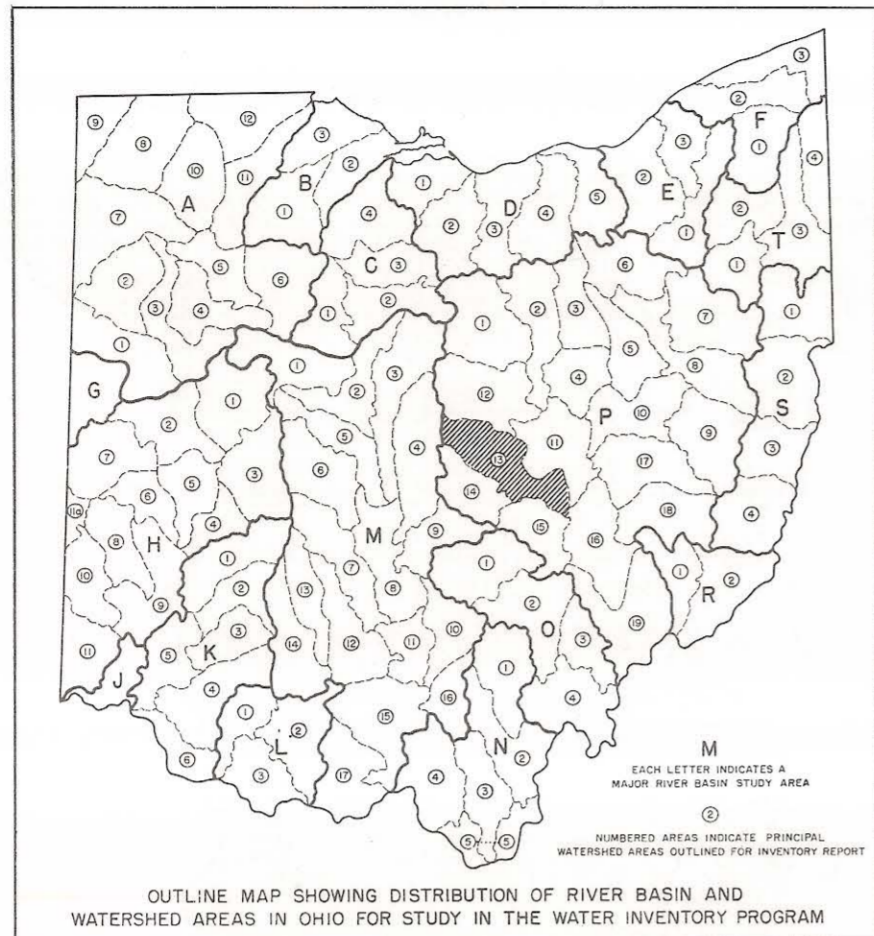


OHIO WATER PLAN INVENTORY  
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A portion of the  
**LICKING RIVER BASIN**  
**UNDERGROUND WATER RESOURCES**

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Ground water owes its origin to that portion of the precipitation which seeps into and saturates the cracks and pore spaces in the earth's crust. The earth's crust, therefore, serves as a vast underground reservoir for the temporary storage and transmission of ground water. The quantity of underground water available to drilled wells depends on the size, kind, and number of water-bearing pores or cracks in the earth's crust. Since the physical characteristics of the geologic formations govern the quantity of water available, a variation in the geology likewise presents a change in availability of underground water.

The geologic formations which occur near the surface in this portion of the Licking River Basin are of sedimentary origin. They may be divided into two major groups: (1) Consolidated layers of sandstone, shale, and limestone, and (2) the unconsolidated deposits of clay, sand, and gravel. The consolidated sandstone, shale, and limestone formations underlie the unconsolidated deposits and crop out in the beds and on the steep slopes of some of the major streams. Sandstone formations may yield large quantities of water; however, the degree of cementation of the individual grains and the composition of the formation often deters the flow of water. Since sandstone formations often grade from a permeable formation to a relatively impermeable sandy shale or shaly sandstone, variable yields are developed from the same formation from one place to another. Shale formations may temporarily store sizable quantities of water; however, yields to drilled wells are meager, owing to the composition of formation. A layer or lense of clay may be likened to an unconsolidated shale, and a deposit of sand and gravel to an unconsolidated sandstone. The ability of these various deposits or formations to yield water depends on the size, shape, and arrangement of the individual rock particles. The permeability, thickness regional extent of the water-yielding formations, and the source of recharge to these formations determine the quantity of water available. The generalized stratigraphic table briefly describes the physical and water-bearing characteristics of the principal water-yielding rocks in the Licking River Basin.

