PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF KENTUCKY, UNIVERSITY OF KENTUCKY
KENTUCKY GEOLOGICAL SURVEY
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GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF GEOLOGIC FORMATIONS

SYSTEM	SERIES	GROUP	FORMATION	THICKNESS, IN FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium	0–36′	Brown to gray silty clay, clay, and sandy silt with gravel, as much as 10 feet thick, at base.	Recent flood-plain deposits in the valleys of the larger streams and their tributaries. In the quadrangle, the maximum known thickness, 36 feet, is in the valley of Obion Creek. The maximum known thickness in the valley of Brush Creek is 35 feet. Thin, or absent, in smaller stream valleys.	Few wells tap the alluvium in the quadrangle. In the tributary valleys, the alluvium is above the main zone of saturation; if water is present locally, it is perched above lenses of clay. In the larger valleys, yields from bored wells may be adequate for domestic use. Yields will be small where the gravel is thin or absent; larger yields are available from the underlying Eocene sand. Based on one sample, the water in the alluvium is soft, acidic, has less than 0.3 ppm (parts per million) of iron, and about 10 ppm of nitrate. Downstream from the 350-foot water-level contour, the stream channels intersect the water table and the streams flow throughout the year.
QUATERNARY	Pleistocene		Loess	0–35′	Brown unstratified silty clay.	Windblown deposits covering all upland areas. Drapes down slopes as colluvial deposits; appears to merge with alluvium on gentle slopes.	Above the main zone of saturation. When saturated by precipitation, transmits water to underlying aquifers.
QUATERNARY / TERTIARY	Pleistocene / Pliocene(?)		Gravel and sand[1]	0–34′	Brown clayey to sandy gravel and sand with clay matrix. Near Fulgham, cemented zones near base.	Continental deposits overlying sediments of Eocene age in uplands. Drapes down slopes as thin colluvial deposits, commonly mixed with loess.	Above the main zone of saturation. Near Fulgham and Watts, water is perched above layers of silty clay and clayey silt of Eocene age. The perched water bodies may provide an adequate domestic supply; however, a few wells are reported to go dry during dry years. Based on two samples, the perched water is hard, has about 300 ppm of dissolved solids, and about 40 ppm of nitrate.
TERTIARY	Eocene, undifferentiated		Sand and clay	200–250′ (total 700–850′)	White to yellow fine- to medium-grained sand and white to gray clay. Upper and basal parts are predominantly clay and some fine sand; clayey sands are common. Middle part is predominantly medium-grained sand, often lignitic; some cemented layers.	Coastal-plain sediments underlying either gravel deposits of Pliocene(?) and Pleistocene age or alluvium in the entire quadrangle. Upper unit crops out along the tributary valleys.	Yields of all wells in the main zone of saturation are adequate for domestic use. Most domestic wells, between 160 and 230 feet deep, are completed in the upper unit; yields may exceed 50 gallons per minute. The water generally is soft, acidic, and has less than 0.3 ppm of iron.
TERTIARY	Eocene, undifferentiated		Sand and clay	400–450′	Brown to white fine- to coarse-grained sand and gray to brown clay. Upper two-thirds is mostly fine- to medium-grained sand and layers of clay. Lower third is mostly medium- to coarse-grained sand.		Only four domestic wells are believed to tap the middle unit. Municipal and industrial wells may be completed as shallow as 250 feet in the northeast corner of the quadrangle to as deep as 850 feet in the southwest; yields may exceed 700 gallons per minute.
TERTIARY	Eocene, undifferentiated		Sand and clay	100–150′	Brown to gray clay and sand, often lignitic, and a basal fine- to medium-grained sand.		No wells tap the lowest unit.
TERTIARY	Paleocene	Midway	Porters Creek Clay	200–250′	Gray micaceous clay. Upper and basal parts are micaceous glauconitic clayey very fine sand.	Marine sediments underlying Eocene sediments in the entire quadrangle. Thickness is variable owing to pre-Eocene erosion. Overlies the McNairy Formation of Cretaceous age which overlies limestone of Paleozoic age.	Not an aquifer. Retards the movement of water between the Eocene sediments and the underlying formations.

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

EXPLANATION

Gravel; Sand; Silt; Loess; Clay; Mica; Glauconite; Lignite

AVAILABILITY OF GROUND WATER IN THE DUBLIN QUADRANGLE, JACKSON PURCHASE REGION, KENTUCKY

Abundant ground water is available for domestic and industrial use in the Dublin quadrangle. This atlas, one of a series being prepared for the entire Jackson Purchase region in western Kentucky, presents nontechnical data about the ground water in this quadrangle west-southwest of Mayfield, Ky.

