

# **KGS Update On Efforts to Improve Kentucky Groundwater Data Availability and Access**

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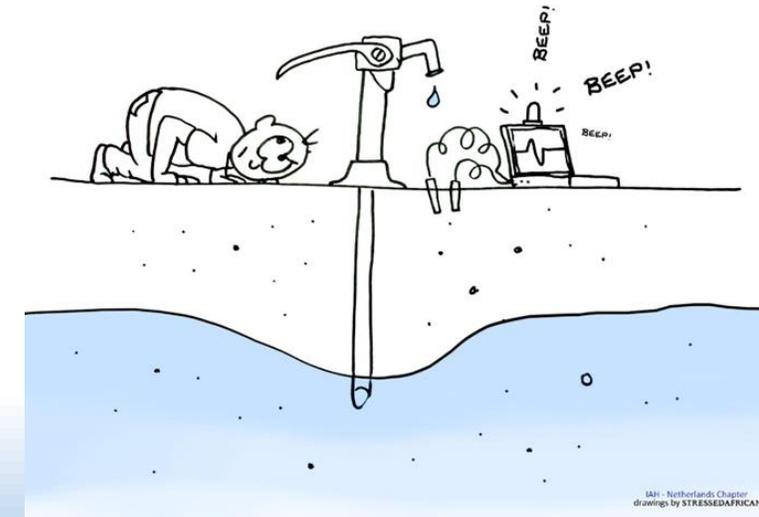
# Outline for this Presentation:

- What Are the Needs and Issues KSG Is Working to Address?
- Making More Groundwater Data Available:
  - Aquifer Designation Project
  - Groundwater Monitoring—KGS Kentucky Groundwater Observation Network (KGON)
- Ongoing and Future Activities

# Needs and Issues KGS Is Addressing:

State, Federal, Private Sector Stakeholders Are Requesting **Access to More Quantitative Groundwater Monitoring Data and Better Characterization and Mapping of Kentucky's Aquifers** Because Of:

- Greater interest in groundwater as a under-utilized resource for:
  - Economic development, especially in agricultural and industrial sectors.
  - Geothermal, biofuels, and other energy related issues.
- Concern over increasing stresses on public water supplies, especially in times of drought, and long-term sustainability of state's groundwater resources.
- Need to develop robust (forecast) modeling and decision-support tools, especially for water withdrawals (budgets), watershed processes, drought.
- National data compilations and assessments regarding water use and source water protection (federal and state programs related to 42 USC Ch. 109B SECURE WATER Act, and S. 3021 America's Water Infrastructure Act).
- To better address KGS mission and legislative mandates regarding water resources.



# KGS Efforts to Improve Groundwater Data Access and Usefulness

- Water Resources Webpage Is Undergoing Renovations in Organization and Contents
- New Content Being Added:
  - Aquifer Designation
  - Groundwater Monitoring

The screenshot shows the Kentucky Geological Survey website. The top navigation bar includes links for University of Kentucky, Academics, Athletics, Research, Site Index, and UK HealthCare. The main header features the UK logo and the text 'Kentucky Geological Survey Earth Resources—Our Common Wealth'. A search bar is located in the top right. Below the header is a secondary navigation menu with links for About, Kentucky Geology, Energy, Water, Hazards, Data, Publications, Online Maps, Education, and Contact. A central content area contains several tiles: 'General Information' (with a water drop icon), 'Karst' (with a brick wall icon), 'Aquifer designation' (with a cross-section icon), 'Groundwater Data' (with a data table icon), 'Surface Water' (with a person icon), and 'Groundwater Monitoring' (with a monitoring station icon). A red circle highlights the 'Aquifer designation' and 'Groundwater Monitoring' tiles. Below these tiles are sections for 'Water Supply', 'Rivers and Streams', 'Lakes and Reservoirs', 'Water Contamination', 'Research' (with a 'Read more' button), and 'Staff' (with a 'Read more' button). At the bottom, there is a section for the 'KY Water Website' featuring the 'Kentucky Water Resources Research Institute' logo and a link to <https://www.research.uky.edu/kentucky-water-resources-research-institute>. The text below the link describes the institute's role and history.

# Aquifer Designation Project

Two-year project (2017-19) funded by USGS Water Use Program through KY Division of Water:

- Compile data from water-well construction records in KGDR to help identify local, primary, and principal aquifers in Kentucky by USGS-formalized stratigraphic names and codes.
- Identify aquifer zones (to the extent possible) and compile other pertinent water-use data for Permitted Water Supply (PWS—withdrawals regulated) wells and springs:
  - 179 PWS wells
  - 13 PWS springs
- As time and resources permit, do the same for agricultural irrigation wells (withdrawals not regulated).
  - 1,031 irrigation wells (~300 records reviewed to date).

**KENTUCKY WATER WELL RECORD**  
 Please read all instructions prior to completing this form. Do not write in shaded area. The original copy of this form must be submitted within 30 days of well completion to the Kentucky Natural Resources and Environmental Protection Cabinet, Division of Water - Groundwater Branch, 14 Rolly Road, Frankfort, KY 40601. Telephone (502) 564-3410.  
 (TYPE OR PRINT CLEARLY)

Attach Water Well Record  
 Id: **0006-4926**  
 (If Applicable)

(1) GENERAL INFORMATION:  
 Name: [Redacted] Owner's Phone: [Redacted] Date Received: **JAN 06 2010**  
 Address: [Redacted] (1) ARGWA NUMBER: **0006-4926**  
 City: **Campton** State: **KY** Zip Code: **41301** City: [Redacted] State: [Redacted] Zip Code: [Redacted]  
 (2) VARIANCE WELL: ( ) Yes (X) No

(3) WELL LOCATION: USGS Quadrangle Name: **Campton KY MAP** County: **Wolfe Co.** Latitude: **37.738226 N** Longitude: **-83.549349 W**

(4) GENERAL WELL CONSTRUCTION:  
 Start Date: **7-13-09** Date: **9-3-09**  
 Finish Date: **7-14-09** Testing Method: (X) Pump ( ) Blowing ( ) Bailer ( ) Other  
 Drilling Method: Type of Work: (X) Air Rotary ( ) Air/Water Well ( ) Mud Rotary ( ) Rework ( ) Cable ( ) Deepen ( ) Auger ( ) Plug ( ) Other ( ) Clean  
 Well Yield: **360** ( ) gpm ( ) gph  
 Drawdowns: **12** ft. after **14** ( ) hrs ( ) min of pumping at ( ) gpm ( ) gph  
 \_\_\_\_\_ ft. after \_\_\_\_\_ ( ) hrs ( ) min of pumping at \_\_\_\_\_ ( ) gpm ( ) gph

(5) WELL TEST:  
 Date: **9-3-09**  
 Testing Method: (X) Pump ( ) Blowing ( ) Bailer ( ) Other  
 Well Yield: **360** ( ) gpm ( ) gph  
 Drawdowns: **12** ft. after **14** ( ) hrs ( ) min of pumping at ( ) gpm ( ) gph  
 \_\_\_\_\_ ft. after \_\_\_\_\_ ( ) hrs ( ) min of pumping at \_\_\_\_\_ ( ) gpm ( ) gph

(6) PHYSIOGRAPHIC OR HYDROLOGIC REGION:  
 ( ) Blue Grass ( ) Ohio River Alluvium ( ) W. Coal Field ( ) W. Coal Field ( ) Max. Plateau ( ) Jackson Purchase

(7) WELL SERVICE:  
 Number of people served: \_\_\_\_\_  
 Number of service connections: \_\_\_\_\_

(8) WELL USE:  
 ( ) Domestic ( ) Industrial ( ) Dry Hole ( ) Public ( ) Livestock ( ) Heat Pump ( ) Irrigation ( ) Other

(9) SKETCH MAP:  


