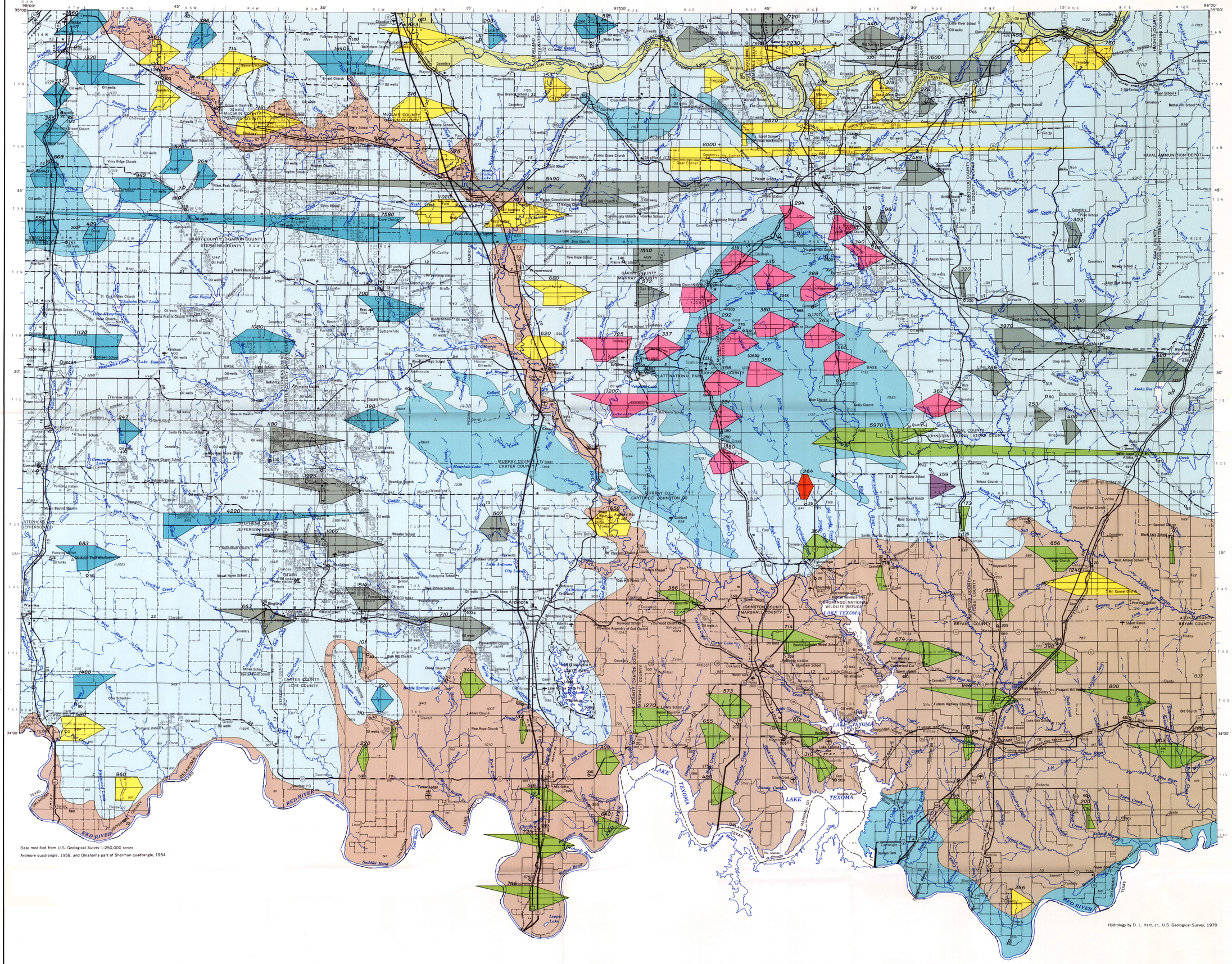


Base modified from U.S. Geological Survey 1:250,000 series
Ardmore quadrangle, 1958, and Oklahoma part of Sherman quadrangle, 1954

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

Chemical quality of water generally good

This area is underlain by alluvium and terrace deposits along the Red River in Bryan County; by the terrace deposits in McClain and Pontotoc Counties; by the Rush Springs Sandstone in Grady and Stephens Counties; and by the Simpson Group, the West Spring Creek, Kindblade, Cool Creek, and McKenzie Hill Formations, the Butterly Dolomite, the Signal Mountain Limestone, the Royer Dolomite, and the Fort Sill Limestone in Carter, Coal, Garvin, Johnston, Murray, and Pontotoc Counties.

The chemical-quality data indicate the dissolved-solids content to be generally less than 500 mg/l. The water is usually of the bicarbonate type and is suitable for most irrigation and municipal uses. Water from the Rush Springs Sandstone aquifer has a median dissolved-solids content of 429 mg/l, and water from the rocks of Ordovician age has a median content of 345 mg/l.

Chemical quality of water generally fair to good

This area is underlain by alluvium and terrace deposits along the Washita and Red Rivers and by the rocks of Cretaceous age in the southeastern part of the area. Analyses of water samples show the dissolved-solids content of much of the water to range from 500 to 1,000 mg/l. Water from the area adjacent to the Washita and Red Rivers is of the calcium magnesium bicarbonate type, and water from the aquifers of Cretaceous age is generally of the sodium bicarbonate type. Water usually is suitable for most municipal and irrigation uses; however, because of the sodium content of water from the aquifers of Cretaceous age some application management may be necessary where this water is used to irrigate tight clayey soils.

Chemical quality of water generally fair to poor

This area is underlain by the alluvium and terrace deposits of the Canadian River. The dissolved-solids content of the water generally ranges from about 250 to more than 1,000 mg/l. Locally, this aquifer may furnish water of good quality. However, relatively large amounts of sodium chloride have been reported in a number of wells completed in the alluvium in Seminole County.