Regionally, the principal water-yielding formations in this basin may be classified into four units. The morainal deposits of the western third of the basin, the Mississippian sandstone formations of the central portion, and the Pennsylvanian sandstone formations of the eastern third. Superimposed on these deposits are the channels of ancient systems of drainage which have been partially or wholly filled with unconsolidated glacial debris.

The morainal deposits in the western portion of the basin are essentially clay interbedded with thin to relatively thick lenses of sand and gravel. Present data shows that wells are developed at depths of 33 feet to 254 feet and yields range from five to 20 gallons per minute. As the logs of wells shown on the availability map indicate, adequate domestic supplies are developed in the Mississippian bedrock beneath these thick morainal deposits and yield three to ten gallons per minute.

The average yield from wells developed in the Mississippian formations beneath the central portion of the basin is 12 gallons per minute. Municipal wells developed for the Village of Utica are reported to yield more than 150 gallons per minute at depths of less than 210 feet. The average well drilled within this central portion has approximately 65 feet of clay above the bedrock and is developed at a depth of 135 to 140 feet. The yield from wells developed in the Pennsylvanian formations in the eastern portion of the basin ranges from one to 15 gallons per minute. The majority of these wells are developed at depths of less than 100 feet and the bedrock is covered with less than 35 feet of overburden. Variable yields are due to the gradational characteristics of these bedrock formations.

Prior to the glacial epoch, the principal channel for the discharge of drainage was in the western portion of the basin. With the repeated advance and recession of various ice fronts, drainage patterns were radically changed. The valleys of these ancient streams were partially or wholly filled with glacial debris and the nature of these deposits is extremely variable, owing to the various modes of deposition. The valley in the western portion of the basin is filled with 300, or more, feet of clay, fine silty sand, and sand and gravel. Interbedded within these thick deposits are thin to thick lenses of permeable sand and gravel. Similar deposits, although not as thick, occur in the eastern portion of the basin in Hanover, Licking, and Muskingum townships. These deposits represent abandoned channels of an ancient system of drainage which existed prior to glaciation.

The valleys beneath the North Fork of the Licking River and a portion of the Licking River are filled with more than 200 and 300 feet of outwash deposits. The former was the principal discharge channel for the debris-laden meltwaters from the advancing and retreating glaciers. Proven yields developed from test wells drilled north of Newark are as much as 1200 gallons per minute at depths of less than 100 feet. However, the potential yield of these deposits to a properly constructed drilled well, and by the actual development of many wells, is about 500 gallons per minute. Recent pumping tests conducted in the vicinity of Newark near Pond Run indicate a potential of as much as 350 gallons per minute per well; however, as much as 1000 gallons per minute could be developed. Owing to the extreme variation in the mode of deposition of the deposits which fill these buried valleys, test drilling and pumping test programs should be conducted to locate and prove the yields of these aquifers. Logs of wells show coarse thick deposits of sand and gravel interbedded with layers of fine silty sand in these buried valleys.

QUALITY OF UNDERGROUND WATER

Partial analyses are shown in the following table. The analyses for the public supply C-3 was made by the Ohio Department of Health. The samples collected from the remaining wells were analyzed by the U.S. Geological Survey, Quality of Water Branch.

