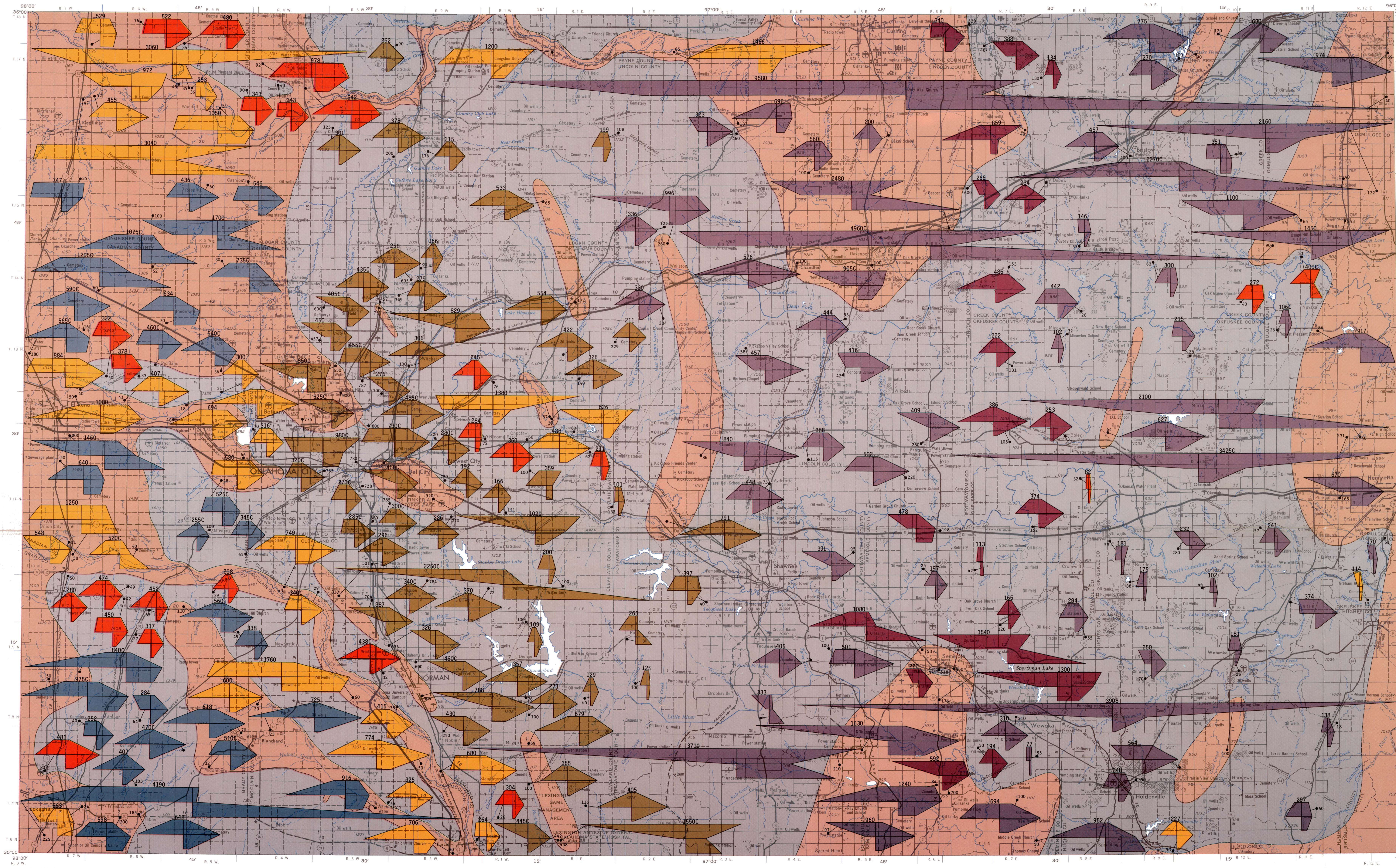


Base from U.S. Geological Survey 1:250,000 series: Oklahoma City quadrangle, 1957

Compiled by Roy H. Bingham and Robert L. Moore
U.S. Geological Survey, 1971

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

Figure 6. Map showing chemical quality of ground water.

