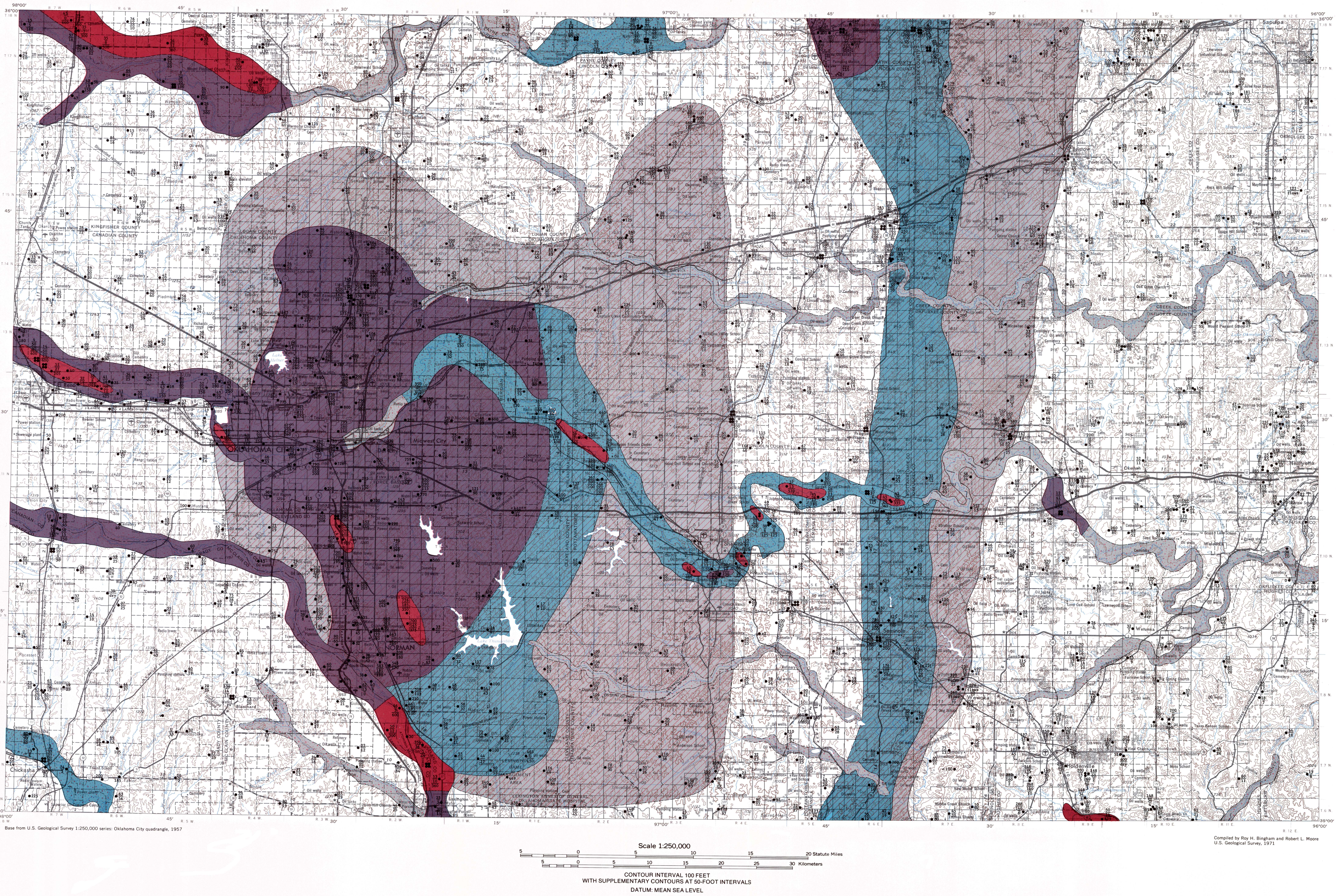


Figure 4. Map showing availability of ground water and pertinent data for drilled wells.

# EXPLANATION

### Major Aquifers

**Alluvium and terrace deposits**

Water is available from saturated layers of fine to coarse sand and gravel. Yields are highest along the Cimarron, North Canadian, and Canadian Rivers where the saturated layers of sand and gravel are thickest.

