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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HYDROLOGIC INVESTIGATIONS
ATLAS HA-112

SYSTEM	SERIES	GROUP	FORMATION	SECTION	THICKNESS, IN FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium		0–53+	Tan to gray silt and clay near the surface. Grades downward to silty and sandy gravel. Gravelly beds common at the base.	Along the larger streams and their tributaries. The thickest deposits are more than 50 feet thick in the valley of Terrapin Creek; the deposits are 15 feet thick in Clarks River valley and thin or not present along smaller streams.	Few wells yield water from alluvial deposits in the quadrangle. Wells in Terrapin Creek valley and along the East Fork of Clarks River east of Wiswell should yield a perennial supply of water. The main zone of saturation in most other alluvial areas is below the base of the alluvium, and water in the alluvium, where present, is perched above a relatively impermeable bed of clay or a cemented sand or gravel zone. The occurrence of perched water-bearing zones in the alluvium is unpredictable. The quality of the water is reported to be good.
	Pleistocene		Loess		0–15'	Tan to gray unstratified silt or clay.	Covers all upland areas but is locally absent along the dissected land adjacent to Terrapin Creek.	Not an aquifer. When saturated by rainfall transmits water to lower aquifers.
	Pliocene(?)		Gravel, sand, and clay[1]		0–70'	Tan, red, or white chert gravel, commonly sandy, grading upward to gravelly sand, sand and chert pebbles, sand, or gray- to olive-colored silt and clay beds. Includes, more gravelly part of this unit in the northern part of the quadrangle; southward the gravel content is less and the unit is difficult to distinguish from the Eocene deposits.	Overlies Eocene sediments in all of the quadrangle except parts of Terrapin Creek watershed and beneath some of the alluvium where it has been removed by erosion. Clay beds underlie the southern part of the Tennessee Valley Divide and, in general, the remainder of the quadrangle is underlain by gravelly sand grading downward to sandy gravel. Cemented beds are common, but their occurrence is unpredictable.	Supplies adequate amounts of water to most large-diameter wells as deep as 70 feet. Some wells in availability area 3 penetrate Eocene sand below the gravel and yield water from both aquifers. The water in area 3 is of good quality, slightly acidic, soft to moderately hard, and the iron content is usually less than 0.3 ppm. One sample with an iron content of more than 0.3 ppm imparts a disagreeable taste to water and may cause staining of clothing and utensils. In availability area 2, the gravel and sand of Pliocene(?) age supply water to large-diameter wells less than 45 feet deep; however, the water level in several of these wells is reported to fluctuate greatly and wells not fully penetrating the aquifer may be dry in summer. The water in area 2 is of good quality, slightly acidic, moderately hard, and may contain iron in excess of 0.3 ppm.
TERTIARY	Eocene (undifferentiated)		Sand and clay		0–90' 60–410'	White, pink, or dark-gray clay and fine- to coarse-grained sand beds. Thin beds of lignitic material are common. The coarser sand beds appear to be in the middle part of the unit.	Not exposed in the quadrangle. Underlies the western three-quarters of the quadrangle and is truncated by gravel deposits near Sinking Springs Church.	Supplies adequate amounts of water to most large-diameter wells less than 100 feet deep and to most small-diameter wells 125 to 186 feet deep in an area north and south of Lynn Grove. The water is generally of good quality, slightly acidic, soft, and the iron content is usually less than 0.3 ppm.
					60–180'	White to red, fine- to coarse-grained sand and pink, white, or gray clay beds or lenses. The coarser sand beds generally are in the lower part of the unit, but in the eastern part of the quadrangle they commonly contain much clay.	Not exposed in the quadrangle, but underlies all of the area and is truncated by gravel deposits in the eastern part of the quadrangle.	Supplies adequate amounts of water to most large-diameter wells 40 to 110 feet deep in the eastern half of the quadrangle, and to most small-diameter wells 108 to 236 feet deep in the central and eastern parts of the quadrangle. The water is generally of good quality, slightly acidic, and soft to moderately hard. The iron content varies and may contain more than 0.3 ppm. One sample contained 55 ppm nitrate.
CRETACEOUS	Paleocene	Midway	Porters Creek Clay		200'±	Light- to dark-gray or black slightly to very micaceous clay with fine- to medium-grained sand beds, commonly glauconitic, in the upper part. Glauconitic sand or clay and black clay in the lower part.	Not exposed, but underlies all of the quadrangle. Well logs indicate that the Porters Creek is overlain unconformably by Eocene sediments. The formation has been penetrated by test holes in adjacent quadrangles, but not in the Lynn Grove quadrangle.	Generally not an aquifer, but a somewhat continuous bed of sand about 15 feet thick in the upper part of the Porters Creek may yield water to some wells.
	Upper Cretaceous		McNairy Formation[3]		300'±	Fine- to medium-grained micaceous sand, commonly interlaminated with dark-gray to black, in places often lignitic, clay. Generally the thicker sand beds are in the lower part of the formation.	Not exposed, but underlies all of the area. Penetrated by wells east of the quadrangle but not in Lynn Grove quadrangle.	East and northeast of the Lynn Grove quadrangle, the McNairy Formation yields water to wells for domestic, commercial, and public supply. The water is generally slightly acidic, moderately hard, and commonly contains iron in excess of 0.3 ppm.
			Tuscaloosa Formation		?	Rounded chert pebbles in a micaceous sand or clay matrix. Not known to be present in this quadrangle.	Present discontinuously east of the Lynn Grove quadrangle, and may be absent or thin in the quadrangle.	Not known to be present in this quadrangle.
DEVONIAN	Lower and Middle Devonian		Devonian rocks (undifferentiated)		200'±	All rocks below the Cretaceous are of Paleozoic age, and are the "bedrock" of well drillers. Chert, commonly deeply weathered, with solutional openings near the top, grading downward to massive chert and limestone beds.	Not exposed, but underlies all of the quadrangle. Penetrated by an oil-test hole in Kirksey quadrangle one half mile north of the northeast corner of Lynn Grove quadrangle.	No wells have penetrated this formation in the Lynn Grove quadrangle. About 75 feet of weathered chert was logged in an oil-test well in Kirksey quadrangle. Wells in other parts of the Jackson Purchase yield abundant water of good quality from such weathered zones at the top of the Paleozoic rocks or from solutional openings deeper in the chert or limestone.

