

GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF GEOLOGIC FORMATIONS

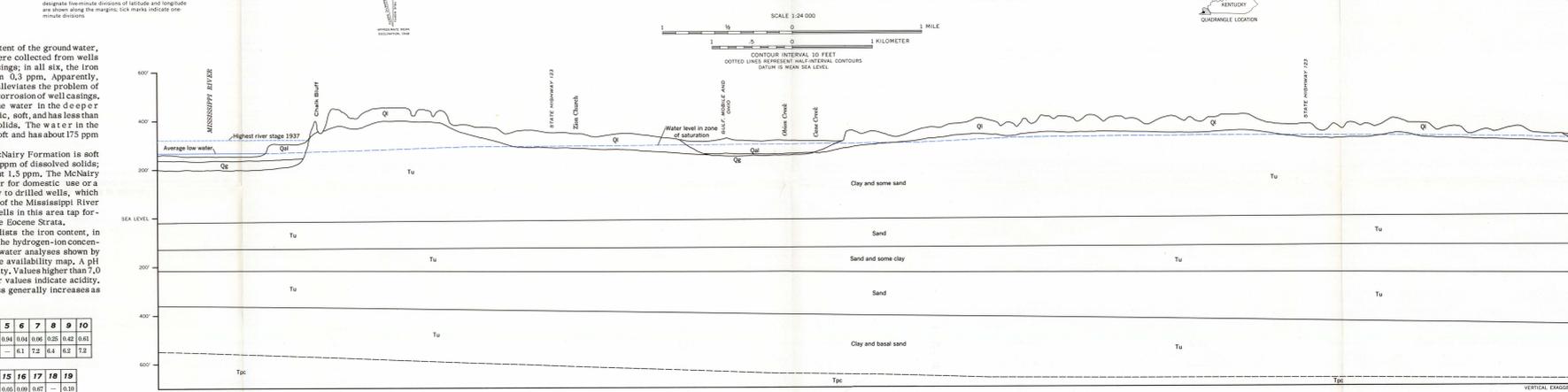
SYSTEM	SERIES	FORMATION	SECTION	THICKNESS, FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
Pleistocene	Alluvium	Alluvial sand, silt, and clay	Qa1	0-30	Light-brown to brownish-gray silty very fine-grained sand, medium-gray to medium-brown silty clay, and medium-gray clayey silt; locally layers of medium-brown fine- to medium-grained sand.	Flood-plain deposits in the valleys of the Mississippi River and Obion Creek. The maximum thickness in the valley of the Mississippi River is about 60 feet; in Obion Creek it is about 30 feet.	In the Mississippi River valley, several driven wells tap this formation. The layers of sand are scattered; that in most places, a well must penetrate the underlying coarse alluvium.
			Qa2	0-100	Medium-gray to grayish-brown lignitic coarse-grained sand, pebbly sand, and fine-grained gravel.	Underlies the alluvial sand and clay throughout Area 1. This unit is at the land surface near the Mississippi River, at three of a mile south of the map. The maximum thickness in the valley of the Mississippi River is about 100 feet. In Obion Creek it is about 50 feet. The thickness in various wells in the hills varies from 10 to 20 feet. The unit contains pebbles and boulders of limestone and chert, which create an irregular surface on which the alluvium was deposited.	In the Mississippi River valley, several driven wells tap the upper few feet of this formation. Drilled wells penetrating the full thickness of the formation may yield as much as 1,000 gpm (gallons per minute) for irrigation. The water is very hard and generally contains between 425 and 525 ppm (parts per million) of dissolved solids. The iron content exceeds 0.3 ppm; more than 0.2 ppm of iron stains fabrics and fixtures and gives water a bitter taste. Along Obion Creek wells may yield as much as several hundred gpm for domestic use. The stream drainage of Obion Creek is about 100 miles. The stream drainage of Obion Creek is about 100 miles. The stream drainage of Obion Creek is about 100 miles. The stream drainage of Obion Creek is about 100 miles.
Quaternary	Alluvium	Alluvial sand and gravel	Qa3	0-100	Yellow-brown to medium-gray silty clay or clayey silt.	Windblown deposits covering all the upland, draping down slopes as colluvium, and merging with alluvium along edges of gently sloping valleys.	Above the zone of saturation. When saturated by rainfall, transmits some water to underlying aquifers.
			Qa4	0-200	Yellow-brown to red-brown sandy silt or silty sand and scattered pebbles. Commonly in matrix of sandy clay. Locally, silty clay.	Continental deposits overlying Eocene strata in uplands. Drapes down slopes as colluvium, commonly mixed with loess.	Usually above the zone of saturation. West of Oakton, water may be collected above clay of Eocene age.
