

*The Kentucky Interagency
Groundwater Monitoring Network:
A Collaborative Effort in Groundwater
Resource Characterization*



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and

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Kentucky Division of Water



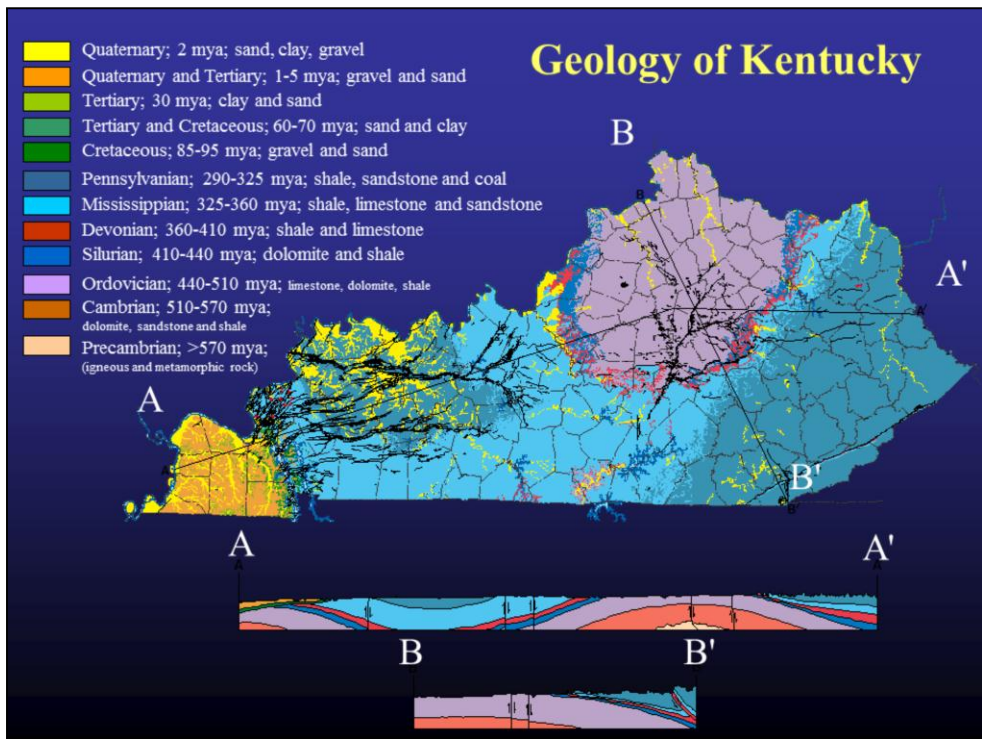
9th National Monitoring Conference
Cincinnati, Ohio
April 28 – May 2, 2014

One of two related presentations on the Kentucky Interagency Groundwater Monitoring Network presented at the 2014 9th National Monitoring Conference in Cincinnati. This presentation focused on the history of how the Network was created and retrieving Network data online; the other presentation by Rob Blair of DOW focused on the mechanics of the Network and DOW's extended sampling programs.

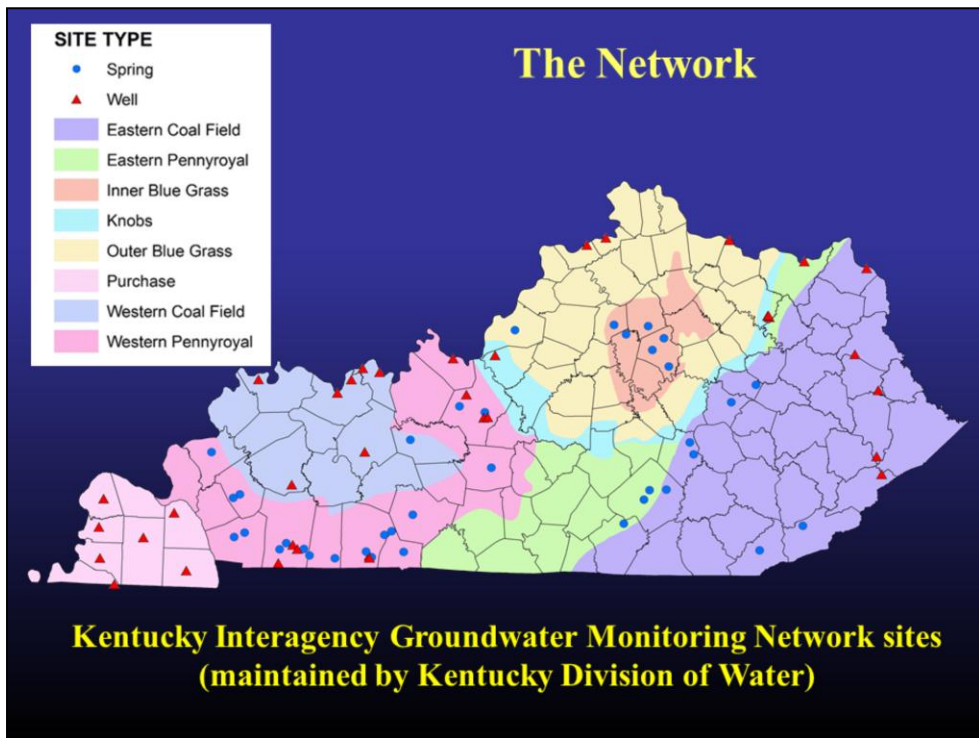
Starting with the Big Picture



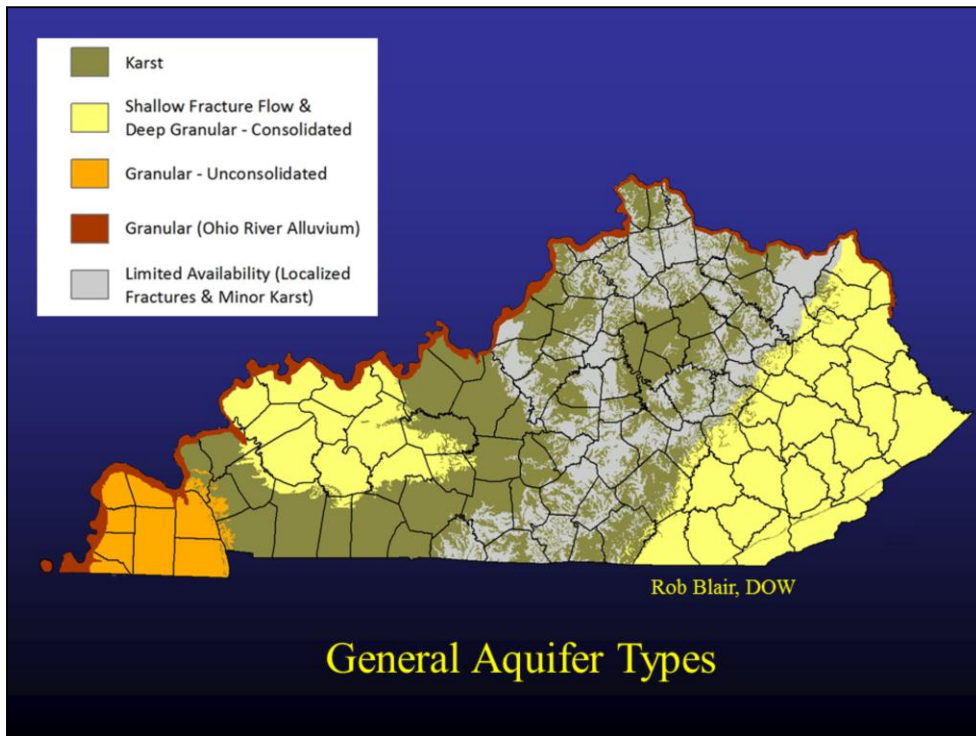
Geologic map of the United States, showing that Kentucky is situated between two large basins, the Illinois Basin and the Appalachian Basin. Between the basins is the uplifted Cincinnati Arch.