The water-availability map shows the occurrence and quality of ground water in the shallowest aquifer that may yield enough water for domestic use. Ground-water availability at any site is shown by the pattern on the map and the data on nearby wells. Chemical quality of water is shown by circular diagrams.

In the quadrangle, the principal aquifer is the sand of Eocene age. Limited data suggest that the Eocene strata dip southwestward about 25 feet per mile and are from 700 to 850 feet thick. Yields from 4-inch wells, generally between 160 and 230 feet deep, may exceed 50 gpm (gallons per minute). Properly constructed wells in the deeper Eocene sand may yield more than 700 gpm. Lenses of clay in the main zone of saturation in the Eocene strata, the zone in which the pore spaces are filled with water under hydrostatic pressure, may require that some wells be drilled deeper than other wells nearby in order to obtain the same yield.

The water level in the main zone of saturation slopes westward from about 400 feet above sea level at the northeast corner of the quadrangle to about 345 feet where Obion Creek flows out of the quadrangle. The annual range of water-level fluctuation in the upland is about 3 feet.

Layers of clay and silt in the Eocene strata above the main zone of saturation retard downward movement of water and perch water above the main zone. Perched water is found near Fulgham and Watts. The water is perched in the Pliocene(?) and Pleistocene gravel, above layers of silty clay and clayey silt of Eocene age. The perched water bodies may furnish an adequate domestic supply to bored wells; however, a few wells tapping the perched water are reported to go dry during relatively dry years.

The Porters Creek Clay of Paleocene age is not an aquifer but retards ground-water movement between the Eocene beds and the underlying sediments. The clay is from 200 to 250 feet thick; its upper surface probably slopes southwestward from about 100 feet below sea level at the northeast corner of the quadrangle to about 450 feet below sea level at the southwest corner.

Below the Porters Creek Clay are sediments of the McNairy Formation of Cretaceous age which are from 300 to 350 feet thick. The McNairy sediments rest on limestone of Paleozoic age. The Paleozoic bedrock surface probably slopes southwestward from about 700 feet below sea level at the northeast corner of the quadrangle to about 1100 feet below sea level in the southwest. No wells in the quadrangle tap either the Cretaceous or Paleozoic formations; the water from these formations may be hard and contain excessive iron and dissolved solids.

The quality of water in the main zone of satuation is satisfactory for most uses. The water generally is soft and has less than 120 ppm (parts per million) of dissolved solids. The water is generally acidic, with a pH lower than 6.4, and may be corrosive. The water generally contains less than 0.3 ppm of iron and 17 ppm of nitrate; the temperature is close to the mean annual air temperature, about 60°F.