**Bedrock**

Water is available from numerous saturated layers of fine- to medium-grained sandstone. Yields of deeper wells are generally greater than shallower wells because more of the sandstone layers are penetrated. In some areas the bedrock aquifers are overlain by aquifers in alluvium and terrace deposits (shown on the map where the alluvium crosses the bedrock). In such areas, water is available from either of the two aquifers. The bedrock aquifer can be reached by drilling through the overlying alluvium and terrace deposits.

### Range in Yield of Major Aquifers, in Gallons per Minute

More than 300

150 to 300

50 to 150

25 to 50

### Yield in Remaining Areas, in Gallons per Minute

Generally less than 25

*Note: Locally, an individual well in one of the areas shown on the map might yield slightly more water than the yield pattern for that area indicates.*

Area boundary; dashed where approximately located

58 / 30 / 10

Well

Upper number is depth of well, in feet; middle number is depth to water, in feet below land surface; lower number is yield of well, in gallons per minute; < indicates well yield less than amount shown; > indicates well yield greater than amount shown; u = unknown. Where only two numbers are shown, they are well depth and depth to water; where only one number is shown, it is well depth.

14 / 50 / 25 / 400

Well field

Upper number is number of wells in field; second number is average depth, in feet; third number is average water level, in feet below land surface; fourth number is average yield per well, in gallons per minute; u = unknown.

e2

Spring

Number beside spring symbol is yield, in gallons per minute; e = estimated yield.

Information used to determine the availability of ground water was obtained in the field, from published and unpublished geologic maps, and from State and Federal agencies. Field information included measurement of well depth and depth to water, and reported yield and well-construction data. The Oklahoma Water Resources Board provided reported data on industrial and irrigation wells. The U.S. Public Health Service provided records on numerous wells in Hughes, Okfuskee, Okmulgee, and Creek Counties, and the U.S. Army Corps of Engineers provided records of wells along the shores of Lake Heyburn.

Delineation of areas of ground-water availability was based on the assumptions that (1) well yields from a particular geologic unit are similar throughout the extent of the unit provided that the lithology is similar, and (2) drilled wells will penetrate the total thickness of the aquifer.

Ground water in the Oklahoma City quadrangle is derived from precipitation falling directly upon the area. The average annual precipitation ranges from about 28 inches in the northwestern part of the quadrangle to about 41 inches in the southeastern part. Of this amount, an estimated 24 to 30 inches is returned to the atmosphere annually through evaporation and transpiration by plants. Runoff ranges from about 2.5 to 8 inches annually. The remaining 1.5 to 3.5 inches of the annual precipitation is available to recharge the ground-water reservoir.

During the principal recharge period, from November to April, a small part of the rainfall percolates from the land surface downward into the underlying rocks and becomes ground water. The capacity of the underlying rocks to absorb and transmit water depends upon the number, size, shape, and arrangement of the openings in them.

Water generally moves very slowly through fine-grained rocks such as siltstone and shale because the openings between the rock particles are too small to transmit water freely; thus, yields of wells penetrating these rocks are small. Water generally moves freely through medium- to coarse-grained sandstone and gravel; therefore, yields of wells penetrating these rocks are relatively large.

### Major Aquifers

An aquifer is a geologic unit, a part of a geologic unit, or a group of units that will yield significant amounts of water to wells. For this report, major aquifers are of two types: aquifers in unconsolidated alluvium and terrace deposits, and aquifers in bedrock. The location and range in yields from major aquifers are shown in figure 4.

Generally, the water-bearing properties of alluvium and of terrace deposits are similar; thus, these two units are combined and shown as a single aquifer along major streams. The units consist of lenticular layers of silt, clay, fine sand, and locally a layer of coarse sand and gravel at the base. The yields of wells depend largely upon the saturated thickness of the coarse sand and gravel; highest yields are obtained where the saturated layers are thickest.