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

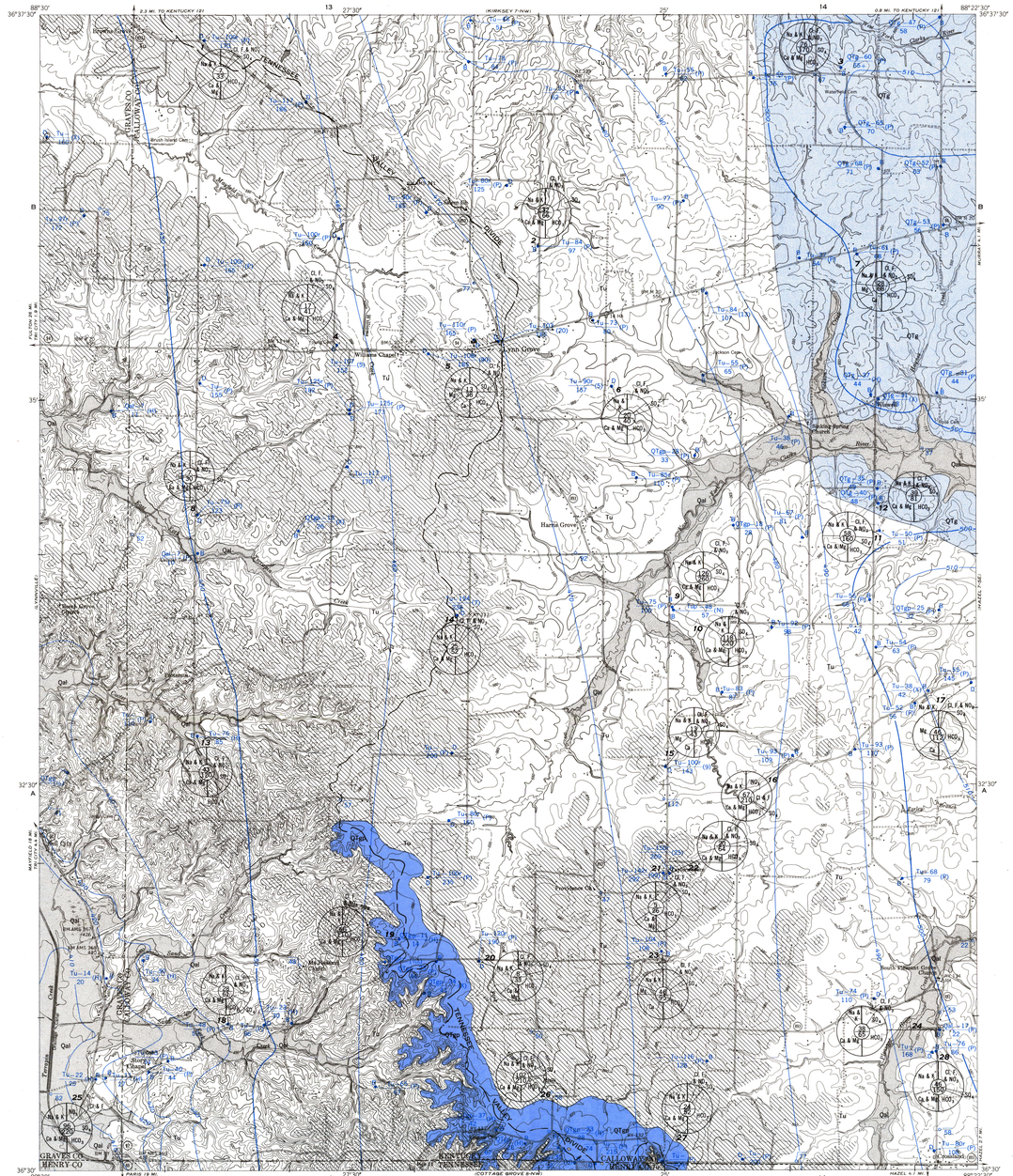
[2] Probably equivalent to the "500-foot" sand of the Claiborne Group in Tennessee