Kentucky's Eastern Coal Field is located within the Appalachian Basin and the Western Coal Field is located within the Illinois Basin. The Bluegrass Region and eastern Mississippian Plateaus (or eastern Pennyroyal) are situated on the Cincinnati Arch. Because of the arch, surface rocks were eroded away and the Bluegrass Region therefore has the oldest rocks in the state (see cross section A – A'). Kentucky does not have a single homogenous aquifer as do some other states, but rather several heterogeneous aquifers.



The current 60 Network sites are shown on this physiographic region map, which closely resembles the previous geology map because geology controls topography and physiography.



This general aquifer type map was generated by Rob Blair, and shows the range of aquifers in the state, from fracture flow to granular, depending on location.



Nada Tunnel Spring



A few of the Network
sample locations...



Dyer Spring



Robert Blair of KDOW provided four pictures of Network sample locations. Nada Tunnel Spring in the Eastern Kentucky Coal Field and Dyer Spring in the Western Pennyroyal are shown here.



Vanceburg Well



Slough's WMA Well



The City of Vanceburg's public water supply well is a Network site in the Eastern Pennyroyal region, and Slough's (pronounced "Slew") Wildlife Management Area well is in the Western Kentucky Coal Field near the Ohio River.

Kentucky Interagency Groundwater Monitoring Network

Contact: Bart Davidson

Groundwater is essential to the economy of Kentucky and to the health of its citizens. Despite its extensive use, until recently there was little systematic effort to describe groundwater quality and to make that information widely available. Recognizing the importance of groundwater, the 1998 Kentucky General Assembly directed the Kentucky Geological Survey to establish a long-term, interagency groundwater monitoring network to characterize the quality, quantity, and distribution of groundwater in Kentucky (Kentucky, 1998). The major goals of the Interagency Groundwater Monitoring Network are to (1) collect groundwater data, (2) characterize groundwater quality, (3) distribute groundwater information, (4) improve coordination between agencies that collect groundwater data, and (5) facilitate sharing of groundwater data (Interagency Technical Advisory Committee, 1996). The network is assisted by an Interagency Technical Advisory Committee on Groundwater (ITAC), which is composed of State, Federal, and university representatives. The ITAC was established by KGS 15.1.629.

SITE TYPE

- Spring
- Well
- County Boundary Regions
- Eastern Coal Field
- Eastern Mountain
- Inner Blue Grass
- North
- Outer Blue Grass
- Parklands
- Western Coal Field
- Western Mountain



Kentucky Interagency Groundwater Monitoring Network sampling sites maintained by the Kentucky Division of Water.

Map No.	ARCWGA	Frequency	Map No.	ARCWGA	Frequency	Map No.	ARCWGA	Frequency
1	90000045	G	28	90002034	G	51	00042044	G
2	90000054	G	27	00002054	W	52	00001469	G
3	90000068	M	28	00000011	G	53	00048111	G
4	90000070	G	29	00001131	W	54	00000601	G
5	90000044	G	30	00012311	W	55	90001000	Feet MGA
6	90000052	G	31	00014293	W	56	90001024	Feet MGA
7	90000102	G	32	00014489	W	57	00001100	Feet MGA
8	90000103	G	33	00002030	W	58	90001201	Feet MGA
9	90000100	M	34	00002050	W	59	90001400	Feet MGA
10	90000110	W	35	00003087	W	60	00001470	Feet MGA
11	90000190	M	36	00003004	W	61	00001093	Feet MGA
12	90000064	G	37	00003060	W	62	00001400	Feet MGA
13	90001020	G	38	00003072	W	63	00011200	Feet MGA
14	90001051	G	39	00003100	W	64	00001000	Feet MGA
15	90001134	G	40	00037176	W	65	00002983	Feet MGA
16	90001107	G	41	00003174	W	66	00042000	Feet MGA
17	90001143	M	42	00041471	W	67	00043203	Feet MGA
18	90001140	W	43	00042084	W	68	00043206	Feet MGA
19	90001148	W	44	00043203	W	69	00041702	Feet MGA
20	90001161	G	45	00048111	W	70	00047170	Feet MGA
21	90001107	W	46	00048102	W	71	00048000	Feet MGA
22	90001343	W	47	90004810	W	72	00003010	Feet MGA
23	90001344	W	48	90005002	G	73	90002823	Feet MGA
24	90001402	G	49	90001400	W	74	90001000	Feet MGA
25	90001407	G	50	90001404	G			

<http://www.uky.edu/KGS/water/gnet/>

Network Website

The network has produced the following annual summaries and descriptions of network activities:

Annual Reports (PDF file)

- * 1999-2000 annual report (0.3 Mb)
- * 2000-2001 annual report (0.1 Mb)
- * 2001-2002 annual report (0.1 Mb)
- * 2002-2003 annual report (0.2 Mb)
- * 2003-2004 annual report (0.3 Mb)
- * 2004-2005 annual report (0.5 Mb)
- * 2005-2006 annual report (1.27 mb)
- * 2006-2007 annual report (1.36 mb)
- * 2007-2008 annual report (0.7 mb)
- * 2008-2009 annual report (0.7 mb)
- * 2009-2010 annual report (0.8 mb)
- * 2010-2011 annual report (1.2 mb)
- * 2011-2012 annual report (1.18 mb)
- * 2012-2013 annual report (1.42 mb)

Monitoring Network Framework Document (PDF file describing the initial work of the Interagency Technical Advisory Committee regarding the establishment of the Kentucky Groundwater Monitoring Network)

* http://kgs.uky.edu/gwnet/itac/pub/kgs/ITAC_framework.pdf (10.6 mb)

The Kentucky Groundwater Monitoring Network (pdf files)

Monitoring Network Framework Document (PDF file describing the initial work of the Interagency Technical Advisory Committee regarding the establishment of the Kentucky Groundwater Monitoring Network)

* http://kgs.uky.edu/gwnet/itac/pub/kgs/ITAC_framework.pdf (10.6 mb)

The Kentucky Groundwater Monitoring Network (pdf files)

- * Statewide
- * Jackson Purchase
- * Western Kentucky Coal Field
- * Eastern Mountain/Parklands
- * Bluegrass and Knobs
- * Eastern Kentucky Coal Field

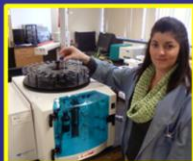
Conference Proceedings (PDF file)

* Fisher, R.S., and Goodman, P.T., 2007. Characterizing groundwater in Kentucky. From site selection to published information, 2002 National Monitoring Conference, National Water Quality Monitoring Council, (p. (5.01 Mb)

The Network website, showing sample locations and ID numbers, along with all annual reports of the Network and other articles of interest.

