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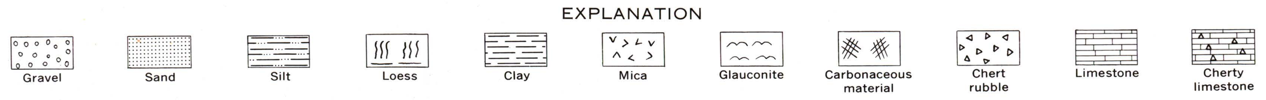
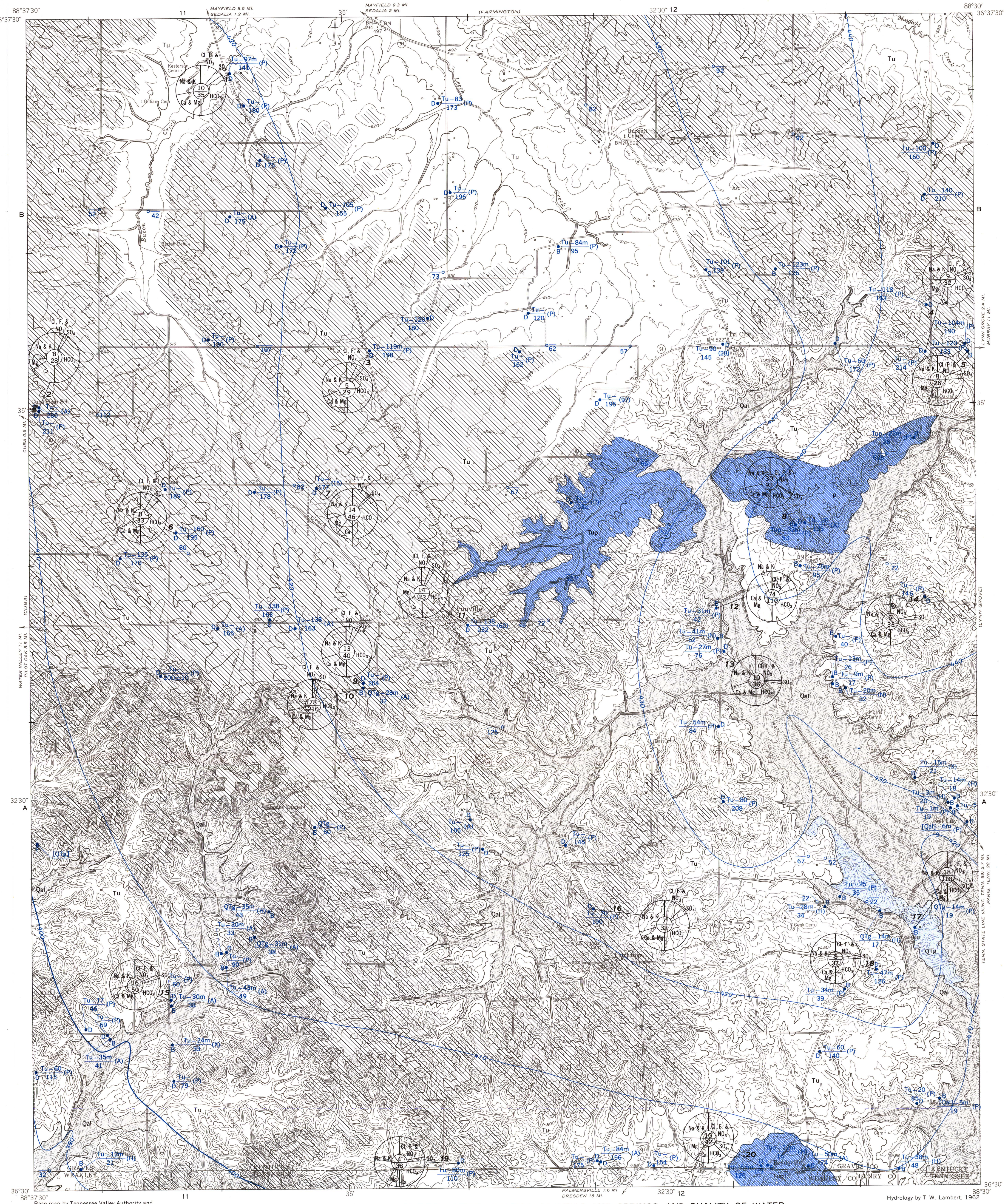
GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF GEOLOGIC FORMATIONS

