# The KENTUCKY Ground-Water Monitoring NETWORK

## Statewide Perspective

**Interagency Technical Advisory Committee**

University of Kentucky Water Resources Research Institute
Kentucky Geological Survey
Kentucky Department for Environmental Protection
Division of Water
Division of Waste Management
Kentucky Department for Surface Mining Reclamation and Enforcement
University of Kentucky College of Agriculture
U.S. Geological Survey
Kentucky Division of Conservation
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Kentucky Department of Agriculture, Division of Pesticides
Kentucky Cabinet for Human Resources, Division of Environmental Sanitation and Community Safety
Kentucky Protection and Regulation Cabinet, Department of Mines and Minerals
Kentucky Ground-Water Association

## Network

Citizens of the Commonwealth are dependent upon clean, reliable ground-water resources. According to the 1990 U.S. Census, about one in four Kentuckians (approximately 900,000) uses ground water from wells and springs in their homes, schools, and businesses. All of Kentucky's streams and rivers are sustained by ground water during periods of low rainfall.

Information on the quality and quantity of ground-water resources in Kentucky is inadequate for most uses. Baseline information is needed by industry and government agencies for public policy matters. This information includes documentation of the wide-ranging natural variability of ground-water quality in each region. Just as important, identifying subsurface zones that have different ground-water quality will in many cases reduce costs and raise the likelihood of obtaining an adequate ground-water supply for the homeowner, agriculture, municipalities, and industry.

A Kentucky Ground Water Consensus Group, with representation from State, Federal, local, industrial, and public interests, was established in 1993 to consider State needs in this vital area. One of their recommendations was to establish a ground-water monitoring network to be administered by the Kentucky Geological Survey. The goals of this network are to characterize and monitor the occurrence, quantity, and quality of Kentucky's ground water, and to support a data base that is readily available to the public, and upon which reliable policy decisions can be based. Legislation will be introduced in the 1996 session of the Kentucky General Assembly for statutory authority for such a network.

### Coordination

An interagency advisory board is developing a framework for the Network. This framework will be used to coordinate with other data-collection efforts in the State and build an appropriate information base on ground-water resources.

Increased coordination of ground-water data collection and data reporting among agencies is a priority. This will limit redundant efforts, make certain that data from various sources are available for use, and assure that the information collected by this network can be used for multiple purposes.

### First step

Information in the Kentucky Ground-Water Data Repository, housed at the Kentucky Geological Survey, is being summarized by the KGS. State agencies are required (KRS 151:035) to provide non-proprietary ground-water information to the Repository; this procedure centralizes the information for more efficient public access. However, the water-quality analyses that are now available are poorly distributed across the State, and most lack enough data on elements, ions, and organic chemicals to sufficiently characterize the quality of ground water for human use. Some preliminary findings concerning ground water in the Western Kentucky Coal Field are provided in this pamphlet.

### Collection

Wide gaps in existing ground-water data for Kentucky need to be filled. Collection and annual reporting of standardized information will be a major contribution of the Network. New information will be stored in the data repository and made available for public use.

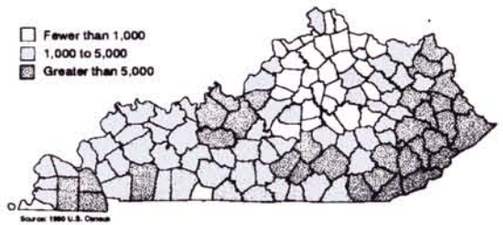
### Summaries and characterization

The location and character of the State's ground-water resources will be determined, and the information will be accessible. Characterization of the aquifers will include defining well yield, normal variations in ground-water quality, and ground-water flow systems that directly influence water quality.

## State of Kentucky

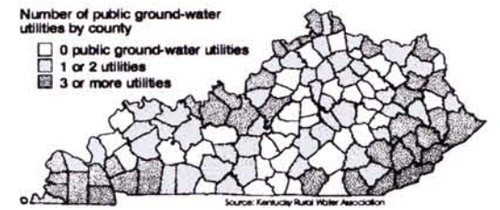
### Distribution of well users

About 500,000 of the 900,000 Kentuckians that use ground water have a private well (U.S. Census, 1990). The distribution of people who use private wells is shown by county on the following map.




### Public utilities using ground water

In addition to the private-well users mentioned above, 400,000 Kentuckians are supplied ground water by public water systems for household use, schools, and businesses (U.S. Census, 1990). The distribution of the approximately 400 public water systems is shown by county on the following map. Most of these systems use wells to obtain water. Ground water stored in mines was used by eight of the public systems; 19 of the utilities used large springs for a source, as of 1994.



## Aquifers

Aquifers are bedrock or sediments that provide enough ground water to supply a household well. The types of aquifers in Kentucky are more varied than in most other states because of the large number of physiographic areas in the State. Characteristics of each area control the types of aquifers that occur. The regions are shown in the physiographic diagram at the bottom of the page. Aquifers in Kentucky can be divided into three basic groups: (1) sand and gravel, (2) granular and fractured bedrock, and (3) karst (cavernous limestone). Approximately half of the State is underlain by limestone bedrock with different degrees of cavern or conduit development.

## Ground-water flow

The generalized pattern of ground-water movement for the sand-gravel and granular-fractured bedrock aquifer is shown in the figure at right. Variations in the direction and speed of ground-water flow in these aquifers become more complex because of degree of rock fracturing, type of rock, and topography of the land.