(10) WATER QUALITY:  
 Well was ( ) pumped ( ) bailed ( ) blown ( ) not purged, for **30** ( ) hrs. ( ) min. at **4.00** ( ) per ( ) min. ( ) hr. before sampling.  
 Well Disinfectant: Type **bleach** Amount: **1.0 ml**  
 Results of ( ) total coliform analysis: ( ) colonies/100 ml  
 Appearance: (X) Clear ( ) Cloudy ( ) Muddy ( ) Other ( ) None ( ) Musty ( ) Sour ( ) Other  
 Other: **M.S.U. KY**  
 Sampling Date: **9-17-09**  
 Analysis Date: **9-17-09**  
 Lab Performing Test: \_\_\_\_\_

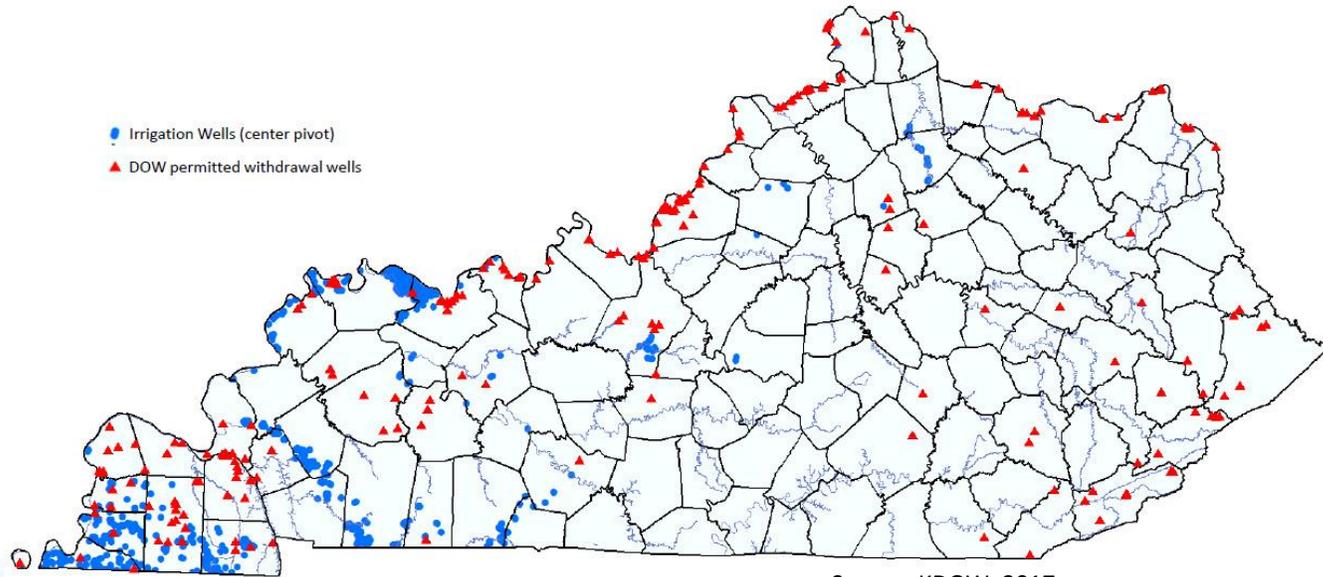
(11) WELL COMPLETION:  
 Feet Below Surface Hole Casing Inside Casing Type  
 From To Diameter (in.) Diameter (in.)  
**0' 22' 12 1/2" 8 5/8" / 8 7/8" steel**

(12) LITHOLOGIC LOG:  
 Feet Below Surface Description Water Quality and GPM  
 From To  
**0' 9' Topsoil surface**  
**9' 21' sand stone**  
**22' 23' Breaks & Fractures @ 2000 ft. +**  
**23' 27' yellow sandstone + coal**  
**27' 32' Gray sandstone**  
**32' Break & Fractures near water + G.P.M.**  
**39' 73' sand stone mix shale**  
**74' Big water + Break & Fractures + G.P.M.**  
**75' 132' mostly shale about all**  
**132' 142' Breaks & Fractures (B.G.) water + G.P.M.**  
**143' 172' Gray sandstone**  
**172' 150' " " mix shale**  
**150' 225' Light white sand**  
**225' 255' Good white sand & some pebbles + G.P.M.**  
**255' 263' Best white sand, pebbles + G.P.M.**

(13) COMMENTS: **ww permit 3316 - DC**

# Aquifer Designation Project—Priority Areas

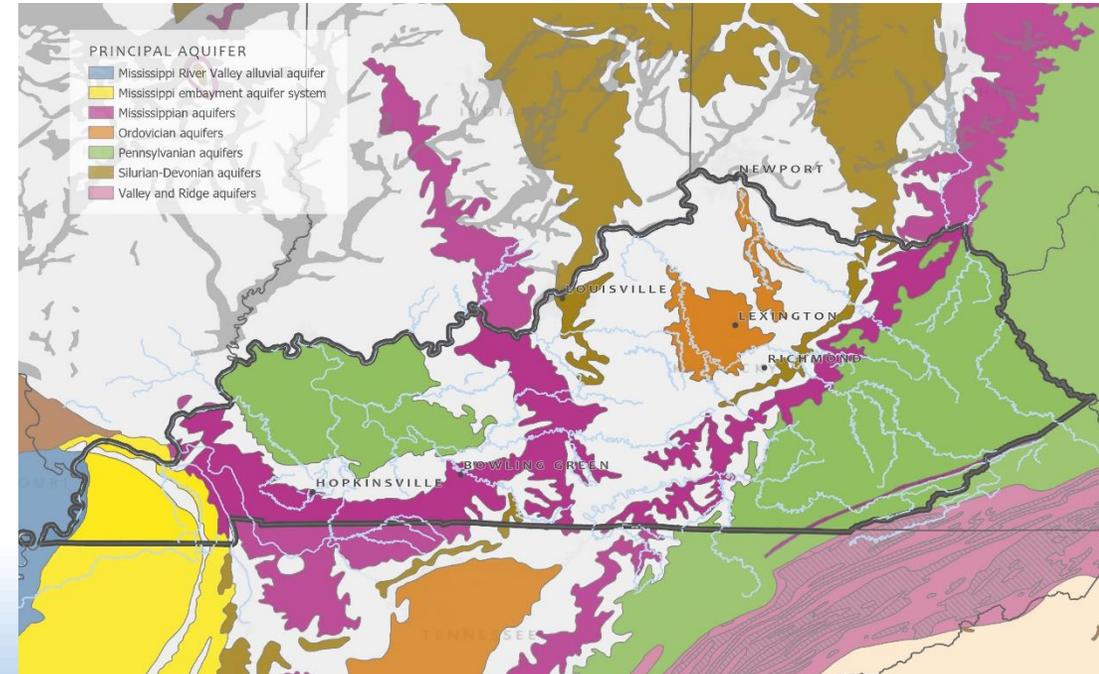
From the State's (KDOW) Perspective:



Source: KDOW, 2017

Locations where groundwater withdrawals are presently regulated (withdraw  $>10,000$  gpd), or are likely to see increasing withdrawals for public water supplies or agricultural production.

From the National (USGS) Perspective:



Geographically extensive (regional) aquifer systems with greatest water well densities and groundwater withdrawals.