[3] May contain beds of Clayton age at the top

EXPLANATION

Gravel · Sand · Silt · Loess · Clay · Mica · Glauconite · Carbonaceous material · Limestone · Cherty limestone

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



Base map by Tennessee Valley Authority and U.S. Geological Survey, 1951

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 SPRINGS, AND QUALITY OF WATER

Hydrology by R. W. Davis, 1962

SCALE 1:24 000

1 MILE · ½ · 0 · 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1964

KENTUCKY QUADRANGLE LOCATION

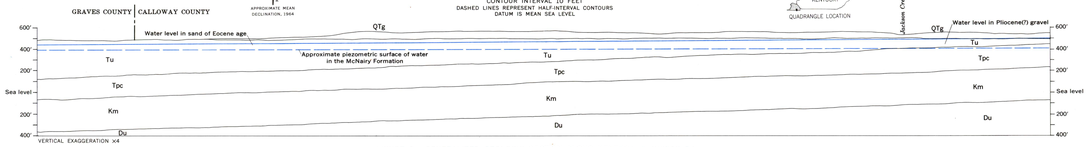


FIGURE 3.—GENERALIZED GEOLOGIC SECTION ALONG KENTUCKY HIGHWAY 94

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 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, figure 2.

Qal

AREA 1
Water in Quaternary alluvium

Large-diameter wells in the valleys of Terrapin Creek and Clarks River east of Wiswell 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 bed or a cemented sand or gravel bed, and generally will not be an adequate supply for domestic use at most places. If the alluvium is dry or yields only small amounts of water, wells may be deepened to obtain water from the underlying Eocene or deeper sediments.

QTgp

AREA 2
Water in Pliocene(?) sand and gravel perched above Pliocene(?) clay

Large-diameter wells range in depths from 26 to 44 feet. May yield sufficient water for an adequate domestic supply to large-diameter wells that penetrate the full thickness of the perched zone. Water levels are reported to fluctuate greatly, and some wells may go dry or nearly dry in the summer. If the shallow Pliocene(?) deposits are dry or yield only small amounts of water, wells may be deepened to obtain water from the underlying Eocene sediments, generally at depths greater than 100 feet.

QTg

AREA 3
Water in the main saturated zone of Pliocene(?) gravel

Furnishes sufficient water for an adequate domestic supply to large-diameter wells as deep as 71 feet. Wells may be deepened into the underlying water-bearing Eocene sediments to increase their yields; wells in the western part of this area commonly obtain water from both the Pliocene(?) gravel and the Eocene sand.

Tu

AREA 4
Water in sand of Eocene age. Diagonal ruling shows areas where the water level in wells is more than 100 feet below land surface

Furnishes sufficient water for an adequate domestic supply to many large- and small-diameter wells. Small-diameter wells are drilled below the water table until a sand of sufficient thickness capable of being retained by a well screen is reached. These wells generally are between 100 and 300 feet deep. Large-diameter wells are dug or bored below the water table for storage, or below confining clay beds until a water-bearing sand is reached. These wells are as deep as 120 feet. Large-diameter wells in this area are difficult to dig or bore where the water level is more than 100 feet below the surface because the thick section of dry sand above the water tends to collapse into the excavation while the well is being dug.

Near the East Fork of Clarks River some shallow, large-diameter wells obtain water from perched zones. Locations of perched zones are difficult to predict. Wells tapping them are capable of furnishing sufficient water for some domestic uses, but are either marginal or not capable of furnishing an adequate domestic supply as defined in this report.