Well number	C-1	C-2	C-3	C-4	C-5
Depth (Ft.)	93	55	200	85	60
Water-bearing formation	Sand and gravel	Sand and gravel	Sandstone	Sandstone	Sandstone
	Parts per million				
Iron (Fe)	1.3	1.3	0.25	0.9	0.82
Chloride (Cl)	0.0	4.2	1.00	1.1	14.0
Dissolved solids	383.	390.	569.	120.	97.
Total hardness	280.	272.	390.	104.	39.
pH	7.65	7.9	7.3	7.3	5.4

GENERALIZED STRATIGRAPHIC SEQUENCE OF THE ROCKS  
IN THIS PORTION OF THE LICKING RIVER BASIN

System or Series	Group or Formation	Character of Material	Water-bearing Characteristics
Quaternary	Recent	Clay, silt and alluvium deposited on the flood plains of the principal valleys.	Generally a poor source of ground water owing to absence of coarse materials.
	Pleistocene	Relatively thick layers of sand and gravel deposited by glacial meltwaters as surficial valley trains or buried outwash.	Potential ground-water yields depend on thickness, permeability, and source of recharge. Where favorable conditions exist, wells may yield as much as 500, or more, gallons per minute.
		Morainal deposits as much as 275 feet thick, consisting of thick layers of clay interbedded with thin discontinuous lenses of sand and gravel.	Adequate ground-water supplies for farm and domestic requirements may be developed. Wells may be developed in underlying sandstone formations.
Pennsylvanian	Allegheny	Medium to coarse grained sandstone and shale.	Sandstone formations in the eastern portion of the basin are the principal aquifer. Yields depend on specific location of well with respect to drainage.
	Pottsville		
Mississippian	Logan	Fine to medium grained sandstone, silty to sandy shale, and siltstone.	Farm and domestic supplies usually available. Yields less than 10 gallons per minute.
	Cuyahoga	Alternating layers of fine to coarse grained sandstone, siltstone, and shale.	Yields of wells range from 5 to 20 gallons per minute, although more than 100 gallons per minute have been reported.
	Berea	Relatively pure, thin to massive bedded sandstone with some layers of sandy shale.	Potable water from this aquifer is limited to the western portion of the basin. Highly mineralized water reported from oil wells in central and eastern part of the basin.

FILE INDEX  
P-13

EXPLANATION OF SYMBOLS

- Domestic well
  - ⊙ Industrial well
  - ⊕ Municipal well
  - △ Test well
  - S Sand
  - G Gravel
  - UN Clay, sand, gravel
  - FS Fine sand
  - LS Limestone
  - SS Sandstone
  - SH Shale
  - SSH Sandy shale
- $\frac{C}{2}$  Chemical analysis in text.

Total depth (Ft.) - Water-bearing formation - Yield (gpm)  
 Depth to bedrock (Ft.)

AREAS IN WHICH YIELDS OF AS MUCH AS 100 TO 500, OR MORE, GALLONS PER MINUTE CAN BE DEVELOPED

Regionally extensive permeable sand and gravel deposits may yield as much as 600, or more, gallons per minute at depths of less than 100 feet. Test drilling is recommended to locate coarser materials, owing to the presence of fine sand deposits.

AREAS IN WHICH YIELDS OF 25 TO 75 GALLONS PER MINUTE CAN BE DEVELOPED

Thin to thick lenses of sand and gravel interbedded in relatively thick layers of clay and/or fine sand. Yields depend on proper well construction and depths may exceed 300 feet. Test drilling may be necessary to locate coarser deposits.