EXPLANATION

Chemical quality of water generally good

These areas generally yield water containing 500 mg/l or less of dissolved solids, which is satisfactory for most uses. The presence of an undesirable constituent or excessive hardness may make the water unsuitable for some purposes.

Chemical quality of water generally fair or poor

These areas generally yield water containing more than 500 mg/l of dissolved solids, the maximum recommended for drinking water. Water having concentrations between 500 and 1,000 mg/l is classed as fair, and water having concentrations greater than 1,000 mg/l is classed as poor. Excessive amounts of dissolved minerals limit the use of water for most purposes.

Area boundary; dashed where approximately located

• 60

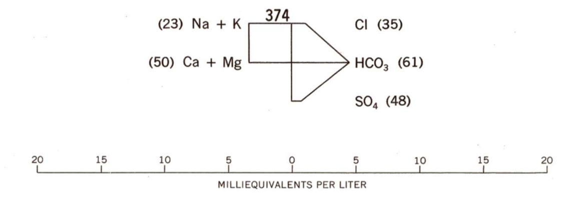
Well from which water sample was collected; number indicates well depth, in feet

Spring from which water sample was collected

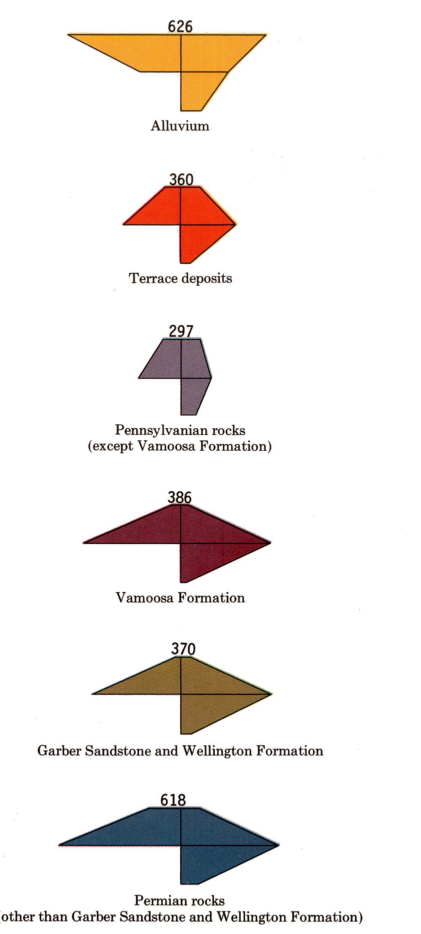
Water-Quality Diagrams

The diagrams, which show the chemical character of ground water, are based on analyses of water samples from wells or springs at the indicated points. Ionic concentrations are plotted for sodium plus potassium (Na + K), calcium plus magnesium (Ca + Mg), chloride (Cl), bicarbonate (HCO_3), and sulfate (SO_4). 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 the dissolved-solids content—larger areas indicate greater dissolved-solids content. Variations in shape of a diagram reflect variations in chemical character. Numbers above diagrams are dissolved-solids content. *C* indicates dissolved-solids content calculated.

Numbers (in parentheses) beside ions are factors that can be used to convert the ionic concentration from milliequivalents per liter to milligrams per liter. For example, use the scale to read the value of milliequivalents per liter of a particular ion, and multiply the value by the number beside the ion. The resulting number for the Cl, HCO_3, or SO_4 ion is the concentration, in milligrams per liter, and the resulting number for Na + K is the concentration as Na. The resulting number for Ca + Mg is the hardness as $CaCO_3$.



Geologic Sources of Water



CHEMICAL QUALITY OF GROUND WATER

To provide data on the chemical quality of ground water in the Oklahoma City quadrangle, water samples from 76 wells and 1 spring were collected and analyzed by the U.S. Geological Survey (fig. 6). Laboratory determinations were made for calcium and magnesium hardness, chloride, bicarbonate, sulfate, nitrate, and dissolved solids. Sodium and potassium were calculated. Other water-quality data used in the preparation of this report were taken from various published reports and from the files of the U.S. Geological Survey.

