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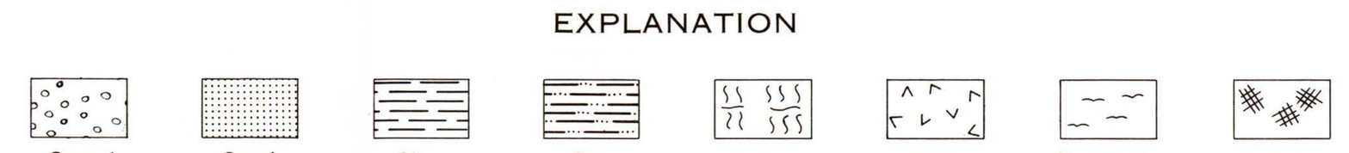
GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF THE GEOLOGIC FORMATIONS

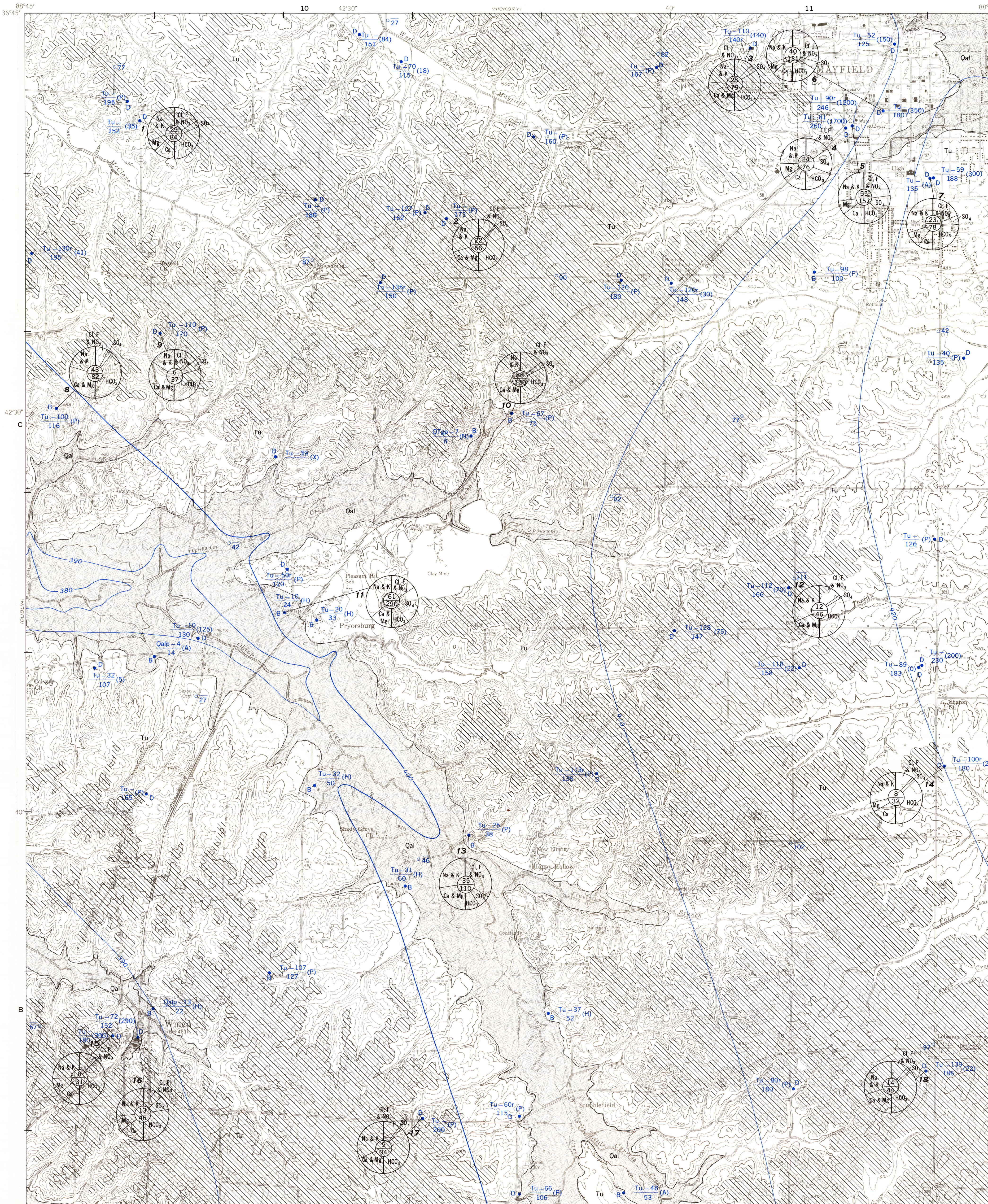
SYSTEM	SERIES	GROUP	FORMATION	SECTION	THICKNESS, IN FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium		0–22′	Tan to gray silt and clay near the surface. Grades downward to silty and sandy gravel. Gravelly beds common near the base.	Fills the valleys of the larger streams and their tributaries. The thickest known alluvium is 22 feet in the valley of Kess Creek; the deposits are about 20 feet thick in the valley of Obion Creek; about 15 feet thick in the larger creek valleys, and thin or not present along smaller streams.	The water table is below the base of the alluvium in most of the quadrangle; therefore, the alluvium generally is not an aquifer (water-bearing bed). Obion and Opossum Creeks are perennial downstream from Pryorsburg, indicating that the alluvium is saturated and the water table is in the alluvium in this area; however, in this area no wells are known that obtain water from the alluvium. Cemented zones or clay beds at the base of the alluvium may perch water locally, but wells tapping these perched zones may not yield an adequate supply.
QUATERNARY	Pleistocene		Loess		0–18′	Tan to gray unstratified silt or clay.	Covers all upland areas; locally absent along steep valley walls of the larger streams.	Not an aquifer. When saturated by rainfall transmits water to lower aquifers.
QUATERNARY / TERTIARY	Pliocene(?)		Gravel, sand, and clay[1]		0–78′	Tan, red, or brown chert gravel, commonly sandy, grading upward to gravelly sand, sand with chert pebbles, sand, or yellow to brown silt and clay beds.	Overlies Eocene sediments in all of the quadrangle, except below some of the alluvium where it has been removed by erosion. Most exposures are gravel; the finer grained sediments in the upland areas are concealed by loess.	The water table is below the base of the gravel in the entire quadrangle; therefore, the gravel is not an aquifer. Cemented zones at the base of the gravel may perch water locally, but only one well is known that obtains water from a perched zone and its supply is inadequate most of the year.