AREAS IN WHICH YIELDS OF 5 TO 25 GALLONS PER MINUTE CAN BE DEVELOPED

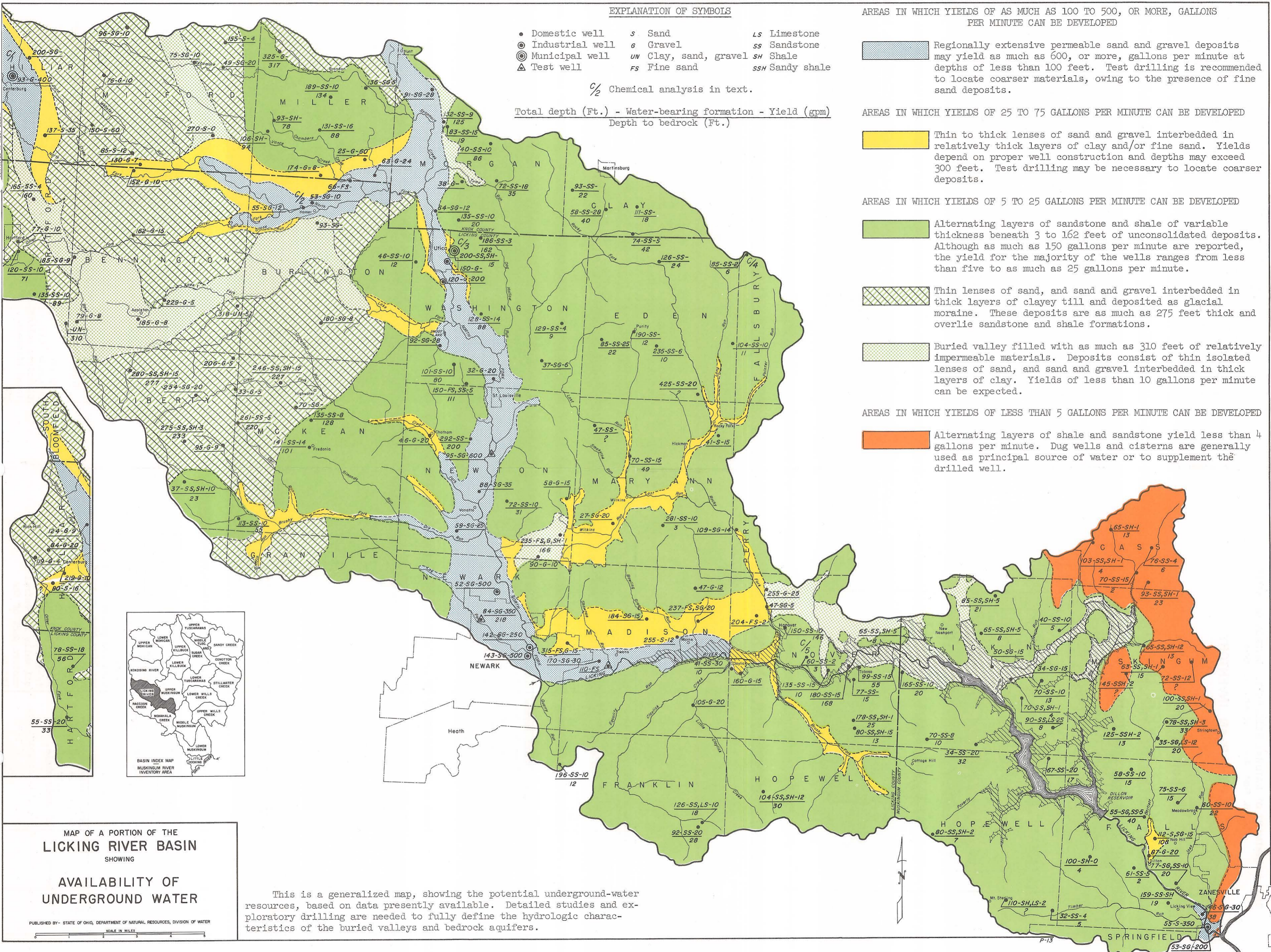
Alternating layers of sandstone and shale of variable thickness beneath 3 to 162 feet of unconsolidated deposits. Although as much as 150 gallons per minute are reported, the yield for the majority of the wells ranges from less than five to as much as 25 gallons per minute.

Thin lenses of sand, and sand and gravel interbedded in thick layers of clayey till and deposited as glacial moraine. These deposits are as much as 275 feet thick and overlie sandstone and shale formations.

Buried valley filled with as much as 310 feet of relatively impermeable materials. Deposits consist of thin isolated lenses of sand, and sand and gravel interbedded in thick layers of clay. Yields of less than 10 gallons per minute can be expected.

AREAS IN WHICH YIELDS OF LESS THAN 5 GALLONS PER MINUTE CAN BE DEVELOPED

Alternating layers of shale and sandstone yield less than 4 gallons per minute. Dug wells and cisterns are generally used as principal source of water or to supplement the drilled well.



MAP OF A PORTION OF THE LICKING RIVER BASIN SHOWING

AVAILABILITY OF UNDERGROUND WATER

This is a generalized map, showing the potential underground-water resources, based on data presently available. Detailed studies and exploratory drilling are needed to fully define the hydrologic characteristics of the buried valleys and bedrock aquifers.