All ground water contains minerals dissolved mainly from the soil and rocks. High concentrations of dissolved minerals may restrict use of water for many purposes. The U.S. Public Health Service Drinking Water Standards (U.S. Public Health Service, 1962) state that the following chemical substances should not be present in a water supply in excess of listed concentrations if, in the judgment of the reporting agency and certifying authority, other suitable supplies are or can be made available.

CONSTITUENT	MAXIMUM CONCENTRATIONS RECOMMENDED (MILLIGRAMS PER LITER)
Sulfate (SO_4)	250
Chloride (Cl)	250
Nitrate (NO_3)	45
Dissolved solids	500

Sulfate in ground water is derived from such minerals as gypsum and anhydrite. Water containing sulfate minerals in excessive amounts has an unpleasant taste and also has a laxative effect on most persons. When in combination with calcium, sulfate may cause hard scale in boilers, water heaters, pipes, and plumbing fixtures.

Chloride is derived from halite and brines and from human, animal, and industrial wastes. Small amounts of chloride have little effect on the usability of water for most purposes, but water containing chloride in concentrations of several hundred milligrams per liter has a salty taste. Small to moderate amounts of chloride have been reported to increase the corrosive characteristics of water.

Nitrate is derived from human and animal wastes and from nitrates in the soil. The nitrate in the soil is artificially increased by man when nitrate fertilizers are used. Concentrations greater than 45 mg/l (milligrams per liter) may cause methemoglobinemia ("blue baby") in infants during their first few months of life. Breast-fed infants of mothers drinking such water may also be affected; therefore, water with a high nitrate content should not be used for infant feeding or by expectant mothers.

Dissolved solids consist principally of dissolved-mineral constituents that remain after a measured quantity of water has been evaporated by heating. Water containing 500 mg/l or less of dissolved solids generally is satisfactory for most domestic and industrial uses. The standards recommend that water having a dissolved-solids content greater than 500 mg/l not be used.

Hardness in water is objectionable because of its scale-forming properties and because it reduces the cleaning action of soap and detergents. The U.S. Geological Survey classifies water having a hardness less than 60 mg/l as soft; 61 to 120 mg/l, moderately hard; 121 to 180 mg/l, hard; and more than 180 mg/l, very hard.

Some mineralization of ground water in the Oklahoma City quadrangle might be due to contamination by oil-well brines, particularly in the vicinity of the many oil fields. Such contamination may result from seepage from waste pits, defective well casing, defective well plugging, water-flooding operations, or improper brine disposal.

Ground water in most parts of the Oklahoma City quadrangle is hard or very hard and locally contains sulfate and chloride in excess of 250 mg/l, the maximum recommended for drinking water. In some areas water from shallow wells contains more than 45 mg/l nitrate, indicating possible pollution.

Quality data indicate that the water from major aquifers in bedrock is generally of good quality and suitable for most uses. In Seminole County, water from the Vamoosa Formation locally contains dissolved solids greater than 1,000 mg/l; the wells are deeper in that area, and, in general, concentrations of dissolved solids increase with depth. Domestic wells in the Vamoosa Formation commonly yield water containing less than 500 mg/l dissolved solids. Water from the Garber Sandstone and Wellington Formation contains more than 1,000 mg/l dissolved solids locally in Cleveland and Oklahoma Counties; this water is commonly of the sodium bicarbonate type. Generally, the Garber Sandstone and Wellington Formation yield water containing less than 500 mg/l dissolved solids.

Quality data indicate that in the western half of the Oklahoma City quadrangle the terrace deposits yield water of good quality. Water from most of the terrace deposits contains less than 500 mg/l dissolved solids; the water is of the calcium bicarbonate type and is generally suitable for irrigation purposes.

Water from the larger part of the alluvium is generally of fair or poor quality along the Cimarron, North Canadian, and Canadian Rivers. Locally, the water contains less than 500 mg/l dissolved solids. The quality of water from alluvium varies greatly within short lateral distances. Such variations may be partly due to irrigation pumpage, which increases inflow of water into the aquifer from the nearby stream. The areal extent, duration, and amount of change in water quality caused by pumpage effects have not been determined.