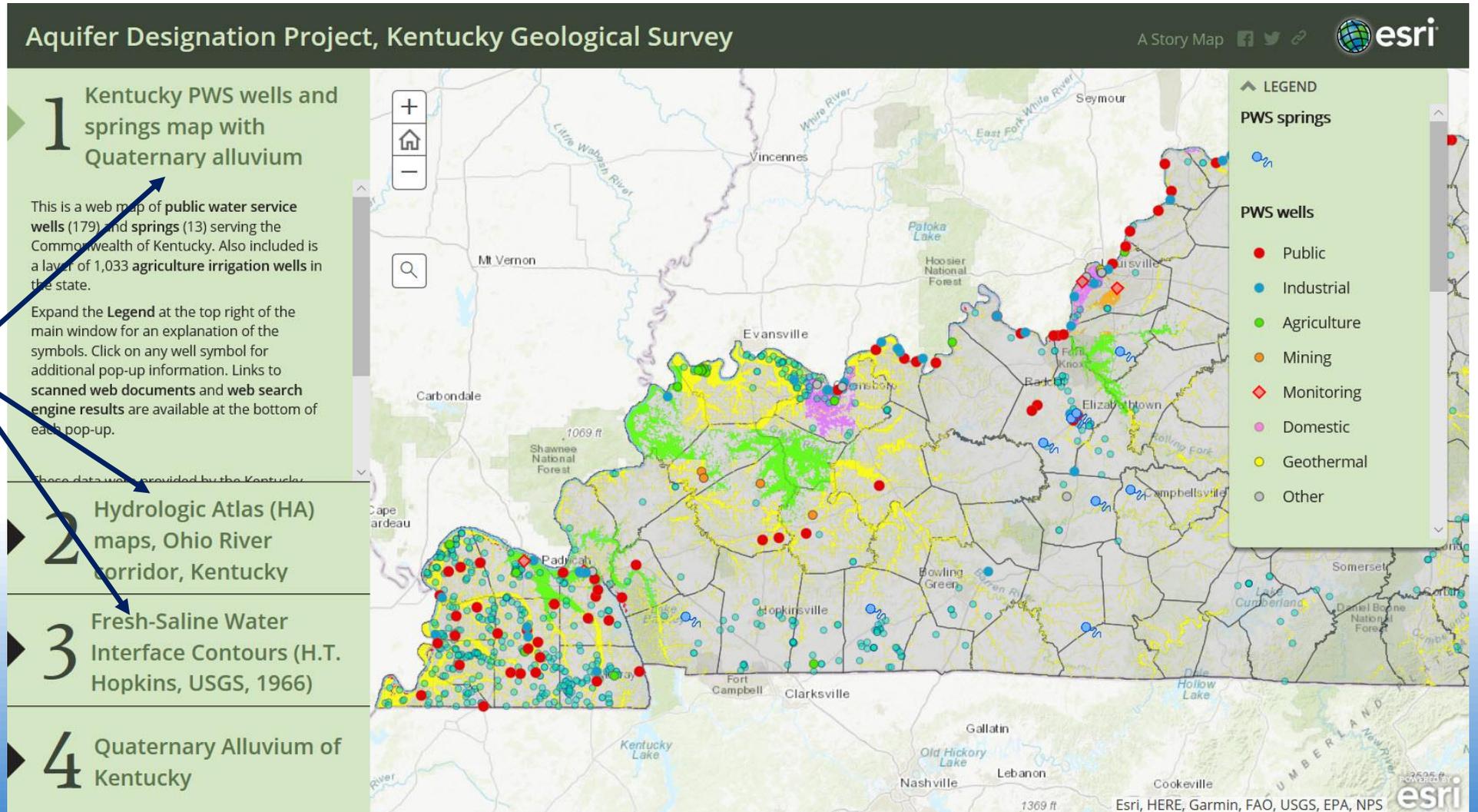
# Products We Produced for the Project...

PWS Wells and Springs_for Online Map_Aug7-2019_V1 - Excel							
USGS National Aquifer Name	National Aquifer Code	Kentucky Local, Primary, or Principal Aquifer Name		Local Aquifer Code			
Alluvial aquifers	N100ALLUVL	Lacustrine and fluvial deposits		112LAFL			
		Alluvium		111ALVM			
		Alluvium along Mississippi and Ohio River tributary streams		111AMOT			
		Ohio River alluvium aquifer		111OHOA			
Mississippi River Valley alluvium	N100MSRVVL						
Mississippian Embayment aquifer system	S100MSEMBM	Claiborne and Wilcox Undifferentiated		124CBWX			
		Upper Claiborne aquifer		124CLBR			
		Middle Claiborne aquifer		124CLBR			
		Lower Claiborne-Upper Wilcox aquifer		124CBWX			
		Middle Wilcox aquifer		124WLCX			
		Lower Wilcox aquifer		124WLCX			
		McNairy aquifer		211MCNR			
Pennsylvanian aquifers	N300PNSLVN	Western Coalfield:		Eastern Coalfield:			
		Shelburn Fm	321SLBR	Four Corners Fm	324FRCR		
				Pikeville Fm	324PKVL		
		Tradewater Fm	321TRDT	Corbin Sandstone	327CRBN		
Mississippian aquifers	N500MSSPPI	Ste. Genevieve - St. Louis Limestone Undifferentiated		333SGSL			
		Ste. Genevieve Limestone		333SGVV			
		St. Louis Limestone		333STLS			
		Fort Payne		337FTPN			
Silurian-Devonian aquifers	N400SLRDVN						
Ordovician aquifers	N400ORDVCN	Lexington Limestone		364LXNG			

A	B	C	D	E	F	G	H
1	AKGWA Site	Well Identifier	LatDecimal	LongDecima	County	Quad Name	Physiographic reg
2	00000330 US Army Garrison - Fort Knox	Well 11; Old Well 12AA-2	37.996667	-85.977778	Hardin	Fort Knox	Ohio River Alluviu
3	00000815 Owensboro Country Club	WELL 1, Main well	37.737222	-87.105278	Daviess	Sutherland	Western Kentucky
4	00002078 Gallatin Terminal Co (Former Clean Coal Term	WELL 01	38.755744	-85.017353	Gallatin	Vevay North	Ohio River Alluviu
5	00004032 First Trust Center	WELL 01	38.253611	-85.759722	Jefferson	New Albany	Ohio River Alluviu
6	00004073 Hickory Water District	WELL 02	36.812778	-88.649167	Graves	Hickory	Jackson Purchase
7	00004253 Clopay Corp	WELL 03A	38.772972	-83.996111	Bracken	Higginsport	Ohio River Alluviu
8	00004255 Kosmos Cement Co	WELL 02	38.035000	-85.908333	Jefferson	Kosmosdale	Ohio River Alluviu
9	00004466 Hawesville Water Works	WELL 03 (BACKUP)	37.903333	-86.750833	Hancock	Tell City	Western Kentucky
10	00004893 Chesapeake & Ohio Railway - Stevens Yard	WELL 01	39.038890	-84.392780	Campbell	Newport	Ohio River Alluviu
11	00004998 Ballard Wildlife Management Area	WELL 01	37.160556	-89.042500	Ballard	Olmsted	Jackson Purchase
12	00005014 Ledbetter Water District	FRONT WELL 04	37.047500	-88.472500	Livingston	Little Cypress	Jackson Purchase
13	00005067 North Marshall Water District - Plant 1	Well 1	36.948125	-88.304527	Marshall	Briensburg	Jackson Purchase
14	00005879 Owensboro Grain Co	WELL 03	37.774444	-87.100278	Daviess	Owensboro	Western Kentucky
15	00006211 North Marshall Water District	Well 7	36.976616	-88.294341	Marshall	Briensburg	Jackson Purchase
16	00006303 Wildlife Management Area	WELL 01	36.795278	-89.114722	Carlisle	Arlington	Jackson Purchase
17	00006430 Northern Ky Aggregates Processing Plant	WELL 01	39.045361	-84.884861	Boone	Aurora	Ohio River Alluviu
18	00006673 Hawley Products	WELL 01	37.096390	-88.621390	McCracken	Paducah East	Jackson Purchase
19	00006782 Captains Quarters Yacht Club	WELL 03	38.328611	-85.640833	Jefferson	Jeffersonvil	Ohio River Alluviu
20	00006852 Hardin County Water District 1 - West Point W	WELL 6	37.993889	-85.999167	Hardin	Fort Knox	Ohio River Alluviu
21	00006857 Dow Corning Corp	SW-01	38.710335	-85.104520	Carroll	Vevay South	Ohio River Alluviu
22	00007140 Birkle Water Supply	0004-9445	39.070833	-84.865556	Boone	Lawrenceebu	Ohio River Alluviu
23	00008446 Eddyville Water Dept	WELL 01	37.075626	-88.103508	Lyon	Eddyville	Mississippian Plat
24	00009226 Lubrizol Advanced Materials (former B F Goodrich Facility)		38.221389	-85.826389	Jefferson	Louisville W	Ohio River Alluviu
25	00009240 World Source Coil Coating - Plating Mill	WELL 02	37.930280	-86.775000	Hancock	Tell City	Ohio River Alluviu
26	00010283 Wallins Water System	WELL 01	36.841944	-83.428056	Harlan	Wallins Cre	Eastern Kentucky
27	00011038 Coastal Coal Co Site	WELL 01	37.050000	-83.000000	Letcher	Heath	Jackson Purchase
28	00012152 Sedalia Water District	WELL 02	36.642167	-88.606389	Graves	Farmington	Jackson Purchase
29	00014278 Wisers Landing Well Field	WELL 04	38.567655	-85.404862	Trimble	Bethlehem	Ohio River Alluviu
30	00014526 KY Fish-Wildlife - Sloughs WMA	Well 04	37.847778	-87.750000	Henderson	Wilson	Western Kentucky
31	00014530 KY Fish-Wildlife - Sloughs WMA	Well 07	37.863889	-87.759444	Henderson	Smith Mills	Western Kentucky
32	00016933 Country Club of Paducah	WELL 01	37.045000	-88.706940	McCracken	Paducah We	Jackson Purchase
33	00019489 Beaver Dam Municipal Water & Sewer	WELL 02	37.396604	-86.874903	Ohio	Hartford	Western Kentucky
34	00019827 Lewisport Municipal Water Works	Well 03	37.938056	-86.896111	Hancock	Lewisport	Ohio River Alluviu
35	00019834 Benton Water and Sewer System	Well 03 (former Well 05)	36.860833	-88.343333	Marshall	Hardin	Jackson Purchase