SYSTEM	SERIES	GROUP	FORMATION	SECTION	THICKNESS (IN FEET)	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium		0–65′	Tan to gray silt and clay, in parts sandy and gravelly. The alluvium north of State Road 94 and west of State Road 97 is derived mainly from loess.	Flood-plain and terrace deposits in the valleys of the regional drainage system. The alluvium in the flood plain of Terrapin Creek is as thick as 65 feet, but thins to less than 15 feet in many tributaries.	Underlies availability area 1. Yields domestic supplies of ground water to either bored or dug, large-diameter wells along the valley walls of Terrapin Creek.
	Pleistocene		Loess		0–15′	Silt and clay, yellowish-brown to dark-yellowish-orange; unstratified. Contains few to abundant ferruginous concretions.	Windborne material deposited on upland and draped down hillsides. Thickest in upland and thinnest on slopes; partly eroded or removed in places.	Yields little or no water to wells. Transmits some rainfall to underlying aquifers.
TERTIARY	Pliocene(?)		Gravel, sand, and clay[1]		0–95′	Brown to brick-red sand and brown sandy chert gravel. Discontinuous brown to white sand, yellowish-orange silt, and white clayey sand. Pockets of light-gray leaf-bearing conchoidal clay. Brown to white sandy chert gravel. Locally this basal gravel is missing and the above sand or clayey sand rests on the Eocene rocks.	Stream-laid deposits in the upland and in terraces along Terrapin Creek. Now eroded thin or removed in places to form colluvial deposits in highly dissected area south of State Road 94.	Underlies availability area 2. Yields domestic supplies of ground water to either bored or dug, large-diameter wells in terrace deposits along Terrapin Creek. Wells along ridgetop near Rhodes Chapel do not yield sufficient water for peak demands. Numerous small seep springs near Rhodes Chapel cease to flow in summer. These springs are in the upper gravel or sand at the contact of the clayey Pliocene(?) deposits.
	Eocene, undifferentiated		Sand and clay		400–700′	White to light-gray fine-grained micaceous, well-sorted quartz sand containing a small percentage of heavy minerals and numerous lenses of light- to dark-gray, pink to reddish-gray, locally silty clay. Clay is commonly leaf bearing; at one location it contains a trace of glauconite. White to reddish-brown fine- to very coarse-grained, well-sorted quartz sand. Commonly free of any clay matrix or clay lenses. An ironstone layer at the base of the sand is common.	Underlies the loess, Pliocene(?) gravel, and colluvial material in the dissected area of the south half of the quadrangle. In the north half of the quadrangle, underlies a thick section of loess and Pliocene(?) gravel.	About two-thirds of the wells in availability area 3 are in the upper 175 feet of the Eocene deposits. All the drilled and most dug and bored wells furnish sufficient water for domestic and stock uses. Most drilled wells are less than 230 feet deep and probably will yield more than 100 gallons per minute. Many perched water bodies above clay or clayey sand may furnish sufficient water for domestic use. A water-bearing sand about 80 feet thick was encountered at a depth of 170 feet in a test hole near Terrapin Creek. This sand is probably the most important aquifer in the Lynnville quadrangle. About one-third of the drilled wells tap the upper part of the sand. One well supplies a pump with a reported capacity of 97 gpm. No wells obtain water below this sand, although other sand beds below will yield sufficient water for most uses. They probably will not be used because of the great depth. The quality of water is excellent, although some analyses show iron in excess of 0.3 part per million.
	Paleocene	Midway	Porters Creek Clay		260′	Light- to dark-gray slightly micaceous clay; upper part contains fine-grained angular to subangular sand; greenish-gray micaceous, glauconitic clayey sand at base.	A marine deposit concealed by deposits of Eocene age. Projected altitude of the top of the Porters Creek Clay is about 100 feet above mean sea level in the northeast corner and about 175 feet below sea level in the southwest corner of the quadrangle. The thickness is about 260 feet, as indicated by data from oil-test wells in the adjacent quadrangle to the south.	Not significant as an aquifer. Thin sand beds in the upper part may yield some water to drilled wells. The water may be high in iron. The thick section of clay retards the movement of water between the Eocene and Cretaceous aquifers.
CRETACEOUS	Upper Cretaceous		McNairy Formation[2]		300′	Light-tan to white micaceous fine-grained sand interfingered and interlayered with light-gray to black carbonaceous, laminated to massive clayey silt and clay, and very fine-grained sand with a few large ironstone concretions.	Deltaic and possibly marine deposits. Rests on an eroded Paleozoic rock surface except where separated from it by the Tuscaloosa Formation. Thickness varies in the quadrangle owing to the uneven eroded surface and the presence or absence of the Tuscaloosa Formation.	Probably will yield sufficient domestic supplies of confined water to most wells. Not important as an aquifer because of the depth. Yields as large as 1,100 gallons per minute are obtained at Murray which is about 11 miles east of this quadrangle. The quality is excellent, but hardness and dissolved solids probably increase with depth. The water is confined by the Porters Creek Clay as well as by clays within the McNairy Formation. The piezometric surface of the McNairy slopes generally westward from Murray toward the Mississippi River.
			Tuscaloosa Formation		?	Rounded chert sand and gravel in a matrix of tripolitic material. Clay lenses are present locally.	Stream-laid deposits fill channels and depressions in the eroded Paleozoic rock surface. Thickness is not known.	Not significant as an aquifer.
DEVONIAN AND SILURIAN			Devonian and Silurian rocks undifferentiated		200′	All rocks below the Cretaceous are of Paleozoic age and are the bedrock of well drillers. Siliceous to cherty limestone. Upper part is deeply weathered and consists of a chert rubble. No wells are drilled into the Paleozoic rocks in this quadrangle.	Consolidated marine sediments concealed beneath the Embayment deposits. Pre-Cretaceous weathering produced an upper chert rubble of unknown thickness. Rocks probably are faulted.	May yield large quantities of water from solution cavities in the bedrock. Water is hard and contains an objectionable amount of iron.