Data are not available to define the quality of water from alluvium and terrace deposits in the eastern half of the Oklahoma City quadrangle. However, a few data indicate that the water is probably of good quality.

The following tables summarize results of laboratory analyses of ground water in the quadrangle.

Major Aquifers

Summary of chemical analyses of water from alluvium and terrace deposits

	RESULTS IN MILLIGRAMS PER LITER					NUMBER OF SAMPLES
	MAXIMUM	UPPER QUARTILE[1]	MEDIAN	LOWER QUARTILE[2]	MINIMUM	
Hardness as $CaCO_3$	1,320	440	297	186	14	112
Sulfate (SO_4)	1,320	158	64	26	3.3	114
Chloride (Cl)	1,450	98	40	15	2.0	115
Nitrate (NO_3)	189	26	5.8	.6	.0	104
Dissolved solids	3,060	892	520	320	82	81

Summary of chemical analyses of water from Vamoosa Formation

	RESULTS IN MILLIGRAMS PER LITER					NUMBER OF SAMPLES
	MAXIMUM	UPPER QUARTILE[1]	MEDIAN	LOWER QUARTILE[2]	MINIMUM	
Hardness as $CaCO_3$	600	390	200	115	36	20
Sulfate (SO_4)	796	64	28	12	3.5	20
Chloride (Cl)	320	82	13	9.5	4.0	20
Nitrate (NO_3)	214	1.2	.8	.3	.0	19
Dissolved solids	1,540	539	357	221	113	20

Summary of chemical analyses of water from Garber Sandstone and Wellington Formation

	RESULTS IN MILLIGRAMS PER LITER					NUMBER OF SAMPLES
	MAXIMUM	UPPER QUARTILE[1]	MEDIAN	LOWER QUARTILE[2]	MINIMUM	
Hardness as $CaCO_3$	538	217	156	38	4.0	129
Sulfate (SO_4)	1,450	65	17	7.4	3.0	134
Chloride (Cl)	458	37	14	8.5	.2	135
Nitrate (NO_3)	100	2.2	1.0	.6	.0	134
Dissolved solids	2,110	547	320	226	101	117

Pennsylvanian Rocks (other than Vamoosa Formation)

Summary of chemical analyses of water from Pennsylvanian rocks

	RESULTS IN MILLIGRAMS PER LITER					NUMBER OF SAMPLES
	MAXIMUM	UPPER QUARTILE[1]	MEDIAN	LOWER QUARTILE[2]	MINIMUM	
Hardness as $CaCO_3$	2,760	297	164	100	9.0	73
Sulfate (SO_4)	4,850	97	35	20	4.8	68
Chloride (Cl)	2,100	91	38	20	3.0	71
Nitrate (NO_3)	160	35	2.0	.6	.0	61
Dissolved solids	9,580	911	416	295	77	73