Kentucky Groundwater Data Repository

(Established in 1990 by KRS 151.035)



- Over 92,000 water well records
 - Major sources: DOW, USGS (NWIS), EPA (Storet), KGS, NURE
- Approximately 5,100 spring records
- Currently about 60,000 suites of water-quality analyses with millions of individual records
- Online mapping services to display data on various base maps and other geological data

Before proceeding further about the Network, the Kentucky Groundwater Data Repository (another mandated program connected with the Network) was introduced, which is the interface for obtaining Network data.

History of the Network

- Prior to 1992, there was little systematic effort to describe groundwater quality and make that information widely available to the public
- In 1993 the secretary of the Ky. Natural Resources and Env. Protection Cabinet convened a Groundwater Consensus Committee to draft groundwater protection regulations. DOW, KWRRI and KGS participated.
- Between 1993 and 1994, KGS and KWRRI worked jointly on proposed legislation to create a groundwater monitoring network.

History of the Network, Continued

- An ad hoc Interagency Technical Advisory Committee (ITAC) met through 1995 and 1996, and drafted a framework document for the Network. About 10 agencies were represented at these meetings.
- The proposed legislation did not pass in either the 1994 or 1996 Legislature
- In 1998, the Kentucky General Assembly passed two important, ***but unfunded***, statutes:
 1. KRS 151.625 established the Groundwater Monitoring Network
 2. KRS 151.629 established the KY Interagency Technical Advisory Committee

KRS 151.625 Establishment of long-term groundwater monitoring network -- Duties.

1. The KGS shall, in cooperation with the Interagency Technical Advisory Committee on Groundwater, establish a long-term groundwater monitoring network for the purpose of characterizing the quality, quantity, and distribution of Kentucky's groundwater resources.
2. The monitoring network shall include:
 - (a) Representative sites sampled by various agencies;
 - (b) Water wells, springs, and surface water associated with wells and springs; and
 - (c) New monitoring wells installed in areas of demonstrated need.

This network shall collect information on a statewide basis and provide long-term data collection to determine the quality, quantity, and occurrence of groundwater throughout the Commonwealth.

I debated putting the actual legislation wording in my talk, but thought there may be people in the audience who are trying to develop a network for their state who may be interested in seeing exactly how the law is worded. This slide and the two following contain the exact wording of the Kentucky Revised Statute that established the Network.

KRS 151.625, Continued.

3. The KGS shall utilize collected data to support research efforts that develop models for groundwater systems, and to determine and monitor trends of groundwater movement, water quality, and quantity.
4. The KGS shall provide data from the network to the Kentucky Groundwater Data Repository and make the data readily available to the public, government agencies, industry, and other entities that request access. Analyzed data maybe made available in the form of maps, charts, bulletins, and reports.
5. The KGS shall solicit input from federal, state, and local agencies, and industry, agriculture, universities, and the public to determine priority monitoring locations based on water quality and quantity concerns as the network is developed.

KRS 151.625, Continued.

6. Within ninety (90) days of the end of each state fiscal year, the KGS shall provide to the Governor and the Legislative Research Commission a summary of the groundwater monitoring network data collection and analysis activities.

Effective: July 15, 1998

History: Created 1998 Ky. Acts ch. 30, sec. 3, effective July 15, 1998



State Capitol,
Frankfort

Legislation for the Network, slide 3.

KRS 151.629 Interagency Technical Advisory Committee on Groundwater - Duties and responsibilities.

1. There is established an Interagency Technical Advisory Committee on Groundwater to assist the KGS in the development, coordination, and implementation of a groundwater monitoring network for the Commonwealth.

The committee shall consist of one (1) representative from each of the following agencies, to be appointed by that agency:

- (a) Division of Conservation of the Department for Natural Resources;
- (b) Division of Public Health Protection and Safety of the Cabinet for Health and Family Services;
- (c) Division of Forestry of the Department for Natural Resources;
- (d) Division of Environmental Services of the Department of Agriculture;
- (e) Division of Waste Management of the Department for Environmental Protection;
- (f) Division of Water of the Department for Environmental Protection;
- (g) Department for Environmental Protection;
- (h) Department for Natural Resources;
- (i) Kentucky Geological Survey;
- (j) University of Kentucky College of Agriculture; and
- (k) University of Kentucky Water Resources Research Institute.

This is the legislation that establishes the Interagency Technical Advisory Committee, which works in conjunction with the Survey to oversee Network design and activities.

KRS 151.629, Continued.

2. The committee shall have two (2) nonvoting legislative liaisons who shall be members of the General Assembly. One (1) liaison shall be a House member appointed by the Speaker of the House of Representatives and one (1) liaison shall be a Senate member appointed by the President of the Senate. The chair of the committee shall be the director of the University of Kentucky Water Resources Research Institute. The duties and responsibilities of the committee shall include:
 - (a) Developing a plan to coordinate agencies for the overall characterization of the state's groundwater, including occurrence, flow systems, water quantity, and water quality;
 - (b) Reviewing the data entry process to ensure that all data collected is placed into the Kentucky Groundwater Data Repository;
 - (c) Establishing a long-term groundwater monitoring plan for the Commonwealth;
 - (d) Making recommendations for prioritization of the state's groundwater research needs; and
 - (e) Annually reviewing and evaluating groundwater data collection and analysis.

KRS 151.629, Continued.

3. In addition to the members identified in subsection (1) or (2) of this section, the committee may have, as one (1) of its members, one (1) nonvoting representative from the United States Geological Survey, appointed by that agency.

Effective: June 20, 2005

History: Amended 2005 Ky. Acts ch. 99, sec.122, effective June 20, 2005; and ch. 123, sec 18, effective June 20, 2005 – Amended 2004 Ky. Acts ch. 88, sec. 2, effective July 13, 2004. -- Created 1998 Ky. Acts ch. 30, sec. 4, effective July 15, 1998.

Legislative Research Commission Note (6/20/2005). This section was amended by 2005 Ky. Acts chs. 99 and 123, which do not appear to be in conflict and have been codified together.

Legislative Research Commission Note (6/20/2005). 2005 Ky. Acts chs. 11, 85, 95, 97, 98, 99, 123, and 181 instruct the Reviser of Statutes to correct statutory references to agencies and officers whose names have been changed in 2005 legislation confirming the reorganization

**Framework for the
Kentucky Ground-Water Monitoring Network:
A Report of the
Interagency Technical Advisory Committee**

**Dr. Lyle V.A. Sendlein, Director
Kentucky Water Resources Research Institute**

April 1996

**Framework
Document:
1996**

**First report of the
ad hoc ITAC
committee**

The ad hoc ITAC committee (prior to legislation being enacted for the committee) completed a framework document outlining the design and function of the Network in 1996.

Goals of the Network from Framework Document

1. Collect groundwater data
2. Characterize groundwater quality
3. Distribute groundwater information
4. Improve coordination between agencies that collect groundwater data
5. Facilitate sharing of groundwater data

Goals of the Network as outlined by the ad hoc ITAC committee in 1996.