[1]Age undetermined. Estimates of age range from Pliocene or older to Pleistocene
[2]May contain beds of Clayton age at top

EXPLANATION





Base map 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

Hydrology by T. W. Lambert, 1962

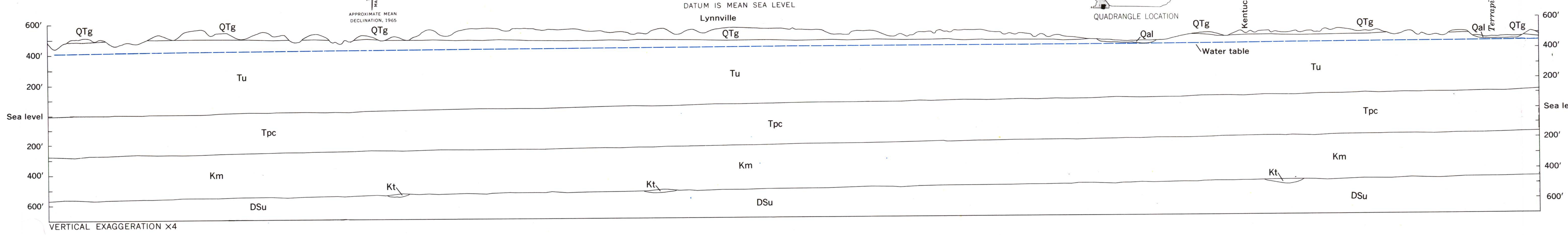
MAP SHOWING AVAILABILITY OF GROUND WATER, LOCATION OF WELLS AND SPRINGS, AND QUALITY OF WATER