Pleistocene	Loess	Sand, silt, and gravel	Ql1	0-100	Blackish-brown to gray-brown clay, white, pink, or light-gray sandy clay, gray to pink silty clay, and yellow to cream clayey very fine- to fine-grained sand. Some layers of yellow, white, or light-brown very fine- to medium-grained sand.	Yields of all wells in the main zone of saturation are adequate for domestic use. In Area 2, wells may be completed in this unit from about 250 feet altitude in the valley of Obion Creek to about 100 feet along the western edge of the map. The water is soft to very hard and generally contains 70 to 275 ppm of dissolved solids; the pH is between 6.0 and 7.0. Both the iron and the concentration of iron dissolved in the water increase toward the Mississippi River.	Yields of all wells in the main zone of saturation are adequate for domestic use. In Area 2, wells may be completed in this unit from about 250 feet altitude in the valley of Obion Creek to about 100 feet along the western edge of the map. The water is soft to very hard and generally contains 70 to 275 ppm of dissolved solids; the pH is between 6.0 and 7.0. Both the iron and the concentration of iron dissolved in the water increase toward the Mississippi River.
			Ql2	0-100	Brown, yellow, or white very fine- to fine-grained sand and silt and some medium- to coarse-grained sand near base.	Coastal-plain sediments underlying other continental deposits of Pleistocene and Pliocene ages or alluvium of Pleistocene age in the entire map. Upper unit cored out along the Mississippi River bluffs and the tributary valleys.	No wells withdraw water from this unit or the underlying strata. Based on data from adjacent areas, wells about 200 to 300 feet deep, completed in the basal sand of this unit may yield more than 500 gpm.
Pleistocene	Loess	Sand, silt, and gravel	Ql3	0-100	Brown to white silt and fine- to medium-grained sand and some gray to brown clay.	This unit has a lower permeability than the units above and below. It probably will not yield enough water for industrial or municipal use.	
			Ql4	0-100	Brown to white fine- to medium-grained sand and some coarse-grained sand near base.	Industrial and municipal wells may be completed in this unit at depths as shallow as 150 feet in the valley of Obion Creek and as deep as 800 feet near South Columbus; yields may exceed 100 gpm.	
Pleistocene	Loess	Sand, silt, and gravel	Ql5	0-100	Brown to gray lignitic clay and a basal fine- to medium-grained sand.	The basal sand of this unit may be an adequate aquifer; however, it may never be utilized because of the excellent aquifer overlying it.	
			Ql6	0-100	Dark-gray clay, locally micaceous and silty. Upper and basal parts are micaceous glauconitic clayey very fine-grained sand.	Not an aquifer. Retards ground-water movement into the Eocene sediments from the underlying McNairy Formation.	
Pleistocene	Loess	Sand, silt, and gravel	Ql7	0-100	Light- to dark-gray micaceous silty clay interbedded with white, gray, or brown silt or very fine-grained sand.	Deltaic deposits underlying the Porters Creek Clay in the entire quadrangle.	The sand in this formation may yield enough water for domestic use and small farms. Wells will flow in the valleys of the Mississippi River and Obion Creek.