Proposed Monitoring Strategies

1. Past and ongoing groundwater projects were identified by physiographic region
2. Separate monitoring strategies were proposed for each of seven major physiographic/geologic regions
3. Three sampling teams proposed taking total of 800 samples per year, using standard methods
4. Analyses were to include field measurements, nutrients, pesticides, major ions, inorganics, radio-metrics, metals


Proposed monitoring strategy summary of the Network as outlined by the ad hoc ITAC committee in 1996.

Monitoring Strategies by Region

Bluegrass Region

Eastern Coal Field

The KENTUCKY Ground-Water Monitoring NETWORK



Blue Grass & Knobs Perspective

Network
The Kentucky Ground-Water Monitoring Network is a cooperative effort of the Kentucky Department of Natural Resources, the Kentucky Geological Survey, and the Kentucky State Water Control Commission. The network is designed to monitor the quality and quantity of ground water in the state and to provide information to the public and to the state government.

First step
The first step in the development of the network was the selection of the areas to be monitored. The areas were selected on the basis of their geologic and hydrogeologic characteristics, their potential for contamination, and their importance to the state's economy and health.

Collection
The collection of data is the second step in the development of the network. The data are collected from a variety of sources, including public wells, private wells, and monitoring wells. The data are then analyzed and reported to the public and to the state government.



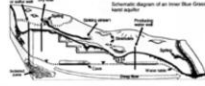
Summarize and characterization
The third step in the development of the network is the summarization and characterization of the data. The data are summarized and characterized in terms of their quality and quantity, and the results are reported to the public and to the state government.

Coordination
The fourth step in the development of the network is the coordination of the data. The data are coordinated in terms of their quality and quantity, and the results are reported to the public and to the state government.


How much information is available?
The amount of information available from the network depends on the location and the type of well. The network is designed to provide information on the quality and quantity of ground water in the state, and to provide information to the public and to the state government.

Condition of supplies
The condition of supplies is a major concern of the network. The network is designed to monitor the quality and quantity of ground water in the state, and to provide information to the public and to the state government.

Improving the information base
The network is designed to improve the information base on ground water in the state. The network is designed to monitor the quality and quantity of ground water in the state, and to provide information to the public and to the state government.

The KENTUCKY Ground-Water Monitoring NETWORK



Eastern Kentucky Coal Field Perspective

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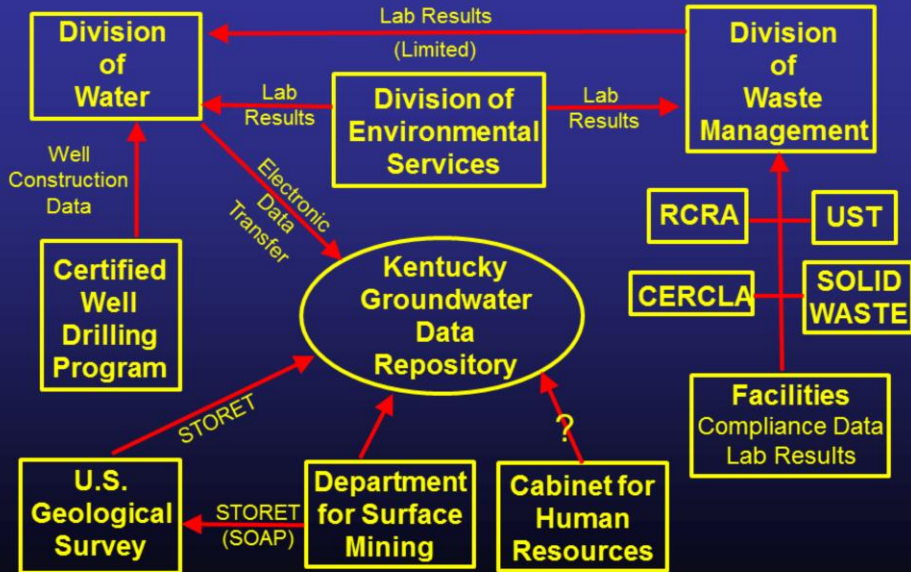
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Subgroups of the ad hoc ITAC committee worked on individual monitoring strategies for each of the seven major physiographic/geologic regions of Kentucky. Two are shown here.

Interagency groundwater data transmission flow chart



This data transmission flow chart was included in the Framework Document of 1996, and reasonably approximates how the data are transmitted today. The ultimate goal was to ensure that Network data was compiled in and disseminated by the Kentucky Groundwater Data Repository, which is indeed the case today.

Framework Document Recommendations

1. All current groundwater data and all groundwater data to be collected in the future should be put into a standard format for entry into the Repository
2. 641 sampling sites should be installed across the state for annual sampling
3. One-time sampling for 120 locations (one per county)
4. Areas requiring more intense study should be identified and monitored as “Intense Study Areas”

Recommendations by the ad hoc ITAC committee in the 1996 Framework document for design of the Network. At the time, major funding was thought to be achievable to support such a robust Network. The current Network represents about 10 percent of the original planned Network.

Suggested Parameters in Framework Document (~60)

Field Measurements

pH
 Conductance
 Temperature
 Dissolved Oxygen
 Salinity
 Turbidity
 Odor

Major Ions

Bicarbonate
 Carbonate
 Chloride
 Sulfate
 Potassium
 Magnesium
 Calcium

Nutrients

Nitrate-Nitrogen
 Nitrite-Nitrogen
 Ammonia-Nitrogen
 Total Organic Carbon
 Orthophosphate

Pesticides

2,4-D
 Alachlor
 Atrazine
 Cyanazine
 Metolachlor
 Simazine

Inorganics

Acidity
 Alkalinity
 Fluoride
 Bromide

Radio- metrics

Tritium
 Gross alpha
 radiation

Metals

Aluminum	Lead	Sodium
Antimony	Lithium	Strontium
Arsenic	Magnesium	Sulfur
Barium	Manganese	Thallium
Beryllium	Nickel	Tin
Cadmium	Phosphorus	Vanadium
Calcium	Potassium	Zinc
Chromium	Mercury	
Copper	Selenium	
Gold	Silicon	
Iron	Silver	

The Framework Document recommended about 60 analytes in 7 categories for the sampling regime.

Current Parameters for the Network (~58)

Bulk

pH
 Conductance
 Temperature
 TSS
 TDS

Major Ions

Bicarbonate
 Carbonate
 Chloride
 Sulfate
 Potassium
 Magnesium
 Calcium

Nutrients

Nitrate-Nitrogen
 Nitrite-Nitrogen
 Ammonia-Nitrogen
 Total Kjeldahl Nitrogen
 Total Organic Carbon
 Total Phosphorus
 Ortho-Phosphate

Pesticides

2,4-D
 Alachlor
 Atrazine
 Cyanazine
 Metolachlor
 Simazine

Organics

Nitrogen/
 Phosphorus
 Chlorinated
 Pesticides
 Herbicides
 PCBs

Inorganics

Chlorine
 Flourine
 Sulphate

Caffeine

VOC's

Benzene
 Toluene
 Ethyl Benzene
 Xylene
 MTBE

Metals

Aluminum	Lead	Sulfur
Arsenic	Magnesium	Zinc
Barium	Manganese	
Cadmium	Nickel	
Calcium	Potassium	
Chromium	Selenium	
Copper	Silver	
Iron	Sodium	

The analytes sampled for today in the current Network are not too different from those suggested in 1996. Volatile organic compounds (VOC's) and caffeine have been added.

