	6N-17E-14dbb1	435	2-26-59	290	QT
24	6N-18E-25cbd1	285	11-19-51	381	QT

[1] QT, Pliocene and Pleistocene deposits
MzP, Permian or Mesozoic rocks (bedrock)



WELL-NUMBERING SYSTEM



INDEX MAP OF OKLAHOMA

AVAILABILITY OF GROUND WATER IN TEXAS COUNTY, OKLAHOMA

By

P. R. Wood and D. L. Hart, Jr.

1967

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1967—W67072

For sale by U.S. Geological Survey, price $1.25 per set