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SUMMARY OF OCCURRENCE OF GROUND WATER IN KENTUCKY

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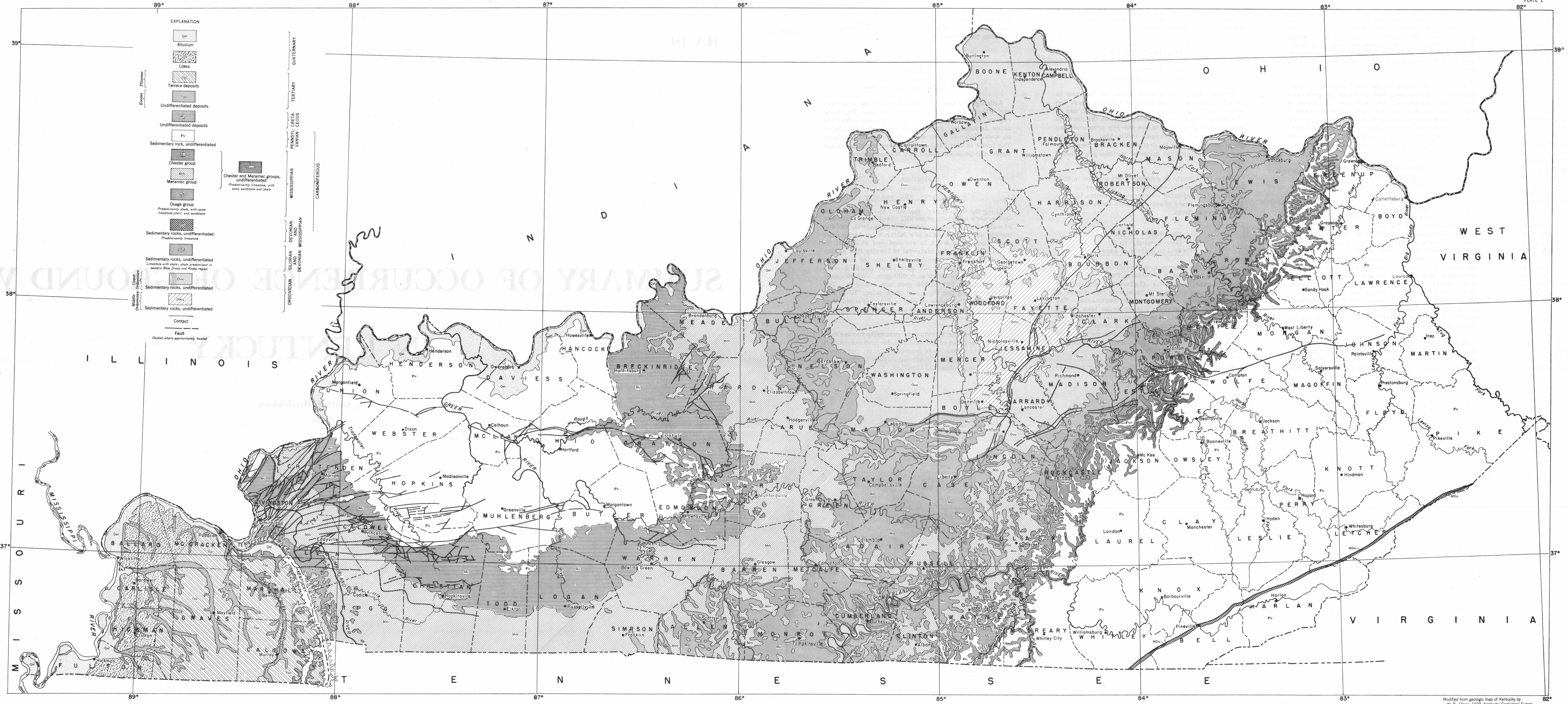

Modified from geologic map of Kentucky by W. R. Jillson, 1929, Kentucky Geological Survey

GEOLOGIC MAP OF KENTUCKY

Scale 1:750,000

10 0 30 Miles

INTRODUCTION

The purpose of this atlas is to summarize the information that has been obtained in ground-water investigations in Kentucky made in cooperation with the State's Department of Economic Development. A series of atlases now in preparation will present this information in much greater detail for the five ground-water regions of Kentucky. Descriptions of the larger ground-water supplies used for public and industrial purposes in those regions are presented in the following reports:

Baker, J. A., and Price, W. E., Jr., 1955, Public and industrial water supplies of the Eastern Coal Field region, Kentucky: U. S. Geol. Survey Circ. 369.

Brown, Richmond F., 1954, Public and industrial water supplies of the Mississippian Plateau region, Kentucky: U. S. Geol. Survey Circ. 341.