TERTIARY	Eocene, undifferentiated		Sand and clay[2]		350′±–650′± (250′±–450′±)	Red, tan, to white coarse- to fine-grained sand; white to dark-gray clay lenses or beds, commonly containing lignitic material; and sandy clay or clayey sand.	Underlies Pliocene(?) gravel or Quaternary alluvium in all of the quadrangle. Poorly exposed in creek beds, a clay pit, and in a few road cuts in the southwest quarter of the quadrangle below altitude of 450 feet. Generally concealed by younger deposits in the remainder of the quadrangle.	An excellent aquifer for public supply, industrial, or domestic wells in all of the quadrangle. Almost all wells in the quadrangle obtain water from Eocene sand presently at depths as great as 260 feet. The water is slightly acidic, soft, and generally contains less iron than 0.3 part per million. An iron content of more than 0.3 part per million imparts a disagreeable taste to water and may cause staining of clothing and utensils.
TERTIARY	Eocene, undifferentiated		Sand and clay[2]		(100′±–200′±)	Black to gray clay, probably lignitic, with some fine-grained sand layers.	Not exposed but probably underlies the main body of Eocene sediments in all of the quadrangle. This unit has not been penetrated by wells or test holes in the Mayfield quadrangle and its presence is inferred from widely spaced test-hole data in adjacent quadrangles.	Not considered to be an aquifer.
TERTIARY	Paleocene	Midway	Porters Creek Clay		300′±	Light- to dark-gray or black, slightly to very micaceous clay with fine- to medium-grained, commonly glauconitic, sand beds in the upper part. Glauconitic sand or clay and black clay at the base.	Not exposed but underlies Eocene sediments in all of the quadrangle. The formation has not been penetrated by wells or test holes in the Mayfield quadrangle. Underlain by about 300 feet of sand and clay of the McNairy Formation of Cretaceous age. The McNairy rests unconformably on Paleozoic rocks, probably of Silurian age, in the southwest and rocks of Devonian age in the remainder of the quadrangle.	Generally not an aquifer. The water-bearing character of the formations below the Porters Creek Clay has not been tested in the Mayfield quadrangle. The sand in the McNairy Formation probably could yield a large amount of water of fair to good quality, but because of the abundance of good-quality water in the shallower Eocene sand, the McNairy may never need to be tapped for a source of ground water in this quadrangle