# To Make Aquifer Designation Data More Useful We Have Developed a New Interactive Webpage



Content for the Aquifer Designation Webpage Will Consist of a Series of On-Line ArcGIS Web Maps.

# Features of Interactive Web Map for PWS Wells and Springs

**Public Water Service well**

AKGWA number	00041466
Site	Jonathan Creek Water District
Well identifier	WELL 01B
Latitude	36.851670
Longitude	-88.242500
County	Marshall
Quad name	Fairdealing
Physiographic region	Jackson Purchase
Surface elevation	430
Total depth	268
Reported yield (gpm)	1000

**Water Well & Spring Documents (AKGWA #00041466)**

File list - click name to view/download:

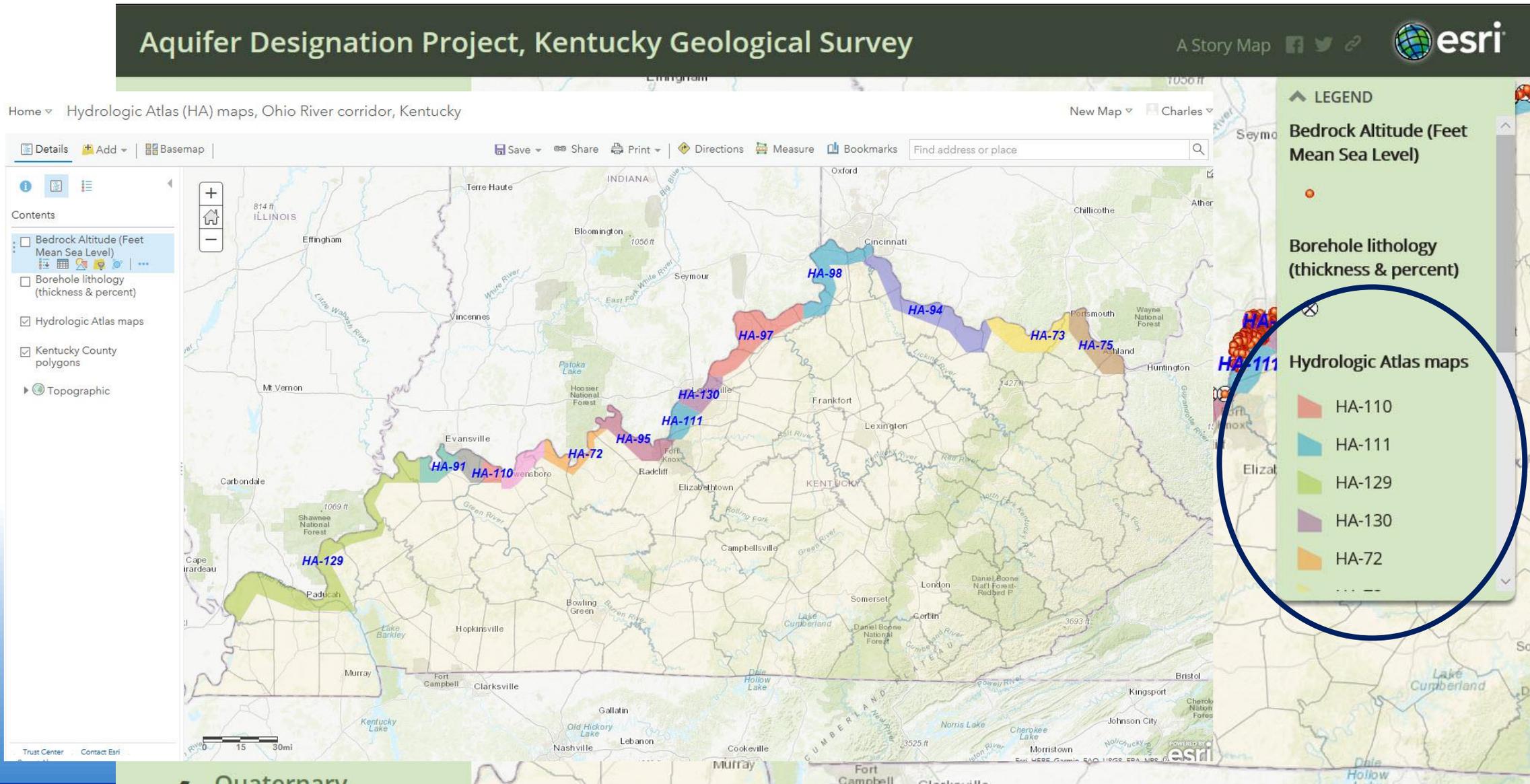
- [2001-05-01\\_marshall\\_fairdealing\\_0212\\_bacterial analysis\\_ \(01180rdep092976\).pdf](#) (200 KB)
- [2001-05-01\\_marshall\\_fairdealing\\_0212\\_correspondence, including nod\\_ \(01180rdep092978\).pdf](#) (236 KB)
- [2001-05-01\\_marshall\\_fairdealing\\_0212\\_dep=4045 water well record\\_ \(01180rdep092968\).pdf](#) (303 KB)
- [2001-05-01\\_marshall\\_fairdealing\\_0212\\_drilling log, non-dow format\\_ \(01180rdep092972\).pdf](#) (128 KB)
- [2001-05-01\\_marshall\\_fairdealing\\_0212\\_map showing site location\\_ \(01180rdep092980\).pdf](#) (218 KB)
- [2001-05-01\\_marshall\\_fairdealing\\_0212\\_well construction diagram\\_ \(01180rdep092974\).pdf](#) (167 KB)

[Zip All Documents for Download \(.zip file\)](#)

