DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
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PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF KENTUCKY, UNIVERSITY OF KENTUCKY
KENTUCKY GEOLOGICAL SURVEY
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SYSTEM	SERIES	GROUP	FORMATION	SECTION	THICKNESS, IN FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium		0–40′	Brown, tan, and gray silt, sand, and gravel, locally cemented with iron oxide.	Recent flood-plain deposits in the valley of Bayou du Chien and its tributaries. Commonly less than 10 feet thick in the tributaries.	Wells in the valley of Bayou du Chien yield sufficient amounts of water for a modern domestic supply. Most wells tap the underlying coarser and more permeable Eocene sands, owing to the fine-grained, low-yielding character of the material in the alluvium. The alluvium in most tributaries is above the main zone of saturation and is dry except where water is perched above Eocene clay. The water is generally of good quality, but may contain more than 0.3 part per million of iron. Iron in excess of this amount may cause staining of porcelain and textiles and impart a disagreeable taste to the water.
QUATERNARY	Pleistocene		Loess		0–15′	Brown to gray silt.	Windblown deposits. Mantle much of the upland surface and overlap the alluvium in the valley of Bayou du Chien.	Not an aquifer. When saturated, transmits water to underlying units.
TERTIARY	Pliocene(?)[1]		Gravel and sand		5–65′	Red to brown gravel and sand, locally cemented. Upper part is sand, silt, and clay.	Underlies loess in upland and drapes down slopes as colluvial deposits.	Not known to be water bearing. Water may be perched in the Pliocene(?) gravel either above Eocene or Pliocene(?) clay in the northeastern part of the quadrangle. Colluvial deposits, derived from the Pliocene(?) gravel, may be water bearing at the base of valley slopes adjacent to Bayou du Chien.
TERTIARY	Eocene undifferentiated		Sand and clay		800′± (325′±)	Numerous beds of gray clay in fine- to medium-grained micaceous sand. Grades downward into massive body of white to brown coarse-grained sand and lenses of fine- to medium-grained sand. May contain thin clay beds.	Coastal plain deposits; concealed by loess, Pliocene(?) gravel, and colluvial deposits throughout most of the quadrangle. Exposed in valleys of dissected upland. Eocene deposits contain several important hydrologically connected aquifers and may be as thick as 1,000 feet.	Underlies the entire quadrangle. All known wells, except those in the alluvial deposits, are completed in the Eocene sand. All properly constructed wells in the main zone of saturation yield more than an adequate amount of water for domestic use. Most domestic and some industrial and municipal wells, generally less than 250 feet deep, are completed in the upper third of the Eocene units and should yield in excess of 100 gpm (gallons per minute). In the northeastern part of the quadrangle and underlying a ridge east of Wesley Cemetery, water is perched above Eocene clay. Large-diameter bored wells and small-diameter jetted wells yield sufficient supplies for domestic use from perched water in these two areas.
					250′±	Gray to brown clay and brown to white fine-grained to locally coarse-grained sand. Grades downward into massive beds of white fine- to coarse-grained sand and minor amounts of clay.		Generally the middle unit is at too great a depth for domestic wells. The municipal and industrial wells in Fulton, Ky., and South Fulton, Tenn., yield large amounts of water from this unit. A municipal well, 425 feet deep at Fulton, yields 1,235 gpm. In a 2-hour pumping test, the specific capacity for this well was 34.2 gpm per foot of drawdown.
					225′±	Dark-gray lignitic micaceous clay and fine-grained to locally coarse-grained sand.		No wells obtain water from the lower unit, although the basal sand should yield sufficient amounts for many uses.
TERTIARY	Paleocene	Midway	Porters Creek Clay		300′±	Light- to dark-gray slightly micaceous clay. Upper part contains fine-grained micaceous glauconitic clayey sand; basal part is micaceous glauconitic clayey sand.	Marine deposit concealed at great depths by the Eocene sediments. Thickness may vary in quadrangle owing to the pre-Eocene erosion of the upper surface. The base of the Porters Creek Clay occurs at a depth of 1,100 feet below land surface along the east-central edge of the quadrangle and about 1,200 feet below land surface at Fulton.	Not an aquifer. The thick section of clay retards the movement of water between the overlying Eocene sand and the underlying Cretaceous sediments. The latter, consisting of sand and clay, and the deeper Paleozoic rocks have not been tapped for ground-water supplies and little is known about the water-bearing character of the deeper sediments. The water in these underlying units may be hard and may contain an objectionable amount of iron and dissolved solids.