EXPLANATION



Scale from U.S. Geological Survey, 1953. The Carter Coordinate System letters and numbers used to designate two-mile squares of latitude and longitude are shown along the margins; SCA marks indicate one-mile squares.

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



AVAILABILITY OF GROUND WATER IN THE OAKTON QUADRANGLE AND PART OF THE WOLF ISLAND QUADRANGLE IN JACKSON PURCHASE REGION, KENTUCKY

Ground water for domestic, irrigation, and industrial use is abundant in the Oakton quadrangle and the Kentucky part of the Wolf Island quadrangle. This atlas, one of a series for the entire Jackson Purchase region, describes the ground-water resources of western Hickman County and northern Fulton County.

The availability map shows the occurrence and quality of ground water in the shallowest aquifer that may yield an adequate domestic water supply. Ground-water availability at a site is shown by the pattern and the data for nearby wells and test holes. Chemical quality is shown by circular diagrams.

The principal aquifers are the sands of Eocene age and the alluvial gravel of Pleistocene age. Sand of Eocene age underlies the entire area; alluvial gravel of Quaternary age underlies alluvial silt and sand of Pleistocene and Recent age throughout Area 1.

Throughout the valley of the Mississippi River the saturated thickness of the alluvial gravel ranges from 32 to 96 feet. In the tributary valleys of Area 1 the saturated thickness ranges from 6 to 27 feet. Yields may exceed 1,000 gpm (gallons per minute) near Missouri where the saturated gravel is thickest.

In Area 2 the sands of Eocene age are the principal aquifers. Data from a test hole near Columbus, north of this map, and other records suggest that the Eocene strata are from 800 to 1,000 feet thick and dip southwestward about 30 feet per mile.

Five water-bearing units in the Eocene are recognizable. In stratigraphically descending order they are: apertic sand layers within a predominantly clay section, a sand unit which may yield large quantities of water, a section of sand with some clay layers, a moderately thick sand which may yield more than 1,400 gpm, and a basal sand.

Wells may be completed in the sands within the upper clay unit at about 260 feet altitude north of Clinton, about 200 feet near Oakton, and about 100 feet along the western edge of this map. Most of the sands in the clay section are probably discontinuous; therefore, some wells must be drilled deeper than others nearby in order to penetrate a water-yielding sand bed.

Wells may tap the sand of the second unit from about 100 feet altitude at the northeast corner of the map to about 150 feet below sea level in the southwest corner. Wells may yield more than 800 gpm; the municipal well at Clinton yields 600 gpm.

Few data are available for the lowest three units: the sand with clay layers, the moderately thick sand, and the basal sand. The sand of the fourth unit may yield more than 1,400 gpm; municipal wells at nearby Fulton, Ky, and Union City, Tenn, yield 1,200 and 1,700 gpm, from this unit.

The water level in the upper part of the saturated zone slopes westward from about 330 feet altitude near Clinton to about 270 feet at the Mississippi River.

The Porters Creek Clay of Paleocene age, which underlies the Eocene strata, although not an aquifer, is hydrologically significant because it retards ground-water movement into the Eocene beds from the underlying Cretaceous sediments. The clay is about 300 feet thick; its upper surface probably slopes south-southwestward and is about 650 feet below sea level in the central part of the map.

The McNairy Formation of Cretaceous age, below the Porters Creek Clay, is about 300 feet thick and overlies the limestone and chert bedrock of Paleozoic age. The water level in the McNairy slopes northward from about 500 feet altitude at the southeast corner of the map to about 335 feet at the northwest corner.

The water in the Quaternary alluvium is very hard and generally contains 425 to 525 ppm (parts per million) of dissolved solids; the pH is between 7.2 and 7.9. The iron and manganese contents are so high that they may need to be removed to make the water satisfactory for many uses.

The quality of water in the Eocene strata is satisfactory for most uses. Approximately east of Greenville Crossing, the water is soft and generally contains 70 to 100 ppm of dissolved solids; the pH is between 6.0 and 6.2. Between Greenville Crossing and Obion Creek, the water is moderately hard or hard and generally contains 150 to 200 ppm of dissolved solids; the pH is generally between 6.4 and 6.8. Northwest of Obion Creek, the water is very hard and contains 250 to 375 ppm of dissolved solids; the pH is about 7.0. The water in the Eocene strata generally contains less than 0.3 ppm of iron. However, most of the wells with steel casings yield water that contains more than 0.3 ppm of iron. Most of this iron is derived from the corrosion of the well casing and pump apparatus as the pH decreases.

samples of the iron content of the ground water, 6 of the 13 samples were collected from wells with 4-inch plastic casings; in all six, the iron content was less than 0.3 ppm. Apparently, plastic casing usually alleviates the problem of high iron content due to corrosion of well casings.

In adjacent areas, the water in the deeper Eocene aquifers is acidic, soft, and has less than 90 ppm of dissolved solids. The water in the lowest Eocene unit is soft and has about 175 ppm of dissolved solids.

The water in the McNairy Formation is soft and contains about 300 ppm of dissolved solids; the iron content is about 1.5 ppm. The McNairy may yield enough water for domestic use or a small municipal supply to drilled wells, which will flow in the valleys of the Mississippi River and Obion Creek. No wells in this area tap formations deeper than the Eocene strata.