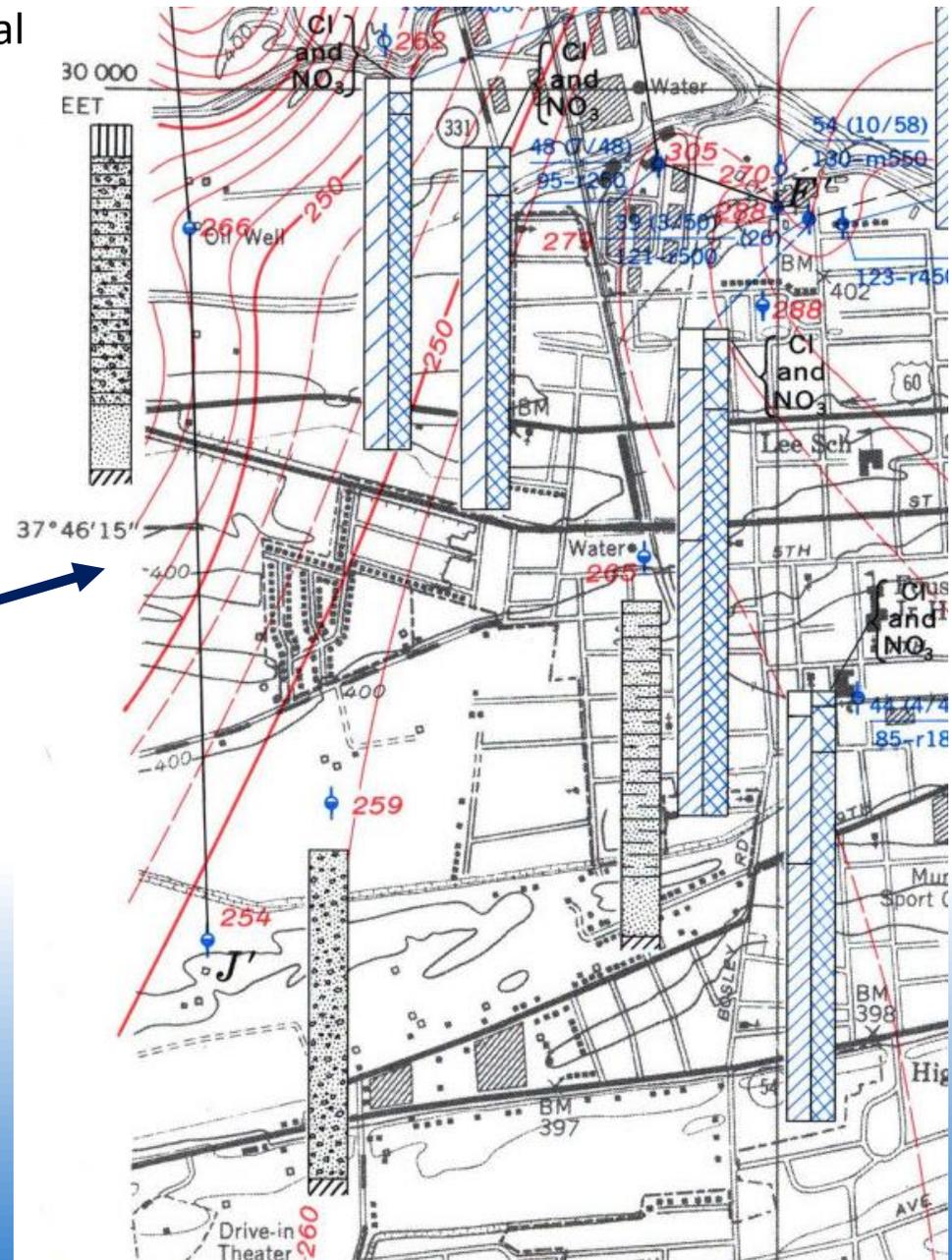
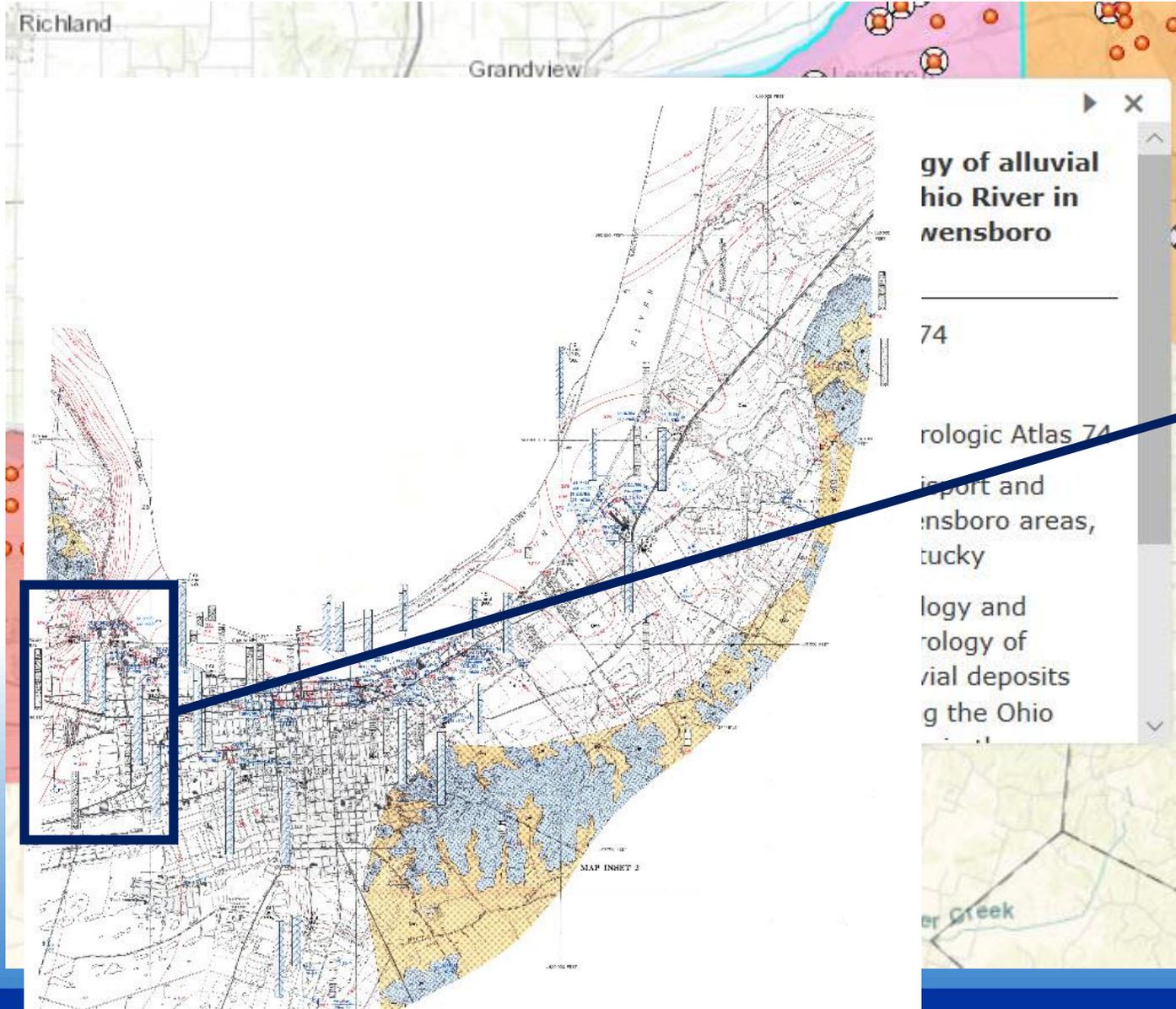
[More info](#)

[More info](#)