The Current Network

1. 60 sites sampled at differing intervals, about 200 samples per year (about half wells and half springs)
2. Division of Water does the sampling, funded by General Funds; Certified Well Drillers' Fees; Federal Insecticide, Fungicide and Rodenticide Act; Section 319 of the Clean Water Act
3. KGS is developing additional sites for water-level monitoring and supplemental quality sampling using internal funding
4. ITAC meets biannually
5. KGS & DOW have compiled detailed groundwater-quality reports for all 5 BMU's, KGS compiles Network Annual Reports

Relevant information about the current Network.

Network Reports via ITAC

Kentucky Interagency Groundwater Monitoring Network

Annual Report

July 2012–June 2013

Bart Davidson, Compiler
Kentucky Geological Survey
University of Kentucky
Lexington, Kentucky

October 2013

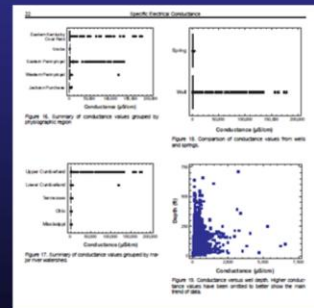
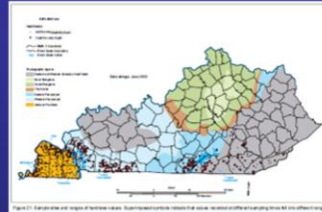
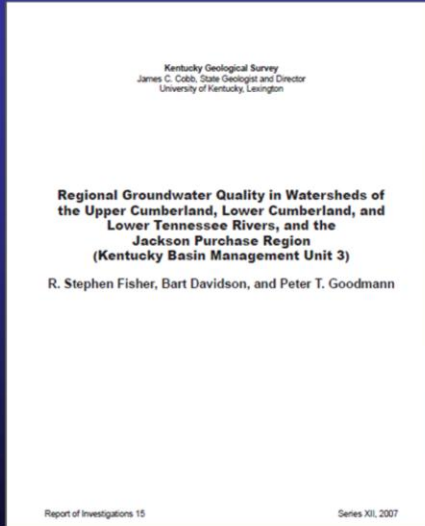
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Annual Reports since 1999, roughly 20 pages each

Several reports have been generated by the Network under the auspice of the ITAC committee – this is the title and content page of last year’s annual report, which summarizes the activities of the Network in general, and of the water-related activities of the agencies who are members of ITAC.

Network Reports via ITAC



Basin Management Unit Reports – 4 from 2004-2008 From 100 – 170 pages

Detailed Basin Management Unit (called BMUs, of which there are 5) reports were generated by KGS and DOW between 2004 and 2008. These reports used well and spring data from the entire Groundwater Data Repository, not just the Network. Additional BMU reports were generated by DOW which specifically targeted about 30 Network-only sites within each BMU. These BMU reports are available on the KGS and KDOW websites respectively, but will also be posted on the Network website by June of 2014.

Current ITAC members

- Kentucky Division of Water, Department for Environmental Protection, Energy and Environment Cabinet
- Kentucky Geological Survey, University of Kentucky
- Kentucky Water Resources Research Institute, University of Kentucky
- University of Kentucky College of Agriculture
- Kentucky Division of Waste Management
- Kentucky Division of Forestry
- Kentucky Division of Conservation
- Kentucky Division of Pesticides, Department of Agriculture
- Kentucky Department for Natural Resources

Current roster of the Interagency Technical Advisory Committee for the Kentucky Interagency Groundwater Monitoring Network.

**Accessing Network Data
via the
Kentucky Groundwater Data Repository**

The slides to follow will show how to access Network data via the Repository.

U.K. KY | Academics | Athletics | Research | Site Index | UK HealthCare | Search UK

U.K. Kentucky Geological Survey

Earth Resources—Our Common Wealth

Home Mobile Contact About Staff Calendar SiteMap ? SEARCH

- General Geology
- Research/Programs
- Online Maps
- Data**
 - GIS
 - Oil and Gas
 - Groundwater**
 - Coal
 - Cores and Samples
 - Photos and other images
 - Geologic Descriptions
 - Geotechnical
 - Presentations
 - Seismic
- Publications
- Outreach and Education
- Laboratory
- Well Sample & Core Library

Of Interest

- KGS testifies before state senate committee
- KGS 2012-13 annual report available
- Want to know more about the geoscience profession?
- More News & Announcements
- KGS Newsletter
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Web Services for KGS Geoscience Information
Fact Sheets

Ask a Geologist! Kentucky Consortium for Carbon Storage Fossils & geohistory file Real-time earthquake recordings KGS photos and images See KGS presentations

See us on YouTube PANGLOSS facebook twitter

**From the KGS front page (www.uky.edu/kgs):
Select “Data”, then “Groundwater”**

On the Kentucky Geological Survey’s front page, select “Data” then “Groundwater”.




Groundwater Information Via The Kentucky Groundwater Data Repository

The Kentucky Geological Survey maintains databases of research data that are searchable on the Web. Below are links to services that can be used to find various types of groundwater data, and to other sites with information about water research in Kentucky:

- ◆ [Changes to the Groundwater Data Repository database.](#)
- ◆ [Changes to the KY Groundwater-Quality Data Services](#)


Water Wells & Springs **Groundwater Quality** Other Water Information

◆ [Search for Groundwater-Quality Data](#) **Groundwater Quality data tab**




Search for groundwater-quality data by county, quadrangle, AKGWA number, or radius around a point of interest. You can view and download data for **545 different analytes from 15 analyte groups**: bulk water properties, caffeine & derivatives, herbicides, inorganics, metals, microbes, nutrients, PCB's, pesticides, petroleum hydrocarbons, radionuclides, residues, SVOC's, VOC's, and other analytes. Data can be downloaded and a link to the groundwater quality map is provided for each location.

◆ [Graphical Groundwater-Quality Comparison](#)



Plot groundwater-quality data by Physiographic Province or HUC 6 Watershed basin for 38 possible analytes. You can choose to display the data in a cumulative, analytical value vs. well depth, or box-and-whisker plot.

◆ [Groundwater-Quality Data Map Service](#)



Use this map service to create a thematic map with the same water quality data (**545 different analytes from 15 analyte groups**) that is found in the groundwater-quality data search above. Select one analyte from a category and view the analysis results as symbols across the state an area of interest. Analysis data for each site can also be viewed, and a link back to the data search is provided for data download capability.

This is the Repository's primary website. There are 3 blue tabs for the Water Well and Spring Search Engine, the Groundwater-Quality Search Engine, and General Water Information. To access Network quality data, the Groundwater Quality tab is selected.



Groundwater Information Via The Kentucky Groundwater Data Repository

The Kentucky Geological Survey maintains databases of research data that are searchable on the Web. Below are links to services that can be used to find various types of groundwater data, and to other sites with information about water research in Kentucky:

- ◆ [Changes to the Groundwater Data Repository database.](#)
- ◆ [Changes to the KY Groundwater-Quality Data Services](#)

Water Wells & Springs

Groundwater Quality

Other Water Information

[Search for Groundwater-Quality Data](#)

Tabular data search

Search for groundwater-quality data by county, quadrangle, AKGWA number, or radius around a point of interest. You can view and download data for **545 different analytes from 15 analyte groups**: bulk water properties, caffeine & derivatives, herbicides, inorganics, metals, microbes, nutrients, PCB's, pesticides, petroleum hydrocarbons, radionuclides, residues, SVOC's, VOC's, and other analytes. Data can be downloaded and a link to the groundwater quality map is provided for each location.