## AVAILABILITY OF GROUND WATER

In some areas in Kingfisher, Canadian, Cleveland, Oklahoma, and Pottawatomie Counties, alluvium and terrace deposits are the source of water for irrigation, industrial, and municipal use (fig. 4). In those counties, yields of 200 to 250 gpm (gallons per minute) are common, except in Kingfisher County, where terrace deposits commonly yield 400 to 500 gpm. As no large-capacity wells are known to have been drilled in the alluvium and terrace deposits in the eastern half of the area, the potential yields of these units in this area are estimated on the basis of geologic information.

Ground-water supplies in alluvium and terrace deposits can be made available for use by the installation of properly constructed wells. Pumping of large amounts of water from these units, however, lowers the water table. Lowering of the water table may cause some water to flow into the alluvium from the nearby stream. Therefore, pumping of large amounts of water from the alluvium can reduce streamflow. In some areas poor-quality water from the stream may cause deterioration of the quality of water in the alluvium.

Mining of water occurs when the amount of water pumped from the aquifer is greater than the amount of recharge. Such mining decreases the amount of water available from the aquifer and is reflected by water levels that continue to decline year after year.

Data are not available to accurately predict the duration, intensity, and areal extent of problems that may result from development and use of large-capacity wells in the alluvium and terrace deposits.

The Vamoosa Formation is a major bedrock aquifer. Sandstone layers in the Vamoosa are fine to coarse grained and are irregularly interbedded with shale; thicknesses of the sandstone layers vary considerably within short lateral distances. Yields of deeper wells in the Vamoosa Formation are generally greater than shallower wells because more of the saturated sandstone layers are penetrated. In some areas of Seminole, Okfuskee, and Creek Counties, wells drilled 600 to 750 feet deep penetrate as much as 150 to 200 feet of saturated sandstone and commonly yield 100 to 150 gpm. In the eastern two-thirds of the outcrop area of the Vamoosa Formation, drilled wells commonly yield 25 to 50 gpm because only part of the formation is present. Domestic wells generally are less than 100 feet deep, and yields are small but could be increased by deepening the wells to penetrate additional water-bearing sandstone.

Major bedrock aquifers in addition to the Vamoosa Formation are sandstone layers in the Garber Sandstone and Wellington Formation. These sandstone layers are fine to medium grained and are irregularly interbedded with shale; thicknesses of individual layers range from a featheredge to as much as 50 feet within short lateral distances.

In Cleveland and Oklahoma Counties, some wells drilled 700 to 850 feet into the Garber-Wellington aquifer may penetrate as much as 200 to 300 feet of water-bearing sandstone, whereas adjacent wells of equal depth may penetrate only a few thin beds of sandstone. Wells that penetrate most of the two formations commonly yield 200 to 250 gpm. Larger yields are obtained locally where the sandstone layers are thickest (Wood and Burton, 1968). In the western parts of Cleveland and Oklahoma Counties, salt water is present at depths of 200 to 300 feet below land surface; thus only the upper few layers of the saturated sandstone provide fresh water (Hart, 1966). The yields of wells from these layers are generally about 25 gpm.

Development and use of large-capacity wells in the sandstone aquifers might result in deterioration of water quality, mining of water from the aquifer (which would decrease the amount of water available), and possibly minor amounts of land-surface subsidence. The areal extent and duration of such effects have not been determined.

Rocks underlying those areas where major aquifers are not present are mostly shale, siltstone, minor sandstone, conglomerate, and thin layers of limestone of Permian and Pennsylvanian age and locally thin layers of alluvium and terrace deposits. Most wells drilled into those rocks probably yield less than 10 gpm; however, an individual well might yield as much as 25 gpm where the sandstone layers are thickest or where the rocks are broken by faults.

### Water-Level Fluctuations

Although most rain falls during the spring and summer months, most ground-water recharge takes place during late winter and early spring when vegetation is dead or dormant and evaporation and transpiration are at a minimum. Thus water levels, as shown by the hydrographs (fig. 5), are highest in early spring, begin to decline in late spring or early summer, and continue to decline until autumn when they are at their lowest levels. In late autumn they begin to rise as evaporation and transpiration decrease. During the summer months, intermittent rains of an inch or more produce a temporary rise in water levels.