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

Sample number	1	2	3	4	5	6	7	8	9	10
Iron, ppm	0.00	0.14	0.22	0.94	0.64	0.60	0.25	0.42	0.61	
pH	7.3	7.0	6.4	6.1	7.2	6.4	6.5	7.2		

Sample number	11	12	13	14	15	16	17	18	19
Iron, ppm	0.48	1.1	0.90	0.60	0.60	0.60	0.20	0.20	
pH	7.0	6.2	7.9	6.1	6.2	7.9	7.1	6.9	

EXPLANATION

Each availability area on this map shows the occurrence and availability of ground water in the shallowest aquifer that may yield enough water for domestic use. This report considers that an adequate aquifer will yield at least 100 gallons per day to a well with a power pump and pressure-distribution system. The shallowest aquifer is indicated by other aquifers which are described in the generalized columnar section.

AREA 1
Water in Quaternary alluvium
Yields from wells are adequate for domestic and/or stock use. Drilled wells may yield more than 1,000 gallons per day to a well with a power pump and pressure-distribution system. The shallowest aquifer is indicated by other aquifers which are described in the generalized columnar section.

AREA 2
Water in Eocene sand
Yields of all wells in the main zone of saturation are adequate for domestic use. In Area 2, wells may be completed in this unit from about 250 feet altitude in the valley of Obion Creek to about 100 feet along the western edge of the map. The water is soft to very hard and generally contains 70 to 275 ppm of dissolved solids; the pH is between 6.0 and 7.0. Both the iron and the concentration of iron dissolved in the water increase toward the Mississippi River.

Area boundary
Test hole
Test hole in upland
Depth to top of Eocene strata, in feet below land surface
Lithology of upper Eocene strata: c, clay; s, sand
Depth of test hole, in feet below land surface
Test hole in valley
Saturated thickness of alluvial gravel, in feet
Depth to base of gravel, in feet below land surface
Lithology of upper Eocene strata: c, clay; s, sand
Depth of test hole, in feet below land surface

Water well
Drilled well, generally 4-inch plastic or smaller steel casing with well screen
Bored or dug well, generally 8-inch vitrified clay pipe, open at the bottom
Eocene well, generally 16-inch pipe with well point
Aquifer (see below)
Water level in well, in feet below land surface; r, if reported
Yield, in gpm, or adequacy (see below)
Depth of well, in feet below land surface

AQUIFER SYMBOLS
Qa1 Alluvial silty sand of Quaternary age
Qa2 Alluvial gravel of Quaternary age
Ql1, Ql2, Ql3, Ql4, Ql5, Ql6, Ql7, Ql8, Ql9, Ql10, Ql11, Ql12, Ql13, Ql14, Ql15, Ql16, Ql17, Ql18, Ql19, Ql20, Ql21, Ql22, Ql23, Ql24, Ql25, Ql26, Ql27, Ql28, Ql29, Ql30, Ql31, Ql32, Ql33, Ql34, Ql35, Ql36, Ql37, Ql38, Ql39, Ql40, Ql41, Ql42, Ql43, Ql44, Ql45, Ql46, Ql47, Ql48, Ql49, Ql50, Ql51, Ql52, Ql53, Ql54, Ql55, Ql56, Ql57, Ql58, Ql59, Ql60, Ql61, Ql62, Ql63, Ql64, Ql65, Ql66, Ql67, Ql68, Ql69, Ql70, Ql71, Ql72, Ql73, Ql74, Ql75, Ql76, Ql77, Ql78, Ql79, Ql80, Ql81, Ql82, Ql83, Ql84, Ql85, Ql86, Ql87, Ql88, Ql89, Ql90, Ql91, Ql92, Ql93, Ql94, Ql95, Ql96, Ql97, Ql98, Ql99, Ql100, Ql101, Ql102, Ql103, Ql104, Ql105, Ql106, Ql107, Ql108, Ql109, Ql110, Ql111, Ql112, Ql113, Ql114, Ql115, Ql116, Ql117, Ql118, Ql119, Ql120, Ql121, Ql122, Ql123, Ql124, Ql125, Ql126, Ql127, Ql128, Ql129, Ql130, Ql131, Ql132, Ql133, Ql134, Ql135, Ql136, Ql137, Ql138, Ql139, Ql140, Ql141, Ql142, Ql143, Ql144, Ql145, Ql146, Ql147, Ql148, Ql149, Ql150, Ql151, Ql152, Ql153, Ql154, Ql155, Ql156, Ql157, Ql158, 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