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1965

QUADRANGLE LOCATION



GENERALIZED GEOLOGIC SECTION ALONG A NORTHEAST-TRENDING LINE FROM NEAR HIGH HILL CEMETERY TO OAKLAND CEMETERY

SECTION EXPLANATION

Qal .... Alluvium of Quaternary age
QTg .... Gravel of Pliocene(?) age
Tu .... Eocene sand, undifferentiated
Tpc .... Porters Creek Clay of Paleocene age
Km .... McNairy Formation of Cretaceous age
Kt .... Tuscaloosa Formation of Cretaceous age
DSu .... Devonian and Silurian rocks, undifferentiated

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. 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 geologic and water-bearing properties are described in the generalized columnar section

Qal

AREA 1
Water in Quaternary alluvium

Shallow large-diameter bored or dug wells will yield sufficient water for domestic and stock uses. Locally, perched water above alluvial clay or cemented gravel may yield minor amounts of water but probably will not provide an adequate domestic supply. Of the several wells in the alluvium, many penetrate into the underlying sands of Eocene age. The water in the Eocene aquifer discharges into the alluvium of Terrapin Creek, as indicated by the ground-water contours. Thus, the zone of saturation in the alluvium extends downward into the underlying sands of Eocene age

QTg

AREA 2
Water in Pliocene(?) gravel

The main area of wells in the Pliocene(?) gravel is in a terrace deposit southwest of Bell City, where shallow large-diameter bored or dug wells are less than 25 feet deep. Only one well yields an inadequate supply for domestic use. The zone of saturation extends downward from this terrace deposit into the underlying Eocene sand. Thus, larger yields may be obtained at slightly greater depths.

In the drainage area of Powell Creek, low-yielding springs are common in the upper part of the Pliocene(?) gravel where clayey material is present within the unit. Only one well taps the upper Pliocene(?) gravel and the water is reported poor in quality. In the Rhodes Chapel area, several small-diameter bored wells tap the Pliocene(?) gravel above clay beds of Eocene age and are reported adequate for small domestic supplies. One well is equipped with an electric pump

Tu

AREA 3
Water in Eocene sand
(Diagonal ruling shows areas where the water level in wells is more than 100 feet below the land surface)

All properly constructed wells in Eocene sands yield sufficient amounts of water for domestic and stock uses, and should yield sufficient amounts of water for municipal and industrial supplies also. On the basis of specific capacities of 17 to 26 gallons per minute per foot of drawdown obtained from the municipal and industrial wells that tap the Eocene aquifer at Mayfield, properly constructed wells should yield several hundred gallons per minute. The zone of saturation extends downward to the Porters Creek Clay (see columnar section) to depths as great as 350 feet. Clay lenses and clayey sand zones in the Eocene sediments confine the water in places.

The depths of the drilled wells in the Eocene average about 155 feet and range from 48 to 321 feet. Small-diameter bored or dug wells concentrated along Powell and Terrapin Creeks average 32 feet in depth. A few large-diameter bored wells in the upland are about 100 feet deep. When the zone of saturation is below 100 feet, large-diameter bored wells are difficult to construct because of the thick section of dry sand. The water is very soft and has a low concentration of dissolved solids. Generally, the iron content is less than 0.3 ppm

Tup

AREA 4
Perched water in Eocene sand

Some perched aquifers in Eocene sand yield sufficient water for domestic and stock uses, but many may go dry during droughts. The only perched zone reported to be adequate is south of Tri-City, where one large-diameter bored well yields sufficient water for two farms. Perched water is found northeast of Bell City along Terrapin Creek. A few test holes, northeast of Lynnville and at High Hill Cemetery, found water at shallow depths, but the yields are unknown. Large-diameter bored wells at these locations probably would yield adequate domestic supplies. The extent of the perched-water zone is unknown and the boundaries are drawn only to illustrate that perched water occurs in this area

Area boundary

608
Test hole
Figure below line is depth of test hole

Water well
D, *Drilled or jetted well, generally 4-inch steel or plastic casing with well screen on lower end*
B, *Bored or dug well, generally 4-inch soil pipe or 24-inch concrete tile casing open at bottom*

Spring

Tu–119 (97) / 198
- Aquifer (see below)
- Water level, in feet below land surface; m, if measured
- Yield in gallons per minute, or adequacy (see below)
- Depth of well, in feet below land surface