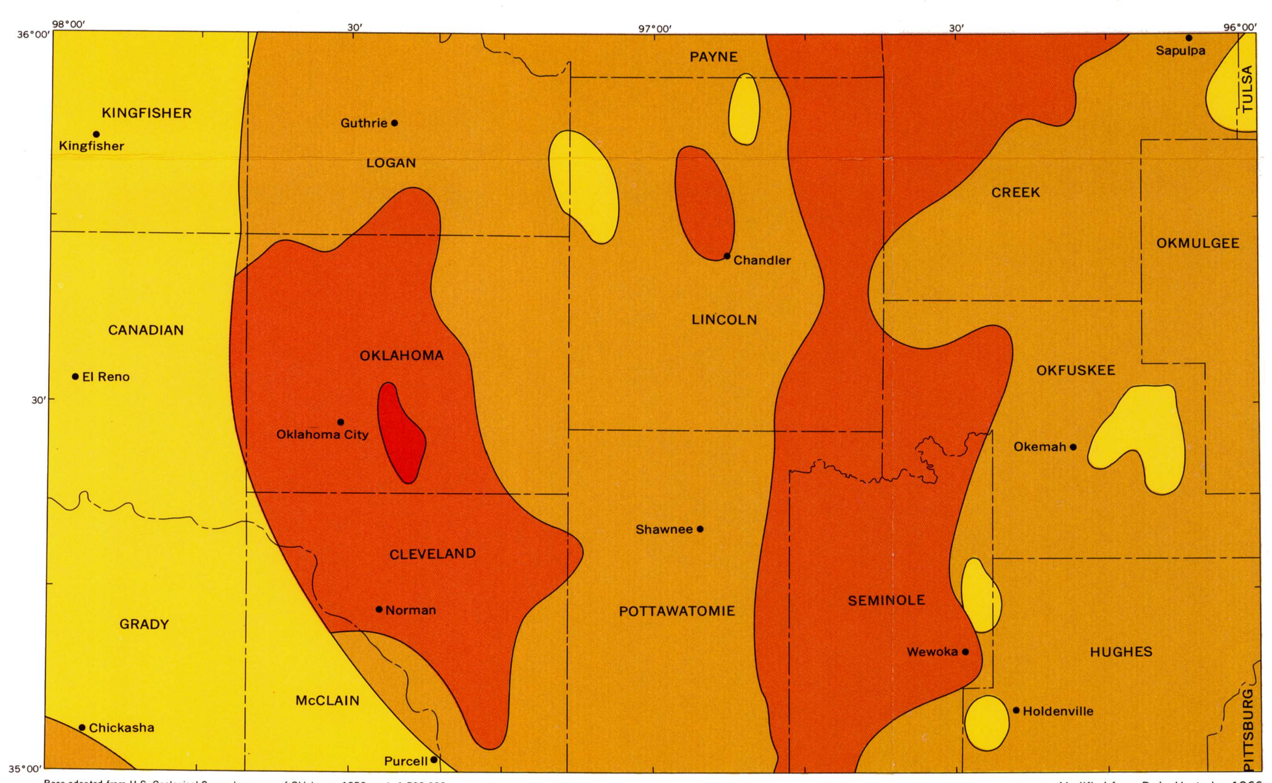
Permian Rocks (other than Garber Sandstone and Wellington Formation)

Summary of chemical analyses of water from Permian rocks

	RESULTS IN MILLIGRAMS PER LITER					NUMBER OF SAMPLES
	MAXIMUM	UPPER QUARTILE[1]	MEDIAN	LOWER QUARTILE[2]	MINIMUM	
Hardness as $CaCO_3$	1,670	507	310	215	40	41
Sulfate (SO_4)	5,350	387	73	26	12	34
Chloride (Cl)	945	92	40	22	9.0	41
Nitrate (NO_3)	175	60	14	3.0	.0	34
Dissolved solids	5,900	916	577	436	246	34

[1] Upper quartile—25 percent of the samples had a content greater than the amount shown, and 75 percent had less.

[2] Lower quartile—25 percent of the samples had a content less than the amount shown, and 75 percent had more.



Base adapted from U.S. Geological Survey base map of Oklahoma, 1952; scale 1:500,000

Modified from D. L. Hart, Jr., 1966

SCALE 1:750,000

10 0 10 20 MILES

Figure 7. Map showing depth to base of fresh water.

EXPLANATION

Depth, in Feet Below Land Surface

0-200

200-500

500-1,000

1,000-1,500

Depth to Base of Fresh Water

The approximate depth to the base of fresh water in the Oklahoma City quadrangle is shown in figure 7. The term "fresh water," as used in this report, includes water that contains less than 1,000 mg/l dissolved solids and can be used for human and stock consumption and for irrigation purposes. The fresh-water body is underlain by a thin layer of slightly saline water containing 1,000 to 3,000 mg/l dissolved solids. Such water can be used for some purposes, provided that treatment facilities reduce the dissolved-solids content to within limitations imposed by water-quality standards. The base of fresh water was determined from electric logs, drillers' logs of water wells and test holes, and information contained in other reports (Hart, 1966).

RECONNAISSANCE OF THE WATER RESOURCES OF THE OKLAHOMA CITY QUADRANGLE, CENTRAL OKLAHOMA

By

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U. S. Geological Survey

1975

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