◆ [Graphical Groundwater-Quality Comparison](#)



Plot groundwater-quality data by Physiographic Province or HUC 6 Watershed basin for 38 possible analytes. You can choose to display the data in a cumulative, analytical value vs. well depth, or box-and-whisker plot.

◆ [Groundwater-Quality Data Map Service](#)



Use this map service to create a thematic map with the same water quality data (**545 different analytes from 15 analyte groups**) that is found in the groundwater-quality data search above. Select one analyte from a category and view the analysis results as symbols across the state or an area of interest. Analysis data for each site can also be viewed, and a link back to the data search is provided for data download capability.

Select the “Search for Groundwater-Quality Data” link for tabular data. Users may also perform simple statistics on quality data, or view data on various base maps, such as geology, topography and aerial photography.

Groundwater-Quality Database Kentucky Groundwater Data Repository

Select A Search Method:

- Search by Geographic
- Search by County
- ADVANCED: Radius Search (defining coordinates)
- ADVANCED: Radius Search (decimal degree coordinates)

SEARCH ON ALL GROUNDWATER-QUALITY RECORDS IN KENTUCKY

REQUIRED - Select Analytes:

- Select from **LABORATORY** measured analytes (include most analytes - divided into 15 categories below).
- Select from **FIELD** measured analytes (these are analytes measured on-site at a well or spring).
 - Return ALL available LABORATORY analytes
 - Only available for individual analysis number search (i.e. all wells within a user-specified radius search)
- Return ALL available **FIELD** analytes
 - Only available for individual analysis number search (i.e. all wells within a user-specified radius search)

Choose one or more analytes from the groups below (you MUST select at least one analyte - or return zero results):

- | | |
|---|---|
| Bulk info | Petroleum Hydrocarbons info |
| Caffeine & Derivatives info | Radionuclides info |
| Herbicides info | Residues info |
| Inorganics info | SVOCs (ARN) info |
| Metals info | VOCs info |
| Nutrients info | Others info |
| PCBs info | |
| Pesticides info | |

Select Data View for Each Returned Location:

- Return **ALL SAMPLES** for each location
 - may include multiple samples on different dates for the same location
- Return a **SUMMARY** of samples for each location
 - for sites with multiple samples, returns statistical summaries including **most recent value and date, median, maximum value and date, and number of samples below detection**
- Limit Results by Sampling Date** (enter in mm/dd/yyyy format: **06/09/1972**):

Limit Results to Kentucky Groundwater Monitoring Network

Limit Results by Regulatory Program:

Water Withdrawal
Superfund
Environmental Protection
UST
Drinking Water

hold the "ctrl" key to make multiple selections

- [HELP: About Groundwater-Quality Analyses Reports](#)
- [About Groundwater-Quality Standards](#)
- [About Best Management Practices](#)

For full functionality, popup blocking software should be disabled during your visit to this site.
This site is optimized for use with the latest version of [Microsoft Internet Explorer](#) or [Mozilla Firefox](#), and uses the following [advertising and data display](#):



Repository Groundwater- Quality Data Search Page

The Groundwater-quality search engine page.



Groundwater-Quality Database

Kentucky Groundwater Data Repository

Changes to the KY Groundwater-Quality Data Services

Select A Search Method:

- Search by Quadrangle
- Search by County
- ADVANCED Radius Search (lat/long coordinates)
- ADVANCED Radius Search (decimal degree coordinates)

SEARCH ON ALL GROUNDWATER-QUALITY RECORDS IN KENTUCKY

Select Analytes

- Select from **LABORATORY** measured analytes (include most analytes - divided into 15 categories below).
- Select from **FIELD** measured analytes (these are analytes measured on-site at a well or spring).
- Return **ALL** available **LABORATORY** analytes (only available for individual - AICGWA Number - well search)

Choose one or more analytes from each group:

Bulk info	Petroleum Hydrocarbons info
Caffeine & Derivatives info	Radionuclides info
Herbicides info	Residues info
Inorganics info	SVOCs (ABN) info
Metals info	VOCs info
	Others info

Thallium
Tin
Titanium
Vanadium
Zinc

hold the "ctrl" key to make multiple selections

Available analyte descriptions/maps:

- Arsenic (expl. & map)
- Barium (expl. & map)
- Cadmium (expl. & map)
- Calcium (expl. & map)
- Chromium (expl. & map)
- Copper (expl. & map)
- Iron (expl. & map)
- Lead (expl. & map)
- Magnesium (expl. & map)
- Manganese (expl. & map)
- Mercury (expl. & map)
- Selenium (expl. & map)
- Sodium (expl. & map)

[Nutrients](#) | info

[PCBs](#) | info

[Pesticides](#) | info

Select Data View for Each Returned Location:

- Return **ALL SAMPLES** for each location
• may include multiple samples on different dates for the same location

Analytes:
Click on any of 14 categories to expand (Metals shown here)

Links for available quality maps and explanations

At least one of the analytes in the 14 blue categories must be selected to run a search. Retrieving all analytes for multiple sites can potentially be a massive amount of data and may time-out on the user, so retrieving all available analyses can only be performed for individual sites, or for a few sites within a small radius search.

Arsenic is a metalloid that occurs naturally at low concentrations in rocks, soil, plants, and animals. In Kentucky, arsenic is commonly found in sulfide minerals associated with coal and black shales. It is released when these sulfides oxidize during weathering. Once released, arsenic is readily sorbed onto iron oxides and oxyhydroxides. This sorption can limit dissolved arsenic concentrations in groundwater, but can produce high total arsenic concentrations in unfiltered groundwater samples that contain suspended particulate material. Arsenic can undergo biochemical processes to form complex ions that are not readily removed from solution by sorption onto soils or the aquifer matrix.

Arsenic is used as a wood preservative and in paints, dyes, metals, drugs, soaps, semiconductors, animal feed additives, and pesticides. From 1860 through 1910, arsenic was heavily used in embalming fluids. It was banned in 1910 because it interfered with investigations into suspected poisoning deaths, but old graveyards may still contribute arsenic to groundwater. Waste disposal sites and landfills may be sources of arsenic contamination because of the materials placed there, coal burning can release arsenic, and agricultural drainage can carry arsenic from pesticides into the groundwater. Hydrocarbons from leaking underground storage tanks can dissolve iron oxide minerals in soils, thus releasing naturally occurring arsenic to the environment.

Long-term exposure to arsenic in drinking water has been linked to cancer of the skin, bladder, lungs, kidneys, nasal passages, liver, and prostate. Arsenic has also been linked to damage of the cardiovascular, pulmonary, immunological, neurological, and endocrine systems. Because of these health effects, the EPA set the Maximum Contaminant Level for arsenic in drinking water at 0.050 mg/L in 1974. In 2001, the EPA announced that this would be lowered to 0.010 mg/L, effective January 2006.