Chemical quality of water variable

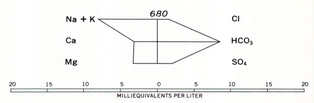
This area encompasses many aquifers, each having unique chemical properties; thus, the character of water differs markedly from place to place. The quality ranges from excellent to saline. The poor quality of some water in this area may result from pollution.

o 60
Well from which water sample was collected; number indicates well depth, in feet

o~
Spring from which water sample was collected

Water-Quality Diagrams

The diagrams, which show the general chemical character of the ground water, represent the analyses of water from wells at indicated points. The ionic concentrations are plotted for sodium and potassium (Na + K), calcium (Ca), magnesium (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 dissolved-solids content—larger areas reflect greater dissolved-solids content. Numbers above diagrams are dissolved solids, in milligrams per liter. Changes in configuration reflect changes in chemical character. (Calcium and magnesium values were not available for some sampling sites; at such sites only a line representing sodium and potassium has been plotted to the left of the center line.)



Sources of Water

Alluvium and terrace deposits

Rocks of Cretaceous age

Rocks of Permian age

Rocks of Pennsylvanian age

Rocks of Mississippian age

Rocks of Ordovician age

Rocks of Precambrian age

CHEMICAL QUALITY OF GROUND WATER

Information on the chemical quality of ground water was provided by water analyses from 132 selected sites. Most of the water samples were analyzed by the U.S. Geological Survey; a few analyses were obtained from reports published by the Oklahoma State Department of Health and Oklahoma State University. Laboratory determinations include sodium plus potassium (Na + K), calcium (Ca), magnesium (Mg), chloride (Cl), bicarbonate (HCO_3), sulfate (SO_4), and total dissolved solids (TDS).

All ground water contains minerals dissolved from the soil and rocks. The chemical quality of ground water is related to the type of rock with which the water has been in contact. Slightly soluble rocks may contribute only small quantities of dissolved substances; highly soluble rocks contribute large quantities of dissolved substances to the ground water. In some localities the quantity of the dissolved material is sufficient to make the water unsuitable for most uses. Generally, the limestones of Ordovician age yield ground water of the best quality, and the shales yield water of the poorest quality. Ground water that has been in contact with the coal beds in the eastern part of the area or the gypsum beds in the western part of the area is usually highly mineralized. Activities associated with coal mining and oil- and gas-field development may cause deterioration of water quality in local areas.

The U.S. Public Health Service Drinking Water Standards state that the following chemical substances should not be present in a public water supply in excess of the listed concentrations if, in the judgment of the reporting agency and certifying authority, other suitable supplies are or can be made available.

CONSTITUENT	MAXIMUM CONCENTRATION RECOMMENDED (MILLIGRAMS PER LITER)
Chloride	250
Sulfate	250
Total dissolved solids	500

Chloride is derived from certain minerals, from ancient sea brines trapped in the rocks, and from animal and industrial waste. Where chloride is present in small amounts it has little effect upon the usability of the water; but where concentrations of several hundred milligrams per liter (mg/l) are present, the water tastes salty, it may have a detrimental effect on crops, and it may increase the corrosiveness of the water.

Sulfate is derived chiefly from gypsum and anhydrite. In small amounts sulfate has little effect upon the usability of the water, but in large quantities it gives the water a bitter taste. Where calcium is also present a scale-forming compound will be deposited in boilers, water heaters, and pipes.

Bicarbonates affect the usability of water mainly where present with certain other constituents. Bicarbonate is a principal dissolved constituent in many natural waters, especially in water from limestone, dolomite, and sandstone with calcareous cement. Where combined with sodium in high concentrations the water may be undesirable for boiler or irrigation operations.

Sodium and potassium in small amounts have little effect upon the suitability of water for most industrial or domestic uses. More than 50 mg/l may cause foaming in steam boilers, and where the proportion of sodium salts is excessive in water used for irrigation, soils and crops may be injured.

Calcium and magnesium are chief contributors to the hardness of water. Hard water necessitates using large quantities of soap, causes boiler scale, and may be the cause of residue that adheres to the skin, silverware, glassware, and textiles.

Dissolved solids consist principally of dissolved-mineral constituents but include residue of organic materials that may be present after a measured amount of water has been evaporated. Large amounts of dissolved solids may restrict the use of water for most beneficial purposes.

The chemical analyses of water samples for this area indicate that most water is of the sodium bicarbonate or calcium magnesium bicarbonate type. Sodium bicarbonate water commonly occurs in the rocks of Cretaceous age in the southeastern part of the area and in the rocks of Pennsylvanian age in the southwestern part of the area. Calcium magnesium bicarbonate water generally occurs in the rocks of Quaternary age adjacent to the major streams and rivers as well as in the rocks of Ordovician age in the central part of the area.

Analyses show ground water in some localities to be a sodium chloride or sodium sulfate type with relatively high total dissolved solids. The sodium sulfate water probably is derived from gypsiferous rocks in the western part of the area and from shale in the eastern part. The sodium chloride water from the deeper wells probably is derived from minerals that have not been leached or from brines that have not been diluted by fresh water within the aquifer. Sodium chloride water in shallow wells may be due to contamination from solution of minerals, natural brines, or man-made industrial waste such as oil-well surface pits. Several water analyses show indications of contamination by brine in the northern part of the area.

The water analysis of one well drilled in rocks of Cretaceous age in Atoka County shows a large quantity of sulfuric acid. The sulfuric acid may have resulted from coal-mining operations in the area.

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

By

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

1974

Cartographers: Marion E. Clark, David M. Deering, Sondra Underwood