AQUIFER SYMBOLS

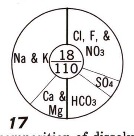
Qal .... Alluvium of Quaternary age
QTg .... Gravel or sand of Pliocene(?) age
Tu .... Sand of Eocene age
Tup .... Perched water in sand of Eocene age
Brackets indicate probable aquifer where not definitely known

YIELD OR ADEQUACY

(97) .... Gallons per minute where reported
Generally this is the capacity of the pump and does not indicate the yield of the aquifer
(P) .... Well reported adequate for power pump for domestic and/or stock supply
(H) .... Well reported adequate for bucket or bailer
(N) .... Well reported not adequate
(X) .... No yield data available
(A) .... Abandoned or destroyed

400
Water-level contour
Contours based on measured water levels in wells in the main zone of saturation. The depth to water is the difference, in feet, between the water-level contour and the topographic contour (land surface). Water level measurements made in July 1962. 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 LYNNVILLE QUADRANGLE KENTUCKY—TENNESSEE

Unlike many areas in Kentucky where water occurs in small quantities, is difficult to obtain, and is of poor quality, ground water in the Lynnville quadrangle is abundant and of excellent quality. However, less than one-seventh of the farms have wells because many farmers, lacking information about local ground-water conditions, believe it is cheaper to buy water for cisterns than to have a well drilled. More than 95 percent of the farmers buy water throughout the year. The purpose of this atlas is to present concise, nontechnical information about ground water to home owners and well drillers who live in the Lynnville quadrangle.

The water-availability map is a graphic representation of the occurrence and quality of water in the shallowest aquifer that may yield water adequate for domestic use. The minimum depth of any proposed well is the difference between the altitude of the land surface and the top of the main saturated zone, or water table, shown by the contours on the map. Usually a well in the Lynnville quadrangle can be completed a short distance below the water table, but local variations in geology cause the depths of wells to vary as much as 80 feet within a small area. Some wells are completed 150 feet below the water table. In a few places, discontinuous clay beds above the main zone of saturation retard the downward movement of water and form water bodies on top of the clay. These water bodies, known as perched water, usually do not furnish sufficient supplies for domestic needs. Bored wells in some perched bodies, however, are capable of yielding more than 5 gallons per minute.

Supplies of ground water may be obtained from bedrock of Silurian age or from deposits of sand and gravel ranging in age from Cretaceous to Recent. Small supplies sufficient for domestic purposes are obtained from alluvium and from Pliocene(?) gravel. Larger supplies of as much as 100 gallons per minute are yielded to wells in Eocene sand, and Eocene aquifers have a potential yield of as much as 1,100 gallons per minute.

The water-table contours show a westward and southward movement of ground water in the area. Terrapin Creek intercepts the water table and acts as a drainage area for the Eocene aquifer. During times of heavy runoff, Terrapin Creek recharges the Eocene aquifer. Powell Creek in the southwest corner of the quadrangle probably functions in a similar manner.

The quality of the water in the Eocene in the main zone of saturation is excellent for most uses. The water is slightly acidic and generally contains less than 0.3 ppm (part per million) of iron, the maximum amount recommended by the U.S. Public Health Service. Iron in excess of this amount causes staining of porcelain and textiles. The hardness of water in the main zone of saturation ranges from 4 to 30 ppm. One sample of perched Eocene water has a hardness of 74 ppm. The concentration of dissolved solids rarely exceeds 75 ppm.

The following table shows the iron content in ppm and the hydrogen ion concentration, expressed as pH, of the water analyses shown by circular diagrams on map. 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	0.12	12.0	0.10	0.16	0.15	8.5	1.8	0.06	0.16	0.23
pH	6.0	6.4	6.0	7.1	6.4	6.1	6.8	6.2	6.3	7.4

Analysis number	11	12	13	14	15	16	17	18	19	20
Iron content	0.15	0.04	0.10	0.27	1.8	12.0	0.09	0.09	0.08	0.10
pH	5.8	6.4	6.9	5.8	6.1	5.8	6.1	7.0	7.1	7.4

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AVAILABILITY OF GROUND WATER IN THE LYNNVILLE QUADRANGLE, KENTUCKY—TENNESSEE

By
T. W. Lambert
1965