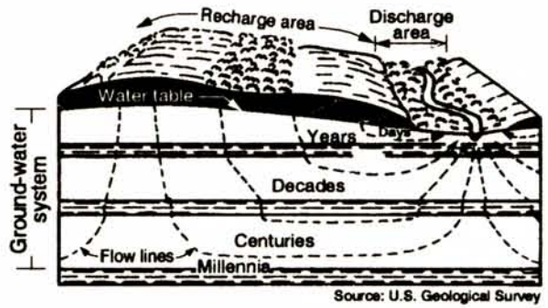
Ground-water flow in karst areas of Kentucky differs from that shown in the preceding diagram, partly because flow in the natural conduits is much more rapid. Also, surface water enters the karst systems very quickly, in some areas through conduits that open directly to the ground surface. The conduit flow causes complexity in ground-water recharge, flow through aquifers, and areas of ground-water discharge to the ground surface.

In all of these ground-water flow systems, the water chemistry changes from the start of each flow system to its end. Changes in the amount of elements and ions (such as iron and sulfate) along this route affect its usability for drinking water, for agriculture, and for industry.

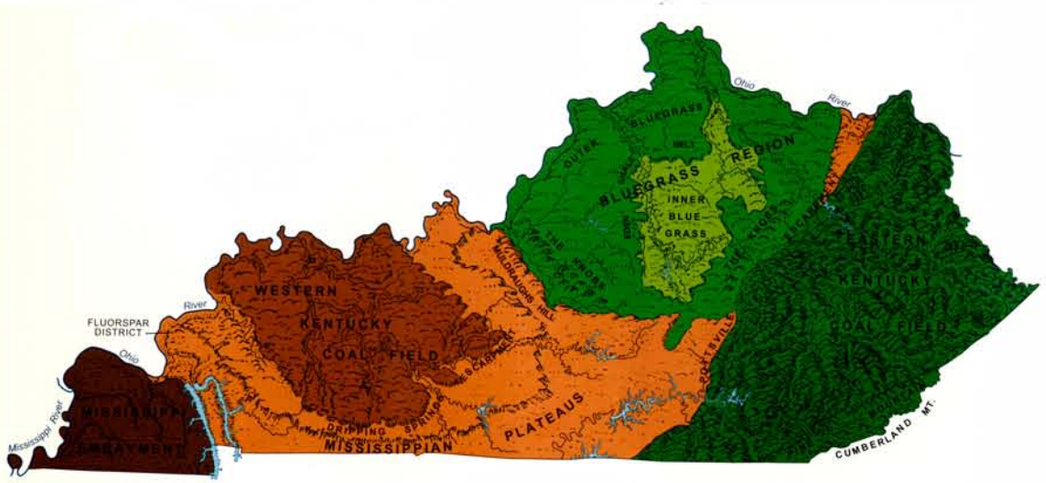
## Conditions of ground-water supplies

The occurrence of good- or bad-quality water in wells is seemingly random in many rural Kentucky communities. Neighbors often have very different water quality in their wells, and different yields. The quality and quantity of ground water is controlled by several factors, including the depth and physical characteristics of the aquifers tapped, the flow system in a particular part of the aquifer, and well construction.

If more complete information is added to the existing data base, subsurface zones with different water quality and quantity can be identified. An important goal of the Network is to provide information on zones with good and poor water quality for water-supply development. In some locations the poorest quality water could be avoided or sealed off during drilling and well construction.



Source: U.S. Geological Survey




## How much information is available?

As part of the KGS summary of information in the Ground-Water Data Repository, the number of wells tested in three important categories of water quality was compared with the total number of private wells in the State. The categories are bacteria content, man-made organic chemicals, and major ions (the most abundant elements and ions that influence ground-water quality). The following table shows that information is available for at most two out of 100 wells in any of the three categories. Fewer than 1 percent of the wells have analyses in all three categories.

| Information in the Ground-Water Data Repository as of June 1995 | | |
|---|---|---|
| Category of wells and springs | Number of wells and springs in region | Percentage of wells and springs in region |
| Total wells in region | 207,000* | 100.0% |
| Records in Repository | 18,825 | 9.1% |
| Records with any quality analyses | 8,119 | 3.9% |
| Bacteria analyses | 213 | 0.1% |
| Organic analyses | 1,577 | 0.8% |
| Major-ion analyses | 5,005 | 2.4% |
| *U.S. Census Bureau, 1990—household wells only | | |

## Bacteria

Each newly drilled water well is disinfected with chlorine, and shortly afterward a water sample is collected and tested for bacteria. Because of the disinfection, these results should not be used to judge typical conditions, and therefore these data were excluded from the summary of available data. Thousands of analyses have been conducted on water from wells in Kentucky that had not recently been disinfected, but only 215 of these analyses were available in the Kentucky Ground-Water Data Repository in early 1995.

## Improving the information base

- The most valuable ground-water data that are recorded only on paper should be computerized and transferred to the Ground-Water Data Repository. Selected ground-water data submissions to State agencies should be in a computerized format, whenever possible.
- The Network is coordinating with other data-collection activities in the State. An interagency advisory board is creating a framework for data collection by the Network, and will provide continued input on the most-needed ground-water information. The Network will fill many gaps in the data to provide baseline information.
- The Kentucky Ground-Water Monitoring Network will characterize the quality and quantity of ground-water resources in each region. Summaries will include the horizontal and vertical patterns of ground-water quality and quantity. Information will be available in reports, including annual reports. Raw data will be available in various formats through the Kentucky Ground-Water Data Repository.

For more information, contact Jim Dinger at the Kentucky Geological Survey, (859) 257-5500 ext 163.