Maxwell, B. W., 1954, Public and industrial water supplies of the Western Coal region, Kentucky: U. S. Geol. Survey Circ. 339.

Palmquist, W. N., Jr., and Hall, F. R., 1953, Public and industrial water supplies of the Blue Grass region, Kentucky: U. S. Geol. Survey Circ. 299.

Pree, H. L., Jr., and Walker, W. H., 1953, Public and industrial water supplies of the Jackson Purchase region, Kentucky: U. S. Geol. Survey Circ. 287.

In the descriptions below, the phrase "enough water for domestic use" means enough water for a house equipped with a pressure system and modern plumbing. The terms used in describing the quality of water are defined as follows:

Soft water, hardness 0-60 parts per million (ppm).

Moderately hard water, hardness 60-120 ppm.

Hard water, hardness 120-200 ppm.

Very hard water, hardness more than 200 ppm.

Undesirable amounts of iron, more than 0.3 ppm of iron.

Undesirable amounts of chloride, more than 250 ppm of chloride.

Undesirable amounts of sulfate, more than 250 ppm of sulfate.

Salt water, water that has an objectionably salty taste; usually contains more than 250 ppm of chloride.

The geologic units described in the following paragraphs are shown on the map, which is adapted from the geologic map of Kentucky by W. R. Jillson, published in 1929 by the Kentucky Geological Survey. The ground-water conditions described are those to be expected generally in the corresponding areas as shown on the map, but, because of local variations, conditions at any given place within a map area may differ substantially from those described.

ORDOVICIAN SYSTEM
Middle Ordovician Series
(Map symbol, Omu)
Limestone and some interbedded shale

Limestone of the Middle Ordovician series yields enough water for domestic use to most drilled wells in the Inner Blue Grass region, although some domestic wells are failures. Water is generally obtained from openings along joints or bedding planes which have been enlarged by solution. Other things being equal, these solution openings are better developed in the rocks underlying valleys than in those underlying hills. A few wells in valleys of major streams yield 50 to 225 gpm for public and industrial supplies. Limestone yields water to many springs, some of which discharge more than 500 gpm.

Water from most wells is hard to very hard and may contain undesirable amounts of iron, but it is otherwise satisfactory for domestic use. At depths greater than about 75 feet below the level of local streams, salt water may be encountered. Few wells are known to yield fresh water at depths greater than 200 feet below the local stream level. Water from springs is generally softer and lower in dissolved solids than that from wells, although a few springs yield salt water.

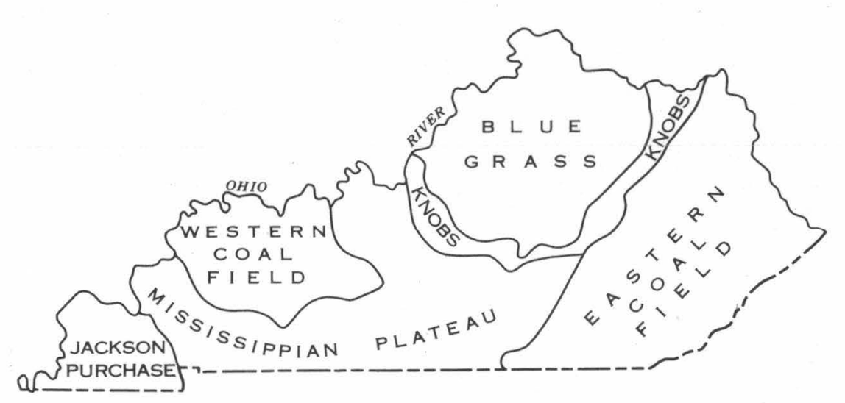

Figure 1.—Physiographic regions of Kentucky.

Upper Ordovician Series
(Map symbol, Ouu)
Interbedded limestone and shale

Where thick limestone of the Upper Ordovician series crops out in the Outer Blue Grass region, it yields enough water for domestic use to about half the drilled wells. Other things being equal, the chances of obtaining a successful well are better in valleys than on ridge tops. A few wells yield as much as 25 gpm. Shale and shaly limestone generally do not yield enough water to wells for domestic use, and most wells in such rocks go dry in late summer. Numerous small springs issue from these rocks, but many go dry in late summer.

Water from most wells is hard to very hard and may contain undesirable amounts of iron, but it is otherwise satisfactory for domestic use. At depths greater than about 50 feet below the level of local streams, salt water may be encountered. Few wells yield fresh water from depths greater than 100 feet below the local stream level. Water from springs is generally softer and lower in dissolved solids than water from wells.