Arsenic (mg/L) MCL = 0.01 mg/L

- ▲ > 0.01
- ≤ 0.01
- Below detection

□ Kentucky river basins

Physiographic Regions

□ Inner Bluegrass

□ Outer Bluegrass

□ Knobs

□ Eastern Coal Field

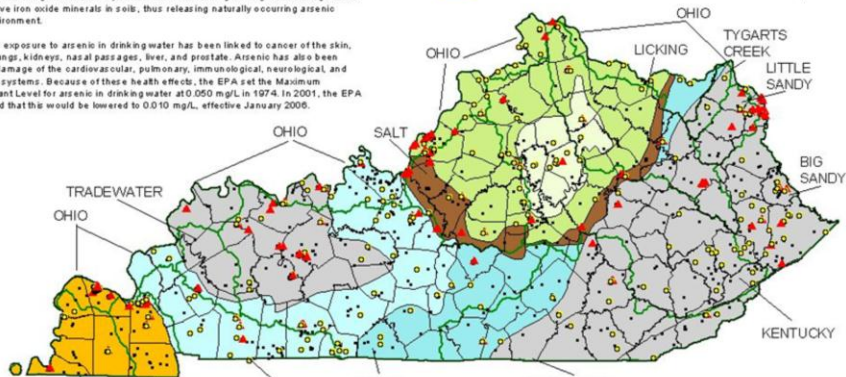
□ Eastern Pennyroyal

□ Western Pennyroyal

□ Western Coal Field

□ Jackson Purchase

Arsenic data for Kentucky



Summary range-of-value maps are available for about 38 of the most-requested analytes.

Two Ways to Access Network Data

1. By individual ID number (AGKWA), thereby obtaining all Network data for that site only
2. By user-specified analyte, thereby obtaining data for all Network sites for that specific analyte

KGS Kentucky Geological Survey
University of Kentucky Search KGS | Contact KGS | KGS Home | UK Home

KGS Home > Data, Maps, & Pubs > Groundwater Info > Groundwater-Quality Database [send us feedback](#) | [tutorials](#)

Groundwater-Quality Database Kentucky Groundwater Data Repository

Select A Search Method: Search by Quadrangle
Search by County
ADVANCED: Radius Search (lat/long coordinates)
ADVANCED: Radius Search (decimal degree coordinates)
ADVANCED: AKGWA Number Search

Enter an **AKGWA NUMBER** for a well or spring of interest:
AKGWA NUMBER (8 digit): 90001134

REQUIRED - Select Analytes:

- Select from **LABORATORY** measured analytes (include most analytes - divided into 15 categories below).
- Select from **FIELD** measured analytes (these are analytes measured on-site at a well or spring).
- Return **ALL** available **LABORATORY** analytes (only available for individual AKGWA number search OR all wells within a user-specified radius search)
- Return **ALL** available **FIELD** analytes (only available for individual AKGWA number search OR all wells within a user-specified radius search)

Select Data View for Each Returned Location:

- Return **ALL SAMPLES** for each location
 - may include multiple samples on different dates for the same location
- Return a **SUMMARY** of samples for each location
 - for sites with multiple samples, returns statistical summaries including **most recent value and date, median, maximum value and date, and number of samples below detection**

Limit Results By Sampling Date (enter in mm/dd/yyyy format: **06/09/1972**):

Limit Results to Kentucky Groundwater Monitoring Network

Limit Results By Regulatory Program:

Water Withdrawal
Superfund
Environmental Protection
UST
Drinking Water

hold the "ctrl" key to make multiple selections

Method 1: Individual Site

Select AKGWA
search method:
Insert AKGWA

Select Analytes:
Return ALL samples

Limit Results:
Limit to Network sites

Run Search

How to retrieve all Network data for an individual Network site.



Kentucky Interagency Groundwater Monitoring Network

Contact [Bart Davidson](#)

Groundwater is essential to the economy of Kentucky and to the health of its citizens. Despite its extensive use, until recently there was little systematic effort to describe groundwater quality and to make that information widely available. Recognizing the importance of groundwater, the 1998 Kentucky General Assembly directed the Kentucky Geological Survey to establish a long-term, interagency groundwater monitoring network to characterize the quality, quantity, and distribution of groundwater in Kentucky ([Kentucky Revised Statute 15.1.620](#)). The major goals of the Interagency Groundwater Monitoring Network are to (1) collect groundwater data, (2) characterize groundwater quality, (3) distribute groundwater information, (4) improve coordination between agencies that collect groundwater data, and (5) facilitate sharing of groundwater data (Interagency Technical Advisory Committee, 1996). The network is assisted by an Interagency Technical Advisory Committee on Groundwater (ITAC), which is composed of State, Federal, and university representatives. The ITAC was established by [KRS 15.1.620](#).



Kentucky Interagency Groundwater Monitoring Network sampling sites maintained by the Kentucky Division of Water.

Map No.	AKGWA	Sample Frequency	Map No.	AKGWA	Sample Frequency	Map No.	AKGWA	Sample Frequency
1	90000045	G	26	90002934	G	51	00040944	G
2	90000054	G	27	90003064	50	52	00051148	G
3	90000055	M	28	00000111	50	53	00058511	G
4	90000455	50	29	00007133	50	54	00069806	G
5	90000544	50	30	00012311	G	55	90001200	Post MDA
6	90000552	G	31	00014293	20	56	90000624	Post MDA
7	90000702	G	32	00018480	50	57	90001150	Post MDA
8	90000703	G	33	00028100	50	58	90001201	Post MDA
9	90000705	M	34	00029005	20	59	90001460	Post MDA
10	90000710	50	35	00032887	50	60	90001475	Post MDA
						61	00055953	Post MDA
						62	90001485	Post MDA
						63	00011280	Post MDA
						64	90004658	Post MDA
						65	00029983	Post MDA
						66	00043250	Post MDA
						67	00043253	Post MDA
						68	00043258	Post MDA
						69	00047172	Post MDA
						70	00047175	Post MDA
						71	00048559	Post MDA
						72	00053510	Post MDA
						73	90002823	Post MDA
						74	90000310	Post MDA
15	90001137	G	41	00029374	50			
17	90001143	M	42	00041474	G			
18	90001145	20	43	00042984	G			
19	90001149	20	44	00043253	50			
20	90001161	G	45	80048511	20			
21	90001254	50	46	80048512	20			
22	90001343	20	47	80048513	20			
23	90001344	20	48	00055002	G			
24	90001822	G	49	00061608	G			
25	90001857	G	50	00061854	G			

15

90001134

Select AKGWA Number of site

Selecting site of interest on Network map by copying AKGWA number to place in "Method" box on previous slide.

KGS Kentucky Geological Survey
 University Of Kentucky Search KGS | Contact KGS | KGS Home | UK Home

KGS Home > Data, Maps, & Tools > Groundwater Info > Groundwater-Quality Database [send us feedback](#) | [help](#)

Groundwater-Quality Database
 Kentucky Groundwater Data Repository

Select A Search Method:
 Search Kentucky
 Search by Quadrangle
 Search by County
 ADVANCED: Radius Search (lat/long coordinates)
 ADVANCED: Radius Search (decimal degree coordinates)

SEARCH ON ALL GROUNDWATER-QUALITY RECORDS

REQUIRED - Select Analytes:

Select from **LABORATORY** measured analytes (include most analytes - divided into 15 categories below).