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

[2] Fossil pollen and spores collected from a lignitic bed at the top of the clay pit at Pryorsburg indicate that part of the clay sequence may be of Oligocene(?) age (Oral communication W. I. Finch, 1964)

EXPLANATION





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

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

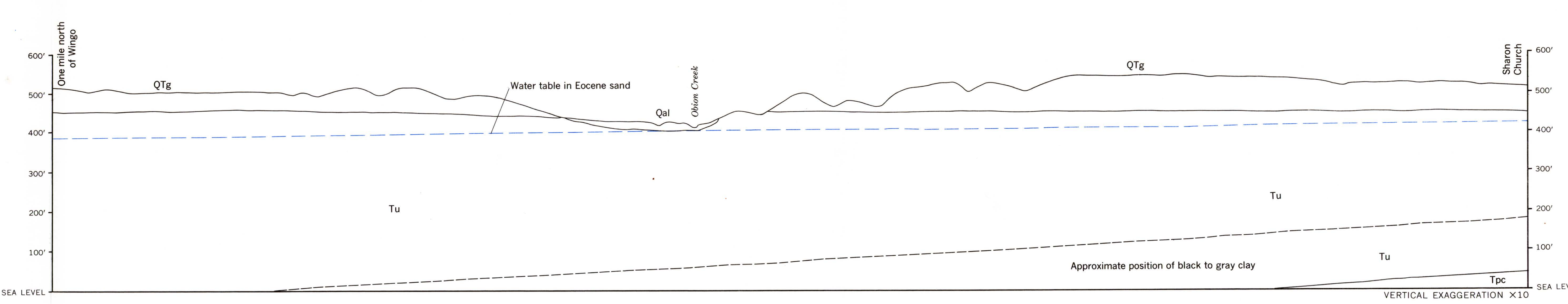
The Carter Coordinate System letters and numbers used to designate five-minute divisions of latitude and longitude are shown along the margins; tick marks indicate one-minute divisions

TRUE NORTH
MAGNETIC NORTH
4½°
APPROXIMATE MEAN DECLINATION, 1965

SCALE 1:24 000
1 ½ 0 1 MILE
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

KENTUCKY
QUADRANGLE LOCATION

Hydrology by R. W. Davis, 1963–64



GENERALIZED GEOLOGIC SECTION ALONG A WEST-EAST LINE FROM ONE MILE NORTH OF WINGO TO SHARON CHURCH

EXPLANATION

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

EXPLANATION

The water-availability areas on this map show the occurrence and availability of ground water in the shallowest aquifer that will yield adequate amounts of water for domestic use in each area. As considered in this report an adequate domestic supply will deliver 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 water-bearing properties are described in the generalized columnar section

Qal

AREA 1
Water in Quaternary alluvium

Large-diameter wells in the valleys of Obion and Opossum Creeks, downstream from the 400-foot water-level contour, should yield sufficient water for an adequate domestic supply from the alluvium. In other parts of Area 1 the water, where present, is perched above a clay or cemented sand bed and will not furnish an adequate supply for domestic use in most places. If the alluvium is dry or yields only small amounts of water, wells may be deepened to obtain sufficient water at shallow depths from the underlying Eocene sands

Tu

AREA 2
Water in Eocene sand

Diagonal ruling shows areas where the water level in wells is more than 100 feet below land surface