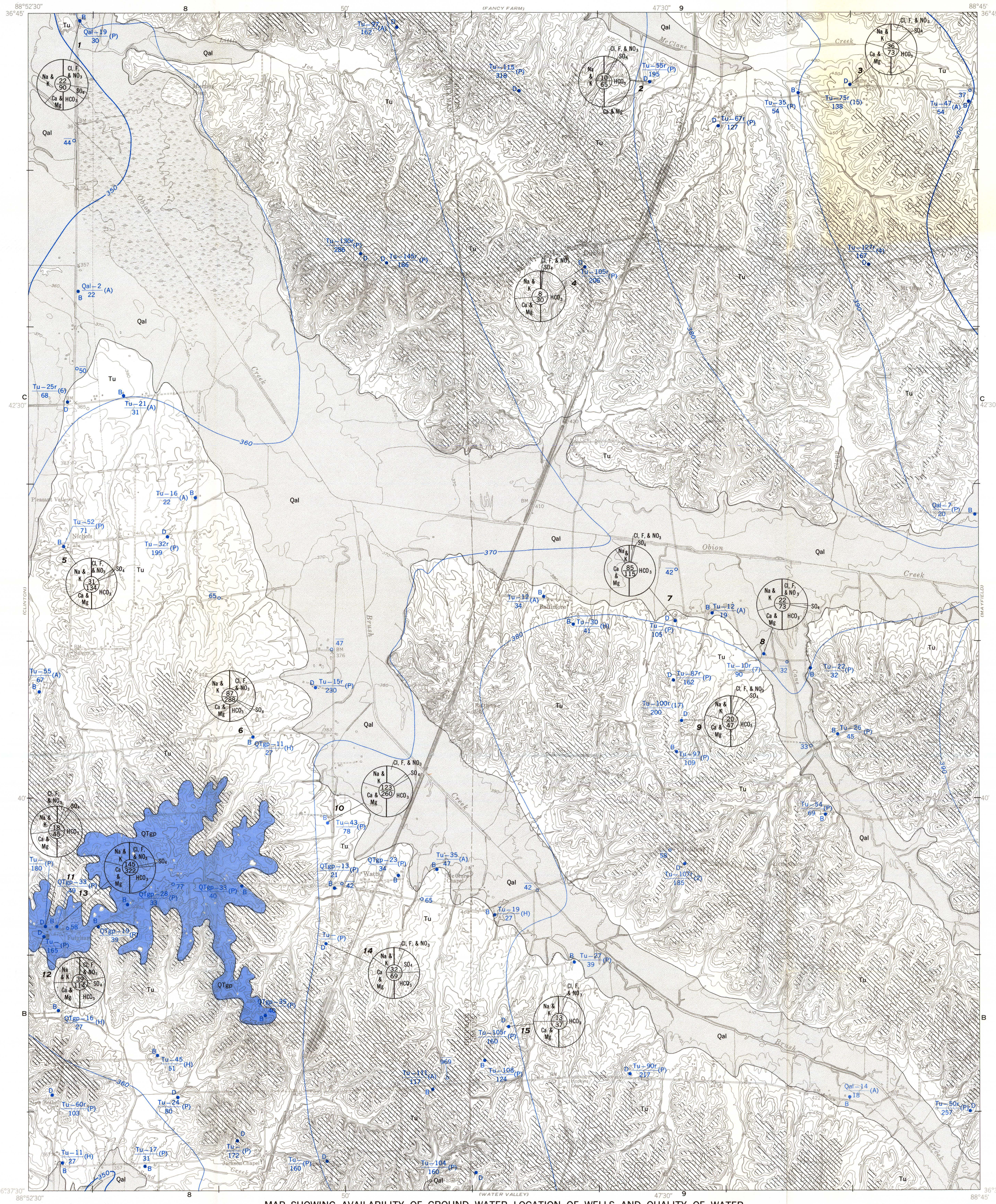
Most of the water that is pumped from small-diameter drilled wells equipped with steel casings and "sucker rod" pumps contains large amounts of iron. Probably, most of this iron is derived from the corrosion of the well casing and pump apparatus by the acidic ground water. To obtain water more representative of the actual iron content of the ground water, 8 of the 10 samples from drilled wells were collected from wells with 4-inch plastic casings. In the table at the end of the text, only analyses 7 and 11 are samples collected from wells with 2 1/2-inch steel casings.

The quality of perched ground water depends upon local factors, and the two samples available may not be typical of the perched water in the quadrangle. Based on these two samples, the perched water is hard, has about 300 ppm of dissolved solids, and about 40 ppm of nitrate.

The following table lists the iron content, in parts per million, and the hydrogen-ion concentration, expressed as pH, of the water analyses 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; lower values indicate acidity. Below 7.0, corrosiveness generally increases as pH decreases.

Analysis number	1	2	3	4	5	6	7	8	9	10
Iron content	0.14	0.32	0.40	0.24	0.30	0.22	3.2	0.05	0.18	0.01
pH	5.9	6.3	7.5	5.9	7.1	—	6.1	5.7	6.3	7.1

Analysis number	11	12	13	14	15
Iron content	0.66	0.20	0.00	0.08	0.26
pH	—	6.1	6.7	6.0	6.0



MAP SHOWING AVAILABILITY OF GROUND WATER, LOCATION OF WELLS, AND QUALITY OF WATER

Base by Tennessee Valley Authority and U.S. Geological Survey, 1952

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

APPROXIMATE MEAN DECLINATION, 1966

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

KENTUCKY
QUADRANGLE LOCATION

Hydrology by Arnold J. Hansen, Jr., 1964

EXPLANATION

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

Qal

AREA 1
Water in Quaternary alluvium

Yields from bored wells may be adequate for domestic use. Yields will be small where the gravel is thin or absent. Wells can be deepened into the sand in the underlying Eocene formations to obtain larger yields

QTgp

AREA 2
Water perched in Pliocene(?) and Pleistocene gravel above Eocene clay and silt

Yields from bored wells may be adequate for domestic use; however, a few wells are reported to go dry during dry years. An alternative supply is available from the underlying main zone of saturation in the Eocene sand

Tu

AREA 3
Water in Eocene sand
Diagonal ruling shows the static water level to be more than 100 feet below land surface