Select from **FIELD** measured analytes (these are analytes measured on-site at a well or spring).

Return ALL available LABORATORY analytes
(only available for individual ARGWA number search OR all wells within a user-specified radius search)

Return ALL available FIELD analytes
(only available for individual ARGWA number search OR all wells within a user-specified radius search)

Choose one or more analytes from the groups below (you **MUST** select at least one analyte - or return zero results):

Bulk info	Petroleum Hydrocarbons info
Caffeine & Derivatives info	Radionuclides info
Herbicides info	Residues info
Inorganics info	SVOCs (ARB) info
Metals info	VOCs info
Nutrients info	Others info
PCBs info	
Pesticides info	

Select Data View for Each Returned Location:

Return **ALL SAMPLES** for each location
 • may include multiple samples on different dates for the same location

Return a **SUMMARY** of samples for each location
 • for sites with multiple samples, returns statistical summaries including **most recent value and date, median, maximum value and date, and number of samples below detection**

Limit Results By Sampling Date (enter in mm/dd/yyyy format: 06/09/1972):

Limit Results to Kentucky Groundwater Monitoring Network

Limit Results by Regulatory Program:

Water Withdrawal
 Superfund
 Environmental Protection
 UST
 Drinking Water

hold the "ctrl" key to make multiple selections
 clear all selections

SEARCH FOR GROUNDWATER-QUALITY DATA RESET

Method 2: By Analyte for All Network Sites

Search method:
(entire state)

Lab or Field Data:
Lab

Analyte:
Arsenic

Select Data View:
Return all samples

Limit Results:
Limit to Network sites

Run Search

Selecting ALL Network data for a single analyte, in this case, arsenic.

**Groundwater-Quality Records Search Results****Kentucky Groundwater Data Repository**

Search Date: 4/9/2014

Search Criteria:All Available Records (no primary limit)
limit by Kentucky Groundwater Monitoring Network Wells**Searched Analyte(s):**

Arsenic (Metals)

Report Type:

All samples for each location

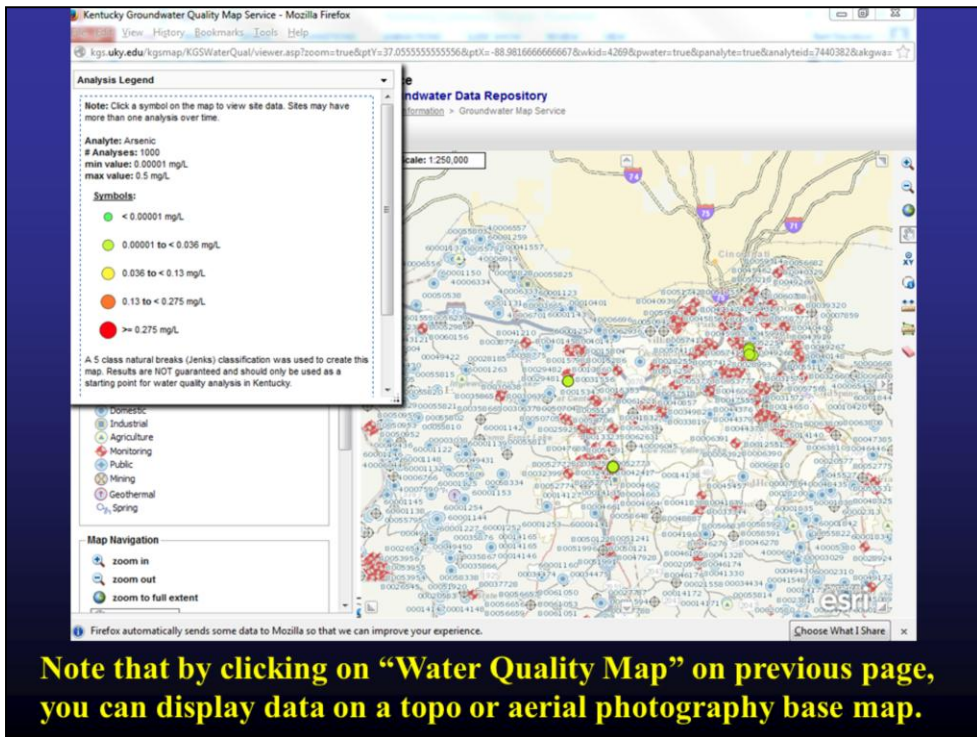
[change to SUMMARY report](#)**Data Search Summary****Summary Report
Toggle Button****RESULTS**

- Note that these data represent only information contained in the Kentucky Ground-Water Data Repository, and may not be representative of all hydrologic sites (i.e., wells, springs) in the search area. Water wells did not have to be registered with the State prior to 1995.
- If this data search revealed any PUBLIC water supply wells, or if you have identified public water supply wells on your site that are not indicated by this search, then you must contact the Kentucky Division of Water (DOW), Groundwater Branch, to determine whether your site is located within a wellhead protection area. The groundwater-protection web address is: <http://water.ky.gov/groundwater/Pages/WellheadProtection.aspx>.

[back to search page](#) | [email feedback](#)**Download Data Button****Water Quality Records (All Samples Report) Search Results:**Sort By: AKQWA number / TYPE (asc) - analyte Records Per Page: 10 Results: 1-10 of 1962 Jump To Page: 1 [First](#) [Prev](#) [1](#) [2](#) [3](#) [Next](#) [Last](#)[download all water quality results](#)**Data Results Table**

-AKQWA # - Site Type - -WELL REPORT - -Use -	-County- -Quadrangle- -Lat, Lon (dms / NAD 83)- (location data in download)	-Surface Elev.- -Water Level- -Depth-	Collection Date	Regulatory Program(s)	Analyte (Group)	Result "<" - value below detection
	-Water Quality Map- -Quick Map-					
AKQWA #: 00000811 type: water well - WELL REPORT (about this well) use: DOMESTIC - SINGLE HOUSEHOLD	County: Ballard Quadrangle: La Center Lat, Lon (dms): 37° 3' 20.000", -88° -58' -54.000" - Water Quality Map - Quick Map	elev: 420 ft level: 60 ft depth: 140 ft	4/27/2010	n/a	Arsenic (Metals)	0.0002 mg/L
AKQWA #: 00000811 type: water well - WELL REPORT (about this well) use: DOMESTIC - SINGLE HOUSEHOLD	County: Ballard Quadrangle: La Center Lat, Lon (dms): 37° 3' 20.000", -88° -58' -54.000" - Water Quality Map - Quick Map	elev: 420 ft level: 60 ft depth: 140 ft	8/3/2004	n/a	Arsenic (Metals)	< 0.0005 mg/L

Groundwater-quality data results for ALL Network data available for arsenic. Note that many more arsenic records are available through the Repository – this search was restricted to arsenic data for the Network only.



Note that by clicking on “Water Quality Map” on previous page, you can display data on a topo or aerial photography base map.

Results from any groundwater-quality search can be displayed spatially on either a topographic or aerial photography base map.



Thanks!

Contacts:

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502-564-3410
robert.blair@ky.gov

Network Website:

<http://www.uky.edu/KGS/water/gnet/>

View from top of the Carew Tower in downtown Cincinnati, along with Contact information for authors, and the Network URL.