[1] Age undetermined. Estimates of age range from Pliocene or older to Pleistocene

EXPLANATION

Gravel — Sand — Clay — Loess — Mica — Glauconite — Carbonaceous material

FIGURE 2.—GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF GEOLOGIC FORMATIONS

Base by Tennessee Valley Authority and U.S. Geological Survey, 1955

The Carter Coordinate System letters and numbers used to designate five-minute divisions of latitude and longitude are shown along the margins; tick marks indicate one-minute divisions

FIGURE 1.—MAP SHOWING AVAILABILITY OF GROUND WATER, LOCATION OF WELLS, AND QUALITY OF WATER

Hydrology by T. W. Lambert, 1963

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1965

KENTUCKY
QUADRANGLE LOCATION

EXPLANATION

The water-availability areas on this map show the occurrence and availability of ground water in the shallowest aquifer that may yield adequate amounts of water for domestic use in each area. As considered in this report, an adequate domestic supply will furnish approximately 500 gallons per day from a well equipped with a power pump and pressure-distribution system. The shallowest aquifer is underlain by deeper aquifers whose geologic and water-bearing properties are described in the generalized columnar section, fig. 2

Qal

AREA 1
Water in Quaternary alluvium

Shallow large-diameter bored or dug wells will yield sufficient water for domestic and stock use from the alluvium along Bayou du Chien downstream from the town of Water Valley. In the tributaries and the upper reaches of Bayou du Chien the alluvium is not water bearing except locally where water is perched above Eocene clay. Only minor amounts of perched water are available for domestic use

Tu

AREA 2
Water in Eocene sand
(Diagonal ruling shows where the water level in wells is more than 100 feet below the land surface)

All properly constructed wells in the Eocene sand yield sufficient amounts of water for municipal, industrial, domestic, and stock supplies. Municipal and industrial wells are as deep as 627 feet; the depth of domestic wells is generally less than 250 feet. The municipal wells at Fulton have specific capacities of 17.4 and 34.2 gallons per minute per foot of drawdown. There are two major sand units that are tapped for ground-water development. Small amounts of ground water are obtained from an upper sand, which supplies most of the farm wells; municipal and industrial wells tap the water in a deeper sand.

Perched water underlies a southward-trending ridge east of Wesley Cemetery and the upland in the northeastern part of the quadrangle. Several jetted wells in these two areas yield sufficient amounts of perched water for domestic and stock use. Only one small-diameter bored well is in use. Using present-day drilling methods, many of these perched zones may yield sufficient amounts of water for domestic and stock use from large-diameter bored wells

Area boundary

○ 52
Test hole
Figure below line is depth of test hole

800
Oil-test well
Figure below line is depth of well

● D
Water well

D, *Drilled or jetted well, generally less than 3-inch steel casing or 4-inch plastic casing with a screen on the lower end*
B, *Bored or dug well, generally 24-inch concrete tile casing open at the bottom*

Tu–91m (P) / 107
- Aquifer (see below)
- Water level in well; m, if measured. A plus sign indicates the water level, in feet above land surface; a minus sign, in feet below land surface
- Yield, in gallons per minute, or adequacy (see below)
- Depth of well, in feet below land surface

AQUIFER SYMBOLS

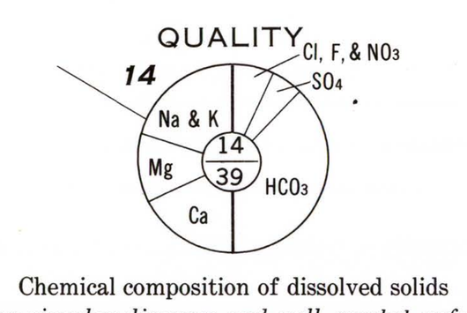
Qal .... Alluvium of Quaternary age
Tup .... Perched water in sand of Eocene age
Tu .... Sand of Eocene age