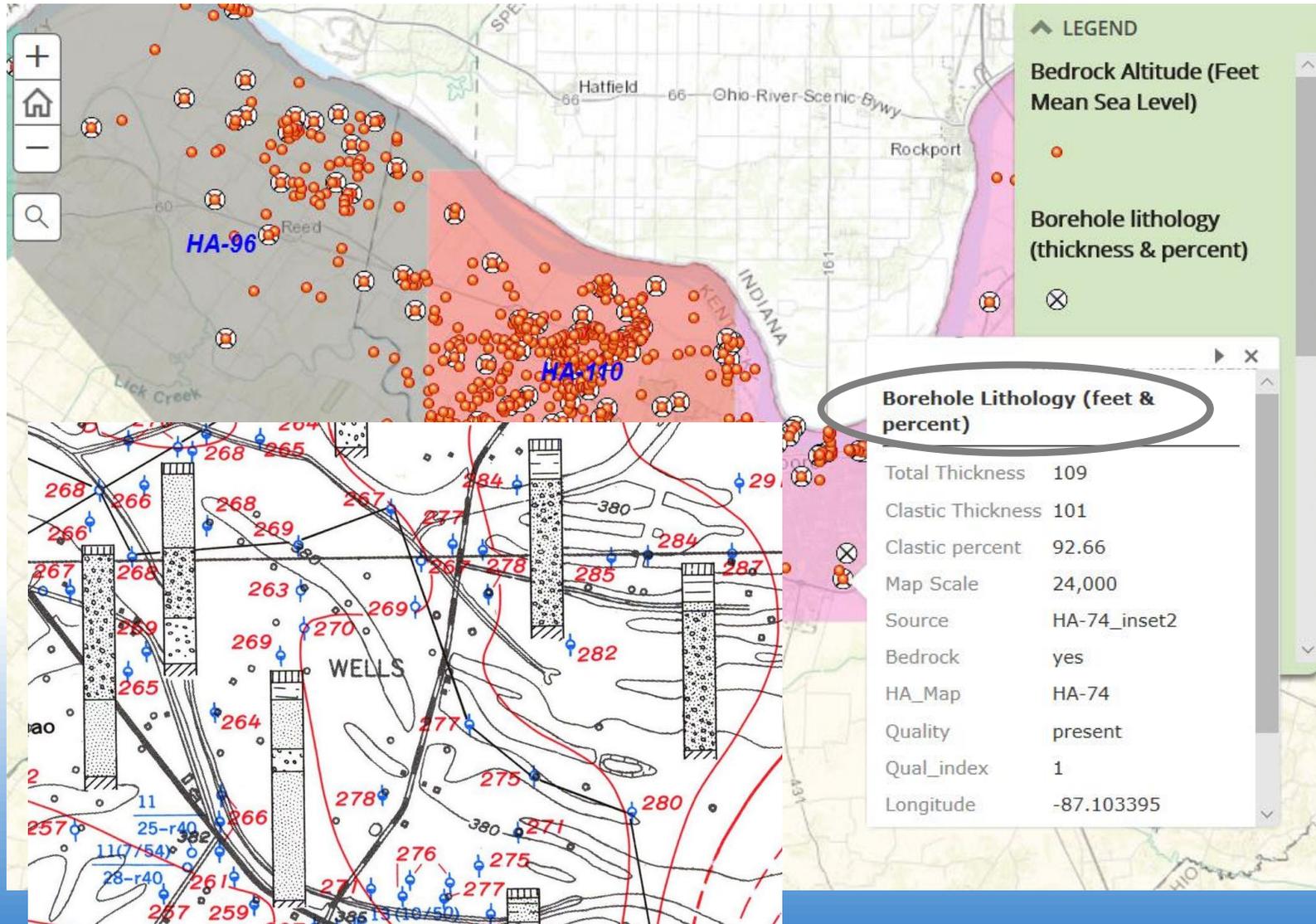
# Content of Ohio River Alluvial Aquifer and Hydrologic Atlas Web Map:



# Links Provided to Hi-Resolution PDF of HA Map Plate for Ohio River Alluvial Aquifer and USGS Publication Warehouse (Source)

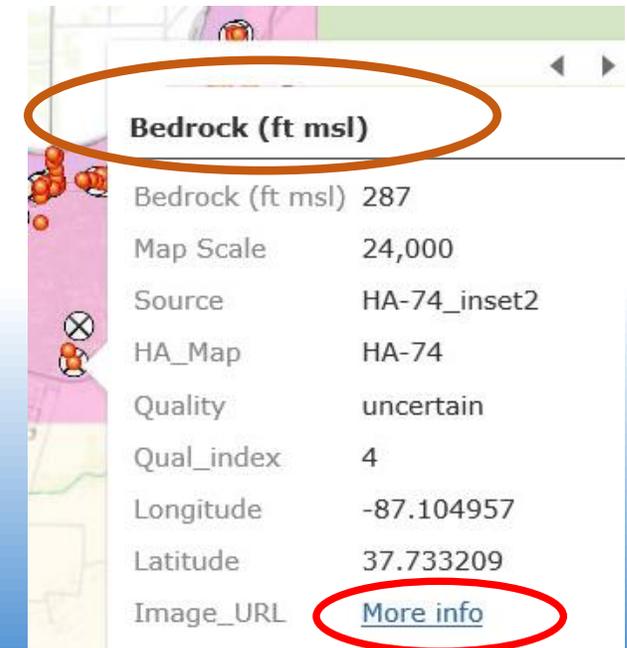


# Data Extracted from HAs for Ohio River Alluvial Aquifer Web Page



➤ One benefit of compiling these data: Useful in estimating and mapping aquifer properties along OAAA:

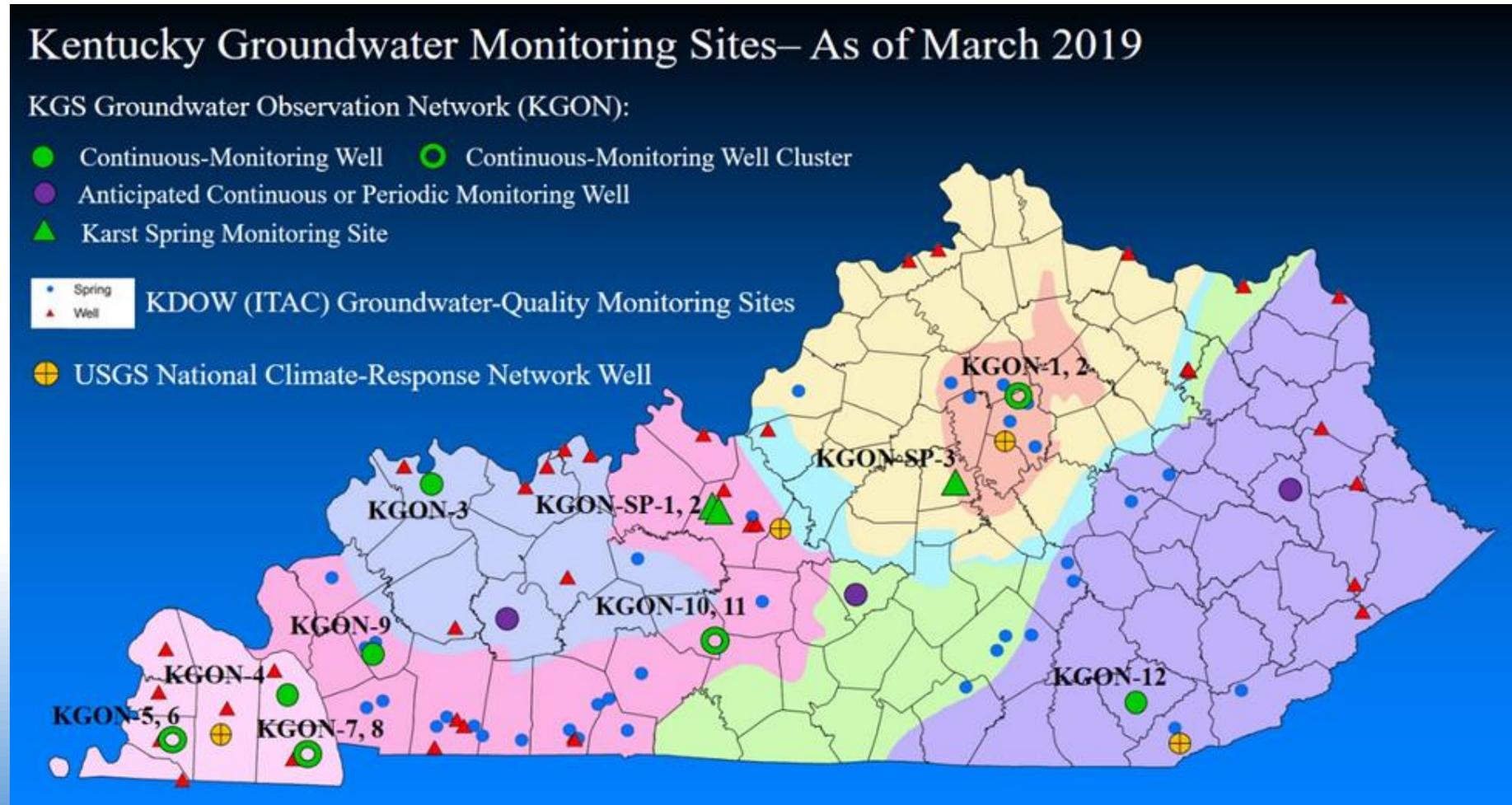
- $T = K_{(H)} \times \text{thickness}$
- $K_{(H)}$  can be measured/estimated for sand, gravel, etc.