Yields of all wells in the main zone of saturation are adequate for domestic use. Most domestic wells are between 160 and 230 feet deep. Industrial wells may be completed at depths varying from 250 to 850 feet, and yields as great as 700 gpm (gallons per minute) may be obtained. The specific capacity of industrial wells in adjacent quadrangles is about 30 gpm per foot of drawdown, when pumped at about 600 gpm. The specific capacity of domestic 4-inch wells is reported to be about 1 gpm per foot of drawdown, when pumped at about 10 gpm.
Around the edges of area 2, a few large-diameter wells tap water perched above the Eocene sand in a gravel of Pliocene(?) and Pleistocene age that is lower than the gravel of area 2. This body of perched water is discontinuous and of small lateral extent

Area boundary

o 44
Test hole
Figure below line is depth of test hole

• D
Water well
D, *Drilled or jetted well, generally 4-inch plastic or smaller steel casing with well screen*
B, *Bored or dug well, generally 24-inch concrete tile or 8-inch vitrified clay pipe, open at the bottom*

Tu–100r / 200 (17)
- Aquifer (see below)
- Water level in well, in feet below land surface; r, if reported
- Yield in gallons per minute, or adequacy (see below)
- Depth of well, in feet below land surface

AQUIFER SYMBOLS

- Qal .... Alluvium of Quaternary age
- QTgp .... Perched water in gravel of Pliocene(?) and Pleistocene age
- Tu .... Sand of Eocene age

YIELD OR ADEQUACY

- (17) .... Gallons per minute where known
- (P) .... Well reported adequate for power pump for domestic and (or) stock supply
- (H) .... Well reported adequate for bailer or hand pump
- (A) .... Abandoned or destroyed

—— 350 ——
Water-level contour
Shows altitude of water level in main zone of saturation. The depth to water is the difference between the land-surface altitude and the water-level contour. Water levels measured in September 1964. Contour interval 10 feet; datum is mean sea level

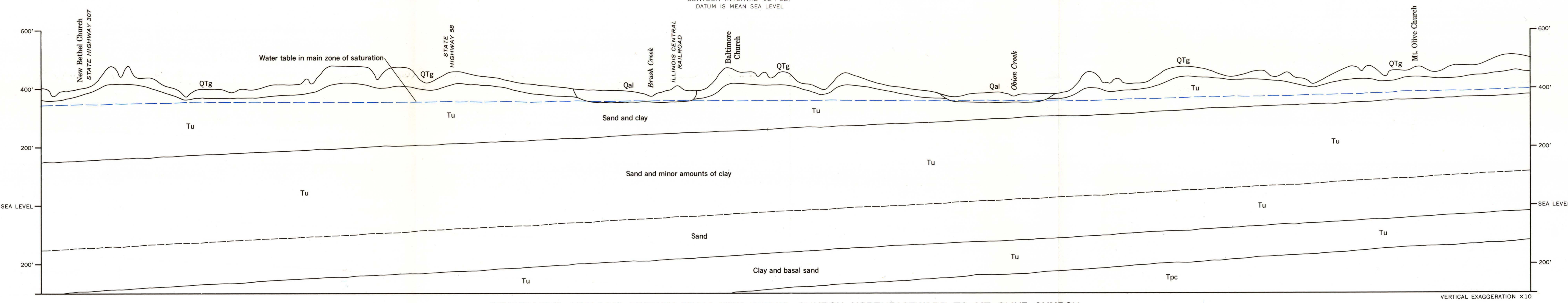
QUALITY

Na & K; Cl, F, & NO_3; SO_4; HCO_3; Ca & Mg; 39 / 114; 12

Chemical composition of dissolved solids
Figure between circular diagram and well symbol is 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 ppm (parts per million). The U.S. Geological Survey classifies hardness of water as follows: 0–60 ppm, soft; 61–120 ppm, moderately hard; 121–180 ppm, hard; and 181 ppm or more, very hard. Figure below line is dissolved solids in parts per million; dissolved solids are computed from specific conductances and are only approximate. In each circle, the segments are proportional to the mineral components dissolved in the water. Percentages are computed from equivalents per million of the anions and cations. Water from one well contains 43 ppm of nitrate. Water containing more than 45 ppm of nitrate may cause methemoglobinemia ("blue baby" disease), sometimes fatal, in infants and should not be used in infants' formulas

EXPLANATION

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



GENERALIZED GEOLOGIC SECTION FROM NEW BETHEL CHURCH NORTHEASTWARD TO MT. OLIVE CHURCH

AVAILABILITY OF GROUND WATER IN THE DUBLIN QUADRANGLE, JACKSON PURCHASE REGION, KENTUCKY

By
Arnold J. Hansen, Jr.
1966

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