SILURIAN AND DEVONIAN SYSTEMS, UNDIFFERENTIATED
(Map symbol, DSu)
Limestone and shale

In the parts of the Outer Blue Grass region west of the Cincinnati arch where thick limestone crops out in valleys or broad uplands, it yields enough water for domestic use to most drilled wells. Where limestone is covered by shale, it yields little or no water, or salty water. Shale and interbedded limestone and shale generally do not yield enough water for domestic use. In the Outer Blue Grass and Knobs regions on the east side of the Cincinnati arch, very few wells yield enough water for domestic use. In the Louisville area, thick limestone overlain by alluvium of the Ohio Valley yields several hundred gallons per minute to drilled wells. Small springs are common in the Outer Blue Grass region, and large springs yielding several hundred gallons per minute occur along stream valleys in the eastern part of the Mississippian Plateau region.

Water from most wells is hard to very hard and may contain undesirable amounts of iron, but it is otherwise satisfactory for domestic use. Salt or sulfur water may be encountered at depths greater than about 75 feet below the level of local streams, particularly where shale occurs below stream level. Few wells yield fresh water at depths greater than 200 feet below the level of local streams. Water from springs is generally softer and lower in dissolved solids than that from wells, although a few springs yield salt water.

DEVONIAN AND MISSISSIPPIAN SYSTEMS, UNDIFFERENTIATED
(Map symbol, MDu)
Limestone and shale

The combined outcrop areas of the Devonian and Mississippian systems are shown on the map along the Pine Mountain thrust fault. The limestone yields water to springs, one of which is used for public supply.

CARBONIFEROUS SYSTEMS
Mississippian System
Osage Group
(Map symbol, Mo)
Shale, limestone, chert, and sandstone

Shale generally does not yield enough water for domestic use. Where thick limestone or sandstone crops out, it yields enough water for domestic use to about half the drilled wells. A few wells yield as much as 50 gpm from limestone. Numerous springs issue from these rocks, especially from limestone beds underlain by shale. Most springs discharge only a few gallons per minute, but at least one discharges more than 20 gpm.

The water from wells is generally hard to very hard and may be high in iron or sulfate, but it is otherwise generally satisfactory for domestic use. Water from springs is generally softer and lower in dissolved solids than water from drilled wells.

Meramec Group
(Map symbol, Mm)
Limestone and minor amounts of chert and shale

In broad outcrop areas, limestone yields enough water for domestic use to about 4 out of 5 drilled wells. A number of wells yield more than 100 gpm for public and industrial supplies. Where rocks of the Meramec group cap narrow ridges (the underlying Osage exposed in the valleys) most wells will not yield enough water for domestic use. Where the Meramec crops out in valley bottoms (the overlying Chester exposed in the hillsides) most wells yield enough water for domestic use. Many large springs issue from these rocks, some of which discharge several hundred gallons per minute. Some of the large springs are used for public supply.

Water from wells is generally hard to very hard and may contain undesirable amounts of iron, but it is otherwise satisfactory for domestic use. The concentration of dissolved solids generally increases with depth of the water-bearing beds, and, at depths greater than about 100 feet below the level of local drainage, salt water may be encountered. A few wells, however, produce fresh water from depths greater than 500 feet below the level of local streams. Water from springs is generally softer and lower in dissolved solids than that from wells.

Meramec and Chester Groups, undifferentiated
(Map symbol, Mcm)
Limestone, sandstone, and shale

The Meramec and Chester groups are combined on the map along the escarpment marking the western boundary of the Eastern Coal Field. Where limestone and sandstone crop out in valleys, they generally yield enough water for domestic use. Many springs flow from these rocks. A few of these yield as much as 100 gpm during periods of high flow.

Chester Group
(Map symbol, Mc)
Sandstone, limestone, and shale

Where limestone or sandstone crops out over broad areas, it yields enough water for domestic use to most drilled wells. A few wells yield as much as 100 gpm. Shale and shaly limestone generally do not yield enough water for domestic use to wells, but they may perch water in overlying limestone and sandstone. Sandstone and limestone

yield water to numerous springs, some of which discharge more than 100 gpm.

Water from wells is soft to very hard and locally contains undesirable amounts of iron. Water from springs is generally softer and lower in dissolved solids than that from wells.

Pennsylvanian System
(Map symbol, Pu)
Eastern Coal Field
Sandstone, siltstone, shale, and conglomerate, and some limestone and coal

Where sandstone, siltstone, or conglomerate crops out in broad uplands or in valleys, it yields enough water for domestic use to most drilled wells. A number of wells yield more than 50 gpm for public and industrial supplies. Some water is obtained from limestone and coal beds. Little water is available from shale. Sandstone and conglomerate yield water to numerous springs and seeps, but most of the springs are small and go dry in late summer.