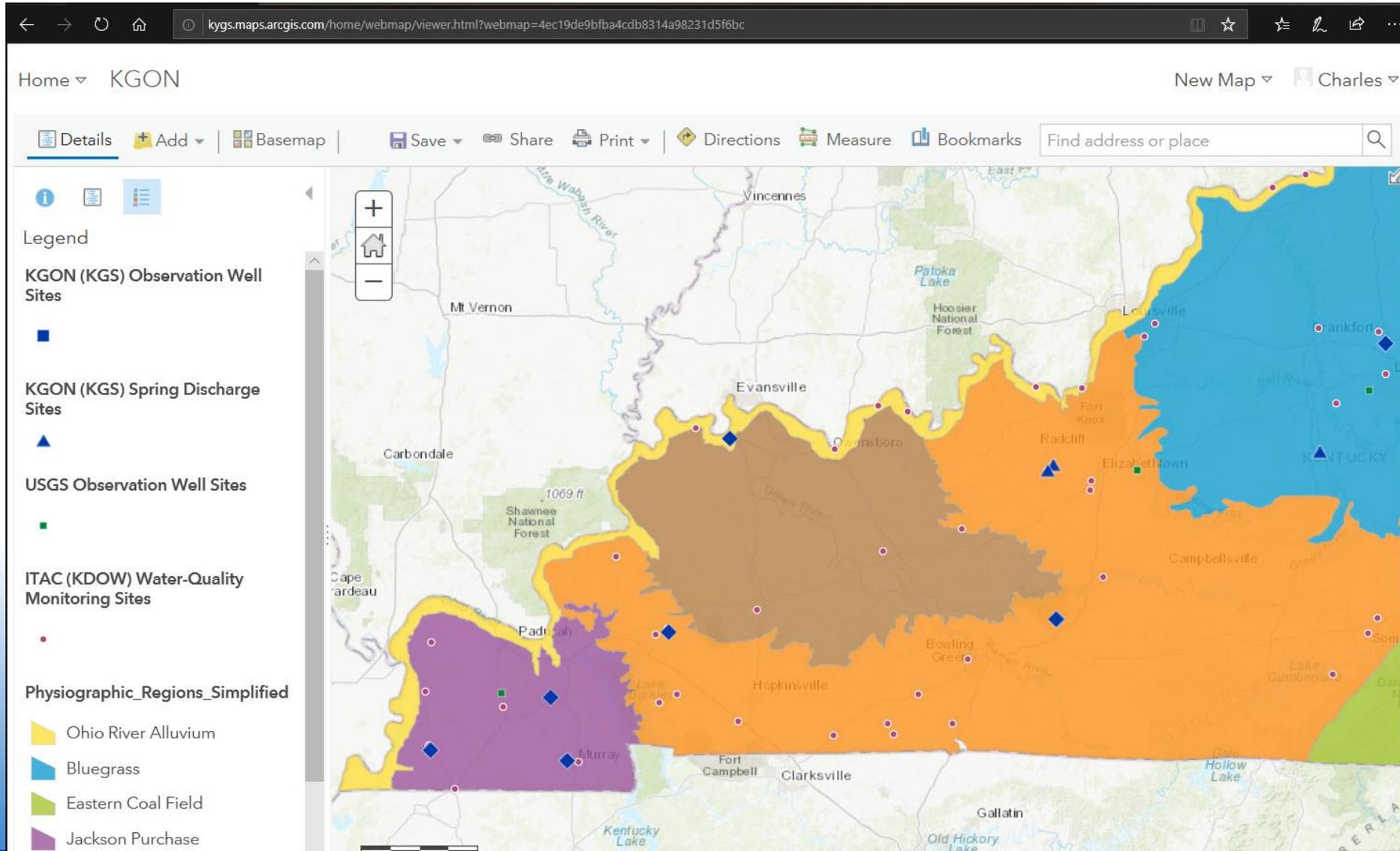
# Groundwater Monitoring Network Update

## KGS Kentucky Groundwater Observation Network:

- At present, active KGON sites include
  - 12 observation wells.
  - 3 karst springs.
- A new webpage has been created to provide public access to all active groundwater monitoring data.



# New Interactive Web Page Developed for All Active Groundwater Monitoring Networks:



# KGS KGON Well Info and Data Accessed Via Webpage

(1 of 3)

Longitude	-88.35
Name	MSU 1 (deep)
County	Calloway
Surface Elevation	576
Total Depth (ft below surface)	350
Aquifer Type	semi-consolidated sand
Aquifer Name	McNairy
Aquifer Code	211MCNR
Purpose	Ambient Trend
Start of Record	11/10/2015
Link	<a href="#">More info</a>

[Zoom to](#) [Get Directions](#)



# KGS Webpage Links to Other GW Monitoring Networks– To USGS Sites

kygs.maps.arcgis.com/home/webmap/viewer.html?webmap=4ec19de9bfba4cdb8314a98231d5f6bc