The potential yield of wells tapping sediments of Eocene age is not known; however, properly constructed wells tapping these sediments probably could yield more than 100 gallons per minute in all the area except possibly east of the 450-foot water-level contour, where the Eocene sand is thinner. In this area, and in the rest of the quadrangle, large supplies can be obtained from wells penetrating the underlying McNairy Formation.

Area boundary

47 — Test hole
Figure below line is depth of test hole

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

Spring

Tu—56 (P) 66
- 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
QTg.....Gravel or sand of Pliocene(?) age
QTgp.....Perched water in gravel or sand of Pliocene(?) age
Tu.....Sand of Eocene age
Tup.....Perched water in sand of Eocene age

YIELD OR ADEQUACY

(S).....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 bucket
(N).....Well reported not adequate
(X).....No yield data available

480 — Water-level contour
Shows altitude of water level in the main zone of saturation. Contour interval 10 feet; datum is mean sea level. Water-level measurements taken in April 1962

QUALITY

Cl, F, & NO_3 / Na & K / SO_4 / 24 / Ca & Mg / HCO_3

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. Nitrate shown separately if present in amounts greater than 45 ppm

AVAILABILITY OF GROUND WATER IN THE LYNN GROVE QUADRANGLE, KENTUCKY—TENNESSEE

Sufficient supplies of ground water for both domestic and commercial uses are available in the area of the Lynn Grove quadrangle. This atlas presents nontechnical information about ground water in the Lynn Grove area for use by well drillers, land owners, and others.

The zone of saturation—that part of the earth that is completely saturated with water—is continuous beneath the quadrangle, but the upper surface of this zone (the water table) is at different depths in several geologic formations. In the northeastern part of the area most ground water is produced from gravel deposits, but in the rest of the area most of the water is produced from sand of Eocene age. The water availability map (fig. 1) presents information on the occurrence of the shallowest ground water that may yield an adequate supply for domestic use.

The availability of ground water at a particular location may be determined by the color pattern for that site, on the map, which shows the source of the shallowest ground water. The map explanation and columnar section briefly describe the water-yielding qualities of the formation. 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. Chemical analyses of water from nearby wells are represented on the map by circular diagrams.

The Lynn Grove area is capable of furnishing ground water for commercial and public supplies as well as for the expanding domestic needs. Wells presently produce as much as 90 gallons per minute from Eocene sand, and it appears probable that properly constructed wells tapping Eocene sand could yield more than 100 gallons per minute in all the quadrangle except, possibly, the area east of the 490-foot water-level contour, where the Eocene sand is thinner. In this area large producing wells may have to be drilled deeper to the McNairy Formation. The McNairy and deeper formations underlie the entire quadrangle and are capable of yielding large amounts of water. The water-yielding properties of these deeper formations are discussed in figure 2 and their approximate depths are shown in the geologic section, figure 3.

The chemical quality of ground water in the area generally is good, chemical analyses show that most of the water from the Eocene sand from 57° to 60° F, is soft, has a slightly acidic characteristic, and generally is low in iron. Water from the McNairy Formation and the deeper formations also is slightly acidic, but it is harder and may contain sufficient iron to require treatment for most uses.

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 figure 1. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote increasing alkalinity; values lower than 7.0 indicate increasing acidity. Corrosiveness of water generally increases with decreasing pH.

Analysis number	1	2	3	4	5	6	7	8	9	10
Iron content	0.03	0.09	0.88	0.02	0.16	0.52	0.10	0.07	0.15	0.11
pH	6.0	6.0	6.6	6.1	6.4	5.8	6.2	5.5	7.2	6.8

Analysis number	11	12	13	14	15	16	17	18	19	20
Iron content	0.08	0.16	0.11	0.98	1.5	0.34	82.0	0.04	0.30	0.09
pH	6.5	6.1	5.9	6.1	5.9	6.3	5.8	5.4	6.7	5.5

Analysis number	21	22	23	24	25	26	27	28
Iron content	0.11	14.0	0.09	0.12	0.06	0.08	0.20	0.04
pH	5.8	–	6.0	6.2	6.5	6.7	6.4	6.2

EXPLANATION

QTg.....Gravel, sand, and clay of Pliocene(?) and Pleistocene age
Tu.....Eocene formations, undifferentiated
Tpc.....Porters Creek Clay of Paleocene age
Km.....McNairy Formation of Cretaceous age
Du.....Devonian rocks, undifferentiated

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AVAILABILITY OF GROUND WATER IN THE LYNN GROVE QUADRANGLE, KENTUCKY—TENNESSEE

By
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1964

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