Furnishes sufficient water for adequate domestic, industrial, and public supplies in all of the area. Drilled wells are most common where the depth to water is greater than 100 feet. Both drilled and large-diameter bored wells are common where the depth to water is less than 100 feet. Large amounts of good-quality water are present at depths shallower than 200 feet throughout the quadrangle. Properly constructed drilled wells, from 300 to 500 feet deep, penetrating the sand in the lower part of the Eocene Series, should be capable of supplying 1000 gallons per minute throughout the quadrangle

Area boundary

○102
Test hole
Figure below line is depth of test hole

●B
Water well

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

Tu – 139 / 186 (22)
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

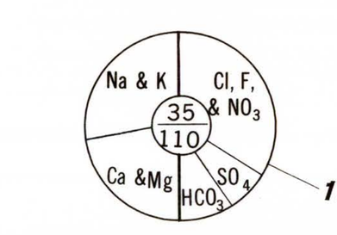
Qalp .... Perched water in alluvium of Quaternary age
QTgp .... Perched water in gravel of Pliocene(?) age
Tu .... Sand of Eocene age

YIELD OR ADEQUACY

(800) .... Gallons per minute where known
(P) .... Well reported adequate for power pump for domestic and/or stock supply
(H) .... Well reported adequate for hand pump or bailer
(N) .... Well reported not adequate
(O) .... Observation well
(A) .... Abandoned

—— 400 ——
Water-level contour, October 1963
Shows altitude of water level in the saturated zone of the Quaternary alluvium and Eocene sand. Contour interval 10 feet; datum is mean sea level

QUALITY



Chemical composition of dissolved solids

Figure between circular diagram and well location refers to analysis number 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. All wells sampled contained less than 45 ppm of nitrate. Water containing more than 45 ppm of nitrate may cause a type of methemoglobinemia in infants ("blue baby" disease), sometimes fatal, and should not be used in infants' formulas

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

Large quantities of good-quality ground water for domestic, industrial, and public-supply uses are available in the area of the Mayfield quadrangle. This atlas presents nontechnical information about the ground water in an area near, and including, Mayfield, Ky., for use by well drillers, land owners, and other well users.

Most wells in the quadrangle are less than 200 feet deep and obtain ground water from sand of Eocene age. A few wells obtain shallow perched water from gravel or alluvial deposits, but in general the perched water zones will not yield sufficient water for an adequate domestic supply. The water-availability map presents information on the occurrence of the shallowest ground water that will yield an adequate supply for domestic use.

Availability of ground water at a particular location may be determined by the area pattern on the map. The map explanation and columnar section briefly describe the water-yielding properties of the formation. Chemical analyses of water from nearby wells are represented on the map by circular diagrams. The approximate depth to water can be calculated by subtracting the altitude of the water level (as shown by the water-level contours) from the altitude of the land surface.

A public-supply well at Mayfield yields 1700 gpm (gallons per minute) with a specific capacity of 26.5 gpm per foot of drawdown. Wells tapping the sand in the lower part of the Eocene Series should have similar capacities and should be capable of supplying 1000 gpm throughout the quadrangle.

The Eocene sand in the Mayfield quadrangle contains an abundance of good-quality ground water for present and future use. The ground-water formation is 200 to 400 feet thick and is completely saturated. Ground water drains from the aquifer continuously and maintains the flow of Obion Creek. The Eocene sands in the Mayfield quadrangle are estimated to contain one trillion (1000 billion) gallons of water. Water levels at Mayfield are reported to have been lowered only 5 feet in about 60 years; wells in the general area pump one-half billion gallons of water per year.

The temperature of ground water from the Eocene sand is about 59°F.

The following table shows 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 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 with decreasing pH.

Analysis number	1	2	3	4	5	6	7	8	9	10
Iron content	0.04	0.18	0.04	0.03	0.84[1]	0.26	0.21	0.03	0.01	0.76
pH	6.1	6.1	6.5	6.6	6.2	5.7	6.1	6.3	7.4	6.5

Analysis number	11	12	13	14	15	16	17	18
Iron content	0.17	0.09	0.39	0.03	0.06	0.20	0.05	0.36
pH	—	6.2	5.7	6.0	6.5	5.9	6.0	6.0

[1] In sediment and solution when analyzed

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1965—W65141

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

By
R. W. Davis
1965

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