YIELD OR ADEQUACY

(650) .... Gallons per minute where measured or reported
(P) .... Well reported adequate for power pump for domestic and (or) stock supply
(H) .... Well reported adequate for hand pump or bucket
(A) .... Well abandoned or destroyed
(O) .... Observation well

380
Water-level contour
Shows altitude of water level in main zone of saturation. Depth to water is difference in feet between altitude of water-level contour and land surface. Measurements made in September 1963. Contour interval 10 feet; datum is mean sea level

QUALITY



Chemical composition of dissolved solids

Figure between circular diagram and well symbol refers to analysis number in table at end of text. Figure above line at center of circular diagram is carbonate hardness (calcium magnesium hardness, as $CaCO_3$) in parts per million; figure below line is dissolved solids, in parts per million. Hardness of water is classified by the U.S. Geological Survey as follows: 0–60 ppm, soft; 61–120 ppm, moderately hard; 121–180 ppm, hard; and 181 ppm or more, very hard. Dissolved solids in partial analyses are computed from specific conductances and are only approximate values. Areas of the segments of each circle are proportional to the mineral component in the dissolved solids in the water. Percentages are computed from equivalents per million of the anions and cations. Calcium and magnesium are shown as one segment in partial analyses

AVAILABILITY OF GROUND WATER IN THE WATER VALLEY QUADRANGLE, KENTUCKY–TENNESSEE

Large undeveloped supplies of ground water are available for domestic and industrial use in the Water Valley quadrangle. This atlas, one of a series that includes the entire Jackson Purchase region, presents nontechnical data about ground water in an area northeast of Fulton, Kentucky.

The water-availability map is a graphic representation of the occurrence and quality of water in the shallowest aquifer that may yield water in adequate amounts for domestic use. The availability of ground water at a particular site may be determined from the pattern on the map and a study of data on wells near the site. The chemical quality of the water is shown by circular diagrams.

The most extensive body of ground water in this quadrangle is in the sand in the Eocene formations which are mantled by loess, Pliocene(?) gravel, colluvial deposits, and alluvium. The Eocene sediments dip westward at about 30 feet per mile and are 750 to 1,000 feet thick. The upper surface of the main zone of saturation (water table) slopes westward from an altitude of 385 feet above sea level along the east-central edge of the quadrangle to about 340 feet near the junction of State Route 307 and Bayou du Chien. Flowing wells, which tap the Eocene sand, occur along Harris Creek in Fulton and along the edge of the valley of Bayou du Chien near State Route 307. Properly constructed drilled wells may yield more than 1,000 gpm (gallons per minute) from the Eocene sand. Specific capacities of two municipal wells at Fulton, which are 627 feet and 425 feet deep, are 17.4 and 34.2 gpm per foot of drawdown. The 425-foot well is pumped at 1,235 gpm. Properly constructed 4-inch wells in the main zone of saturation should yield more than 50 gpm and generally can be less than 250 feet deep.

Discontinuous beds of clay or sandy clay above the main zone of saturation retard the downward movement of water and form water bodies on top of the clay. These bodies of perched water usually will furnish sufficient water for domestic use to large-diameter bored wells. Many of the perched bodies of ground water, however, are of limited areal extent and too small for the development of water supplies; the larger ones may furnish adequate quantities to jetted wells. The perched zones of water are found in the northeast quarter of the quadrangle and beneath a southward-trending ridge east of Wesley Cemetery about parallel with State Route 307.

The main zone of saturation in the Eocene sand extends downward to the top of the underlying Porters Creek Clay. Many clay bodies occur throughout this zone and may cause some wells to be deeper than adjacent wells. Below the Porters Creek Clay are sand and clay of Cretaceous age which rest on limestone of Paleozoic age. These underlying sediments are too deep for present water wells to tap, and the water in them may be of poor quality.