During the spring months, water levels in some of the sandstone formations rise rapidly in response to rainfall and decline nearly as rapidly, indicating that the permeability is sufficient to permit rapid recharge and lateral movement within the sandstone. The hydrographs of wells in sandstone near Perkins and Paden show this rapid response. In contrast, the hydrographs of other wells in the area show less response to rainfall, an indication that fractures in the sandstone through which recharge can enter the formation are few or restricted or that the source of recharge is at a considerable distance from the well.

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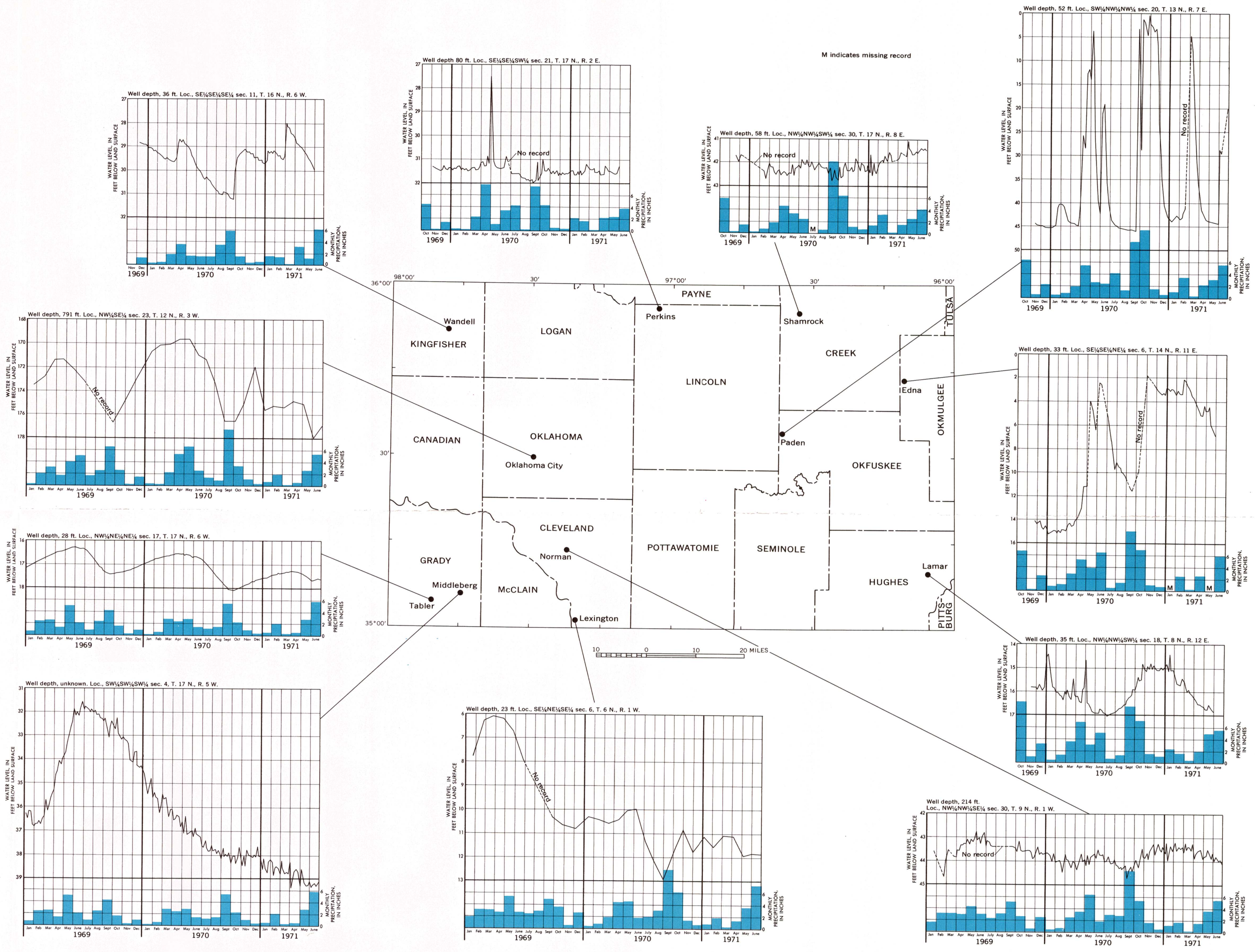


Figure 5. Hydrographs and precipitation data at selected sites.

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

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