Water from wells is soft to very hard, generally contains undesirable amounts of iron, and may contain undesirable amounts of sulfate or chloride. Salt water may be encountered in a few places at depths as shallow as 50 feet below the level of local streams. Few wells yield fresh water from depths greater than about 200 feet below the level of local streams, although wells reported to be more than 1,000 feet deep near Middlesboro yield fresh water. Water from springs is generally softer and lower in dissolved solids than that from wells.

Western Coal Field
Conglomerate, sandstone, siltstone, and shale, and some coal and thin limestone

Where conglomerate, sandstone, or siltstone crops out, it yields enough water for domestic use to most drilled wells. Some wells yield 100 to 500 gpm for public and industrial supplies. Some water may be obtained from limestone and coal beds. Little water is available from shale. Sandstone and conglomerate yield water to numerous small springs.

Water from wells in the outcrop area of conglomerate, sandstone, and siltstone is generally fresh and suitable for domestic use. It is soft to very hard and may contain undesirable amounts of iron. With increasing depth and distance from the outcrop area, the water is more highly mineralized, and salt water may be encountered. The deepest well known to yield fresh water is 943 feet deep.

CRETACEOUS SYSTEM
(Map symbol, Ku)
Sand, gravel, silt, and clay

Although the outcrop area shown on the map is small, the Cretaceous deposits extend to the west and south beneath younger rocks. The sandbeds yield enough water for public, industrial, irrigational, and domestic use to most drilled wells that penetrate them in Marshall, Calloway, McCracken, and Ballard Counties, both in the outcrop area and also where covered by younger sediments. Yields as much as 800 gpm to drilled wells are reported, and yields of more than 100 gpm are common. Clay, silt, and clay-bound gravel yield little or no water. In the area between the Tennessee and Cumberland Rivers and east of the Cumberland River, sandbeds yield enough water for domestic use to most wells but are not known to yield enough for public or industrial supplies.

Water from wells is generally soft to moderately hard and is low in dissolved solids. Water from most wells contains an undesirable amount of iron, but it is otherwise satisfactory for domestic use. There is no record of salty water in these sediments, even at great depth.

TERTIARY SYSTEM
Eocene Series
(Map symbol, Tdu)
Sand, silt, and clay

Although the outcrop area shown on the map is small, sandbeds of this unit yield enough water for public, industrial, irrigational, and domestic use to almost all wells that penetrate them in the Jackson Purchase region, both in the outcrop area and also where covered by younger sediments. Yields as great as 1,400 gpm to drilled wells are reported, and yields of several hundred gallons per minute are common.

Water from wells is generally soft and low in dissolved solids and is satisfactory for domestic use, although it may contain undesirable amounts of iron. There is no record of salty water in these deposits, even at great depth.

Pliocene(?) Series
(Map symbol, Ttd)
Gravel in matrix of sand

Although the outcrop area shown on the map covers a large part of the Jackson Purchase region, the Pliocene(?) gravels (Lafayette formation of former usage) occur as a relatively thin mantle of terrace deposits over the older sediments. The thickness of the gravels ranges from less than a foot to about 65 feet. The gravels yield enough water for domestic use to most dug or large-diameter bored wells in the outcrop area, but do not yield large quantities of water for public and industrial use.

Water from wells in the Pliocene(?) gravels is generally soft to moderately hard. It may contain undesirable amounts of iron, but it is otherwise suitable for domestic use.

QUATERNARY SYSTEM
Loess
(Map symbol, Ql)
Silt and occasional pebbles

Although the outcrop area shown on the map covers a large part of the western Jackson Purchase region, the loess occurs only as a mantle over the older sediments, and drilled wells obtain little or no water from it. Dug wells obtain small supplies. The loess is about 40 feet thick near the Mississippi River and thins eastward to a featheredge.

Alluvium
(Map symbol, Qal)
Sand, gravel, silt, and clay

Along the Ohio River, the sand and gravel of the Quaternary alluvium generally yield large amounts of water for public, industrial, irrigational, and domestic use. Some wells are failures for large supplies because bedrock is encountered at a shallow depth or because the material is locally fine grained. Single vertical wells drilled into the alluvium yield as much as 1,500 gpm, and multiple-well systems yield as much as 9,000 gpm. Wells capable of yielding 200 to 500 gpm are common. The alluvium along the Ohio and Mississippi Rivers in the Jackson Purchase region is finer grained than that along the Ohio in upstream areas and probably will yield less water to wells.

Water from the alluvium is generally harder than water from most of the bedrock formations, and it may contain undesirable amounts of iron, but otherwise it is suitable for domestic, public, irrigational, and many industrial supplies.