The quality of water from the Eocene formations is excellent for most uses, although it is slightly acidic. The concentration of dissolved solids generally is less than 100 ppm (parts per million) and the water is generally soft, although some at shallow depths is moderately hard. Many samples collected for chemical analysis contained more than 0.3 ppm of iron, the maximum amount recommended by the Public Health Service.

The following table shows the iron content, in parts per million, and the hydrogen-ion concentration, expressed as pH, of the water analyzed and shown by circular diagrams on the availability map. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkalinity; values lower than 7.0 indicate acidity. Corrosiveness of water generally increases as pH decreases.

Analysis number	1	2	3	4	5	6	7	8	9	10
Iron content	2.9	3.2	7.8	19.0	2.6	0.05	5.0	0.83	0.24	2.7
pH	6.3	6.1	6.3	—	6.1	6.0	—	6.0	6.9	6.6

Analysis number	11	12	13	14	15	16	17	18
Iron content	0.33	0.15	0.54	0.43	0.05	0.61	0.28	0.21
pH	6.4	6.3	5.9	7.1	5.8	6.0	—	6.2

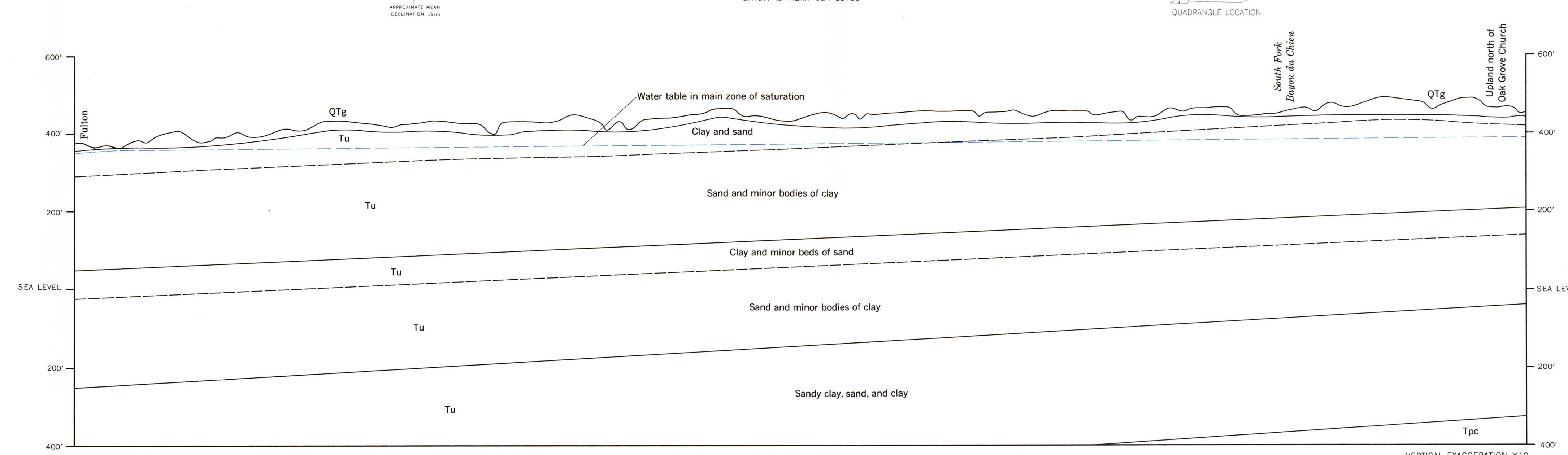


FIGURE 3.—GENERALIZED GEOLOGIC SECTION FROM FULTON TO THE UPLAND NORTH OF OAK GROVE CHURCH

VERTICAL EXAGGERATION ×10

EXPLANATION

Qal .... Gravel and sand of Pleistocene and Recent age
QTg .... Gravel and sand of Pliocene(?) age
Tu .... Sand and clay of Eocene age, undifferentiated
Tpc .... Porters Creek Clay of Paleocene age

AVAILABILITY OF GROUND WATER IN THE WATER VALLEY QUADRANGLE, KENTUCKY–TENNESSEE

By
T. W. Lambert
1965

For sale by U. S. Geological Survey, price 50 cents