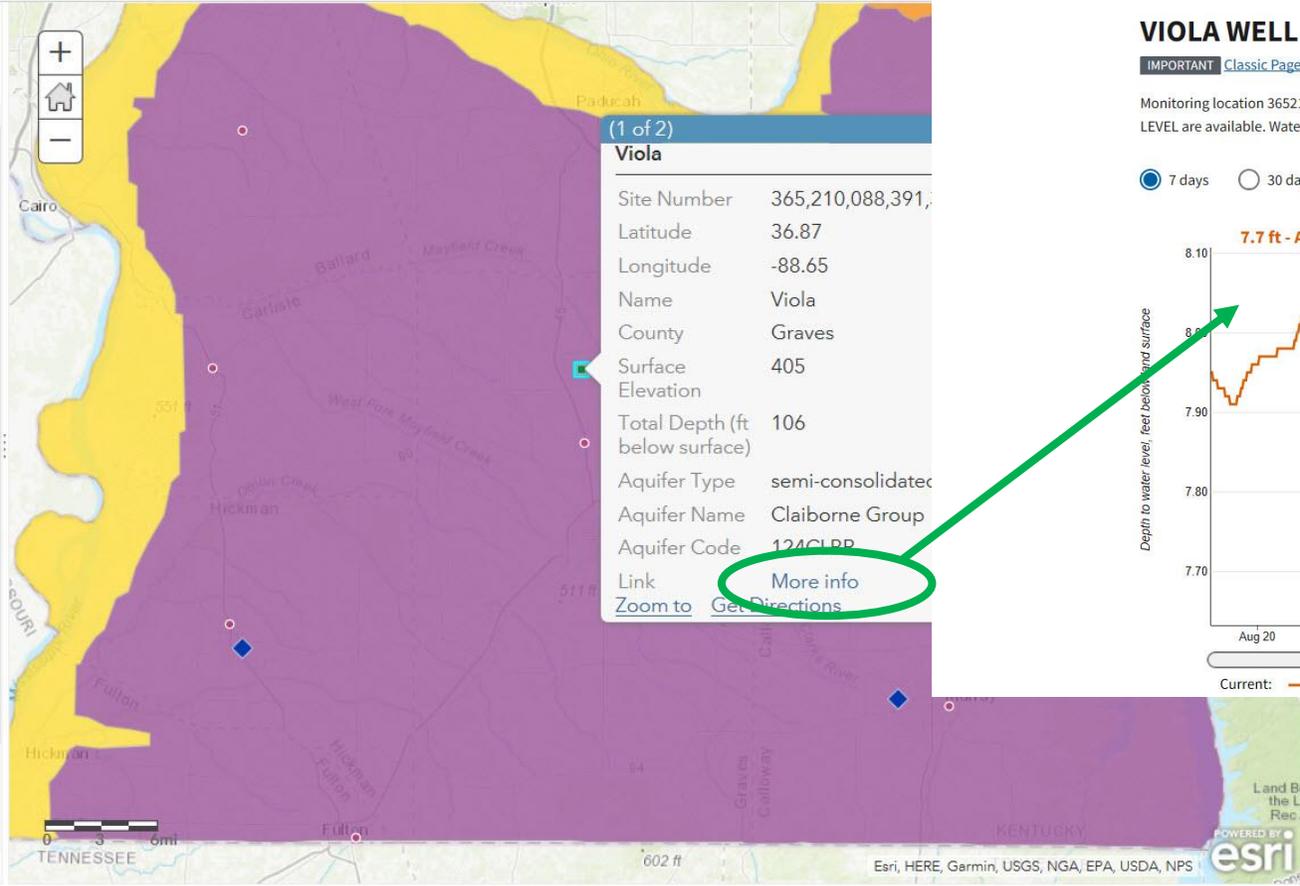
Home ▾ KGON

Details Add ▾ Basemap Save Share Print ▾ Directions Measure Bookmarks Find a

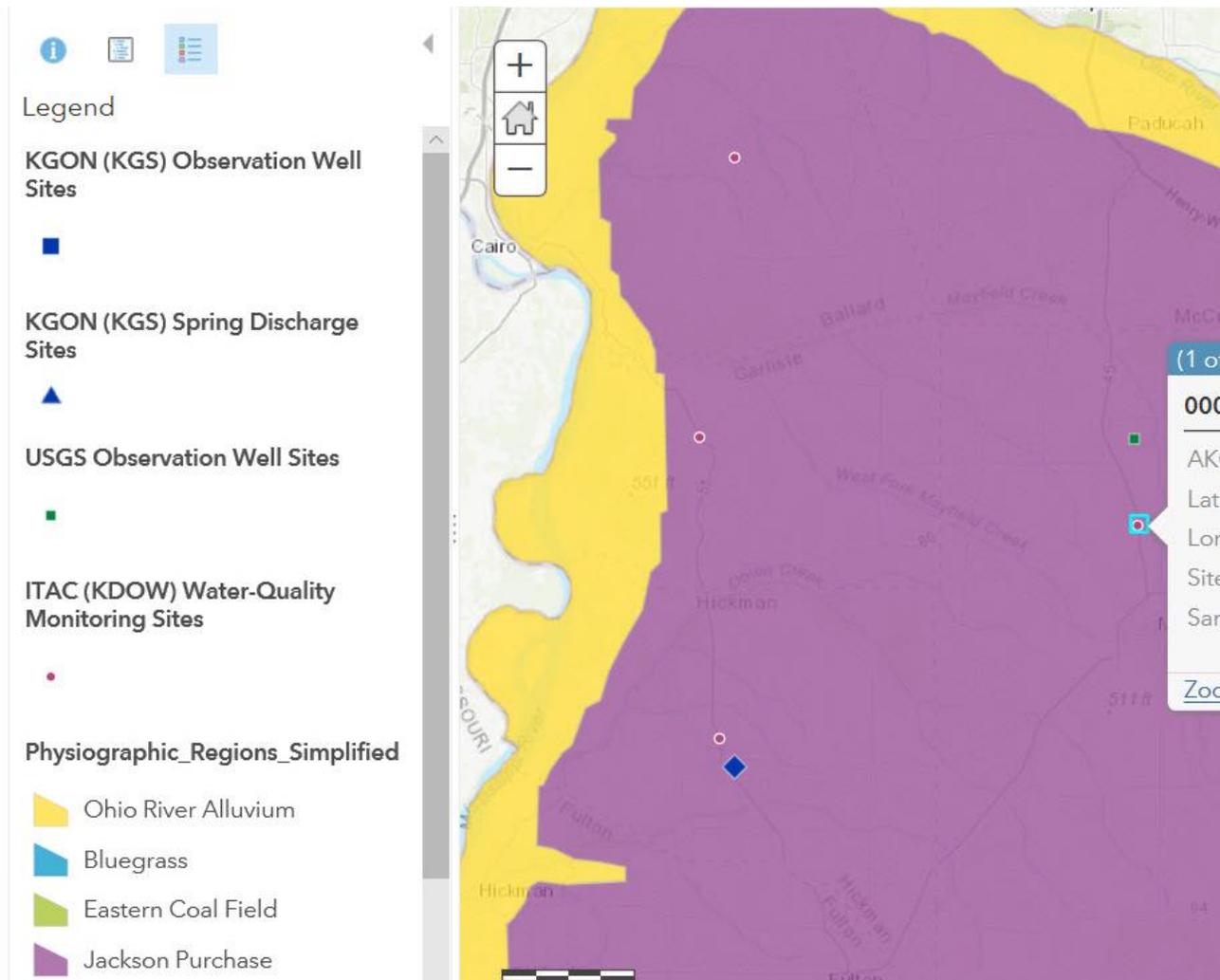
Legend

- KGON (KGS) Observation Well Sites
- KGON (KGS) Spring Discharge Sites
- USGS Observation Well Sites**
- ITAC (KDOW) Water-Quality Monitoring Sites
- Physiographic\_Regions\_Simplified
  - Ohio River Alluvium
  - Bluegrass
  - Eastern Coal Field
  - Jackson Purchase

Trust Center Contact Esri Report Abuse



# KGS Webpage Links to Other GW Monitoring Networks– To ITAC (DOW) GWQ Sites



Home / Water

## Kentucky Interagency Groundwater Monitoring Network

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 151.625). 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 on Groundwater (ITAC), which is composed of State, Federal, and university representatives. The ITAC was established by KRS 151.629.

### SITE TYPE

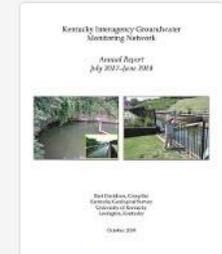
- Spring
- ▲ Well
- Eastern Kentucky Coal Field
- Eastern Pennyroyal
- Inner Bluegrass
- Knobs
- Outer Bluegrass
- Purchase
- Western Kentucky Coal Field
- Western Pennyroyal



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

Map No.	AKGWA No.	Sample Frequency	Map No.	AKGWA No.	Sample Frequency	Map No.	AKGWA No.	Sample Frequency
1	00000811	5Q	21	00061854	Q	41	90000798	M
2	00007133	5Q	22	00061858	Q	42	90000854	2Q
3	00012311	Q	23	00065002	Q	43	90001020	Q
4	00014293	2Q	24	00065149	Q	44	90001051	5Q
5	00019489	5Q	25	00068511	Q	45	90001134	Q
6	00028100	5Q	26	00069574	Q	46	90001137	Q

### Annual Reports



Annual Reports in KGS Publication & Maps Catalog

### Interagency Technical Advisory Committee on Ground Water

- » Kentucky Cabinet for Health and Family Services
- » Kentucky Department for Natural Resources
- » Kentucky Department of Agriculture
- » Kentucky Division of Conservation
- » Kentucky Division of Forestry
- » Kentucky Division of Mine Reclamation and Enforcement
- » Kentucky Division of Waste Management
- » Kentucky Division of Water
- » Kentucky Department for Environmental Protection
- » U.S. Geological Survey, Ohio-Kentucky-Indiana Water Science Center
- » University of Kentucky College of Agriculture, Food, and Environment
- » University of Kentucky, Kentucky Geological Survey
- » University of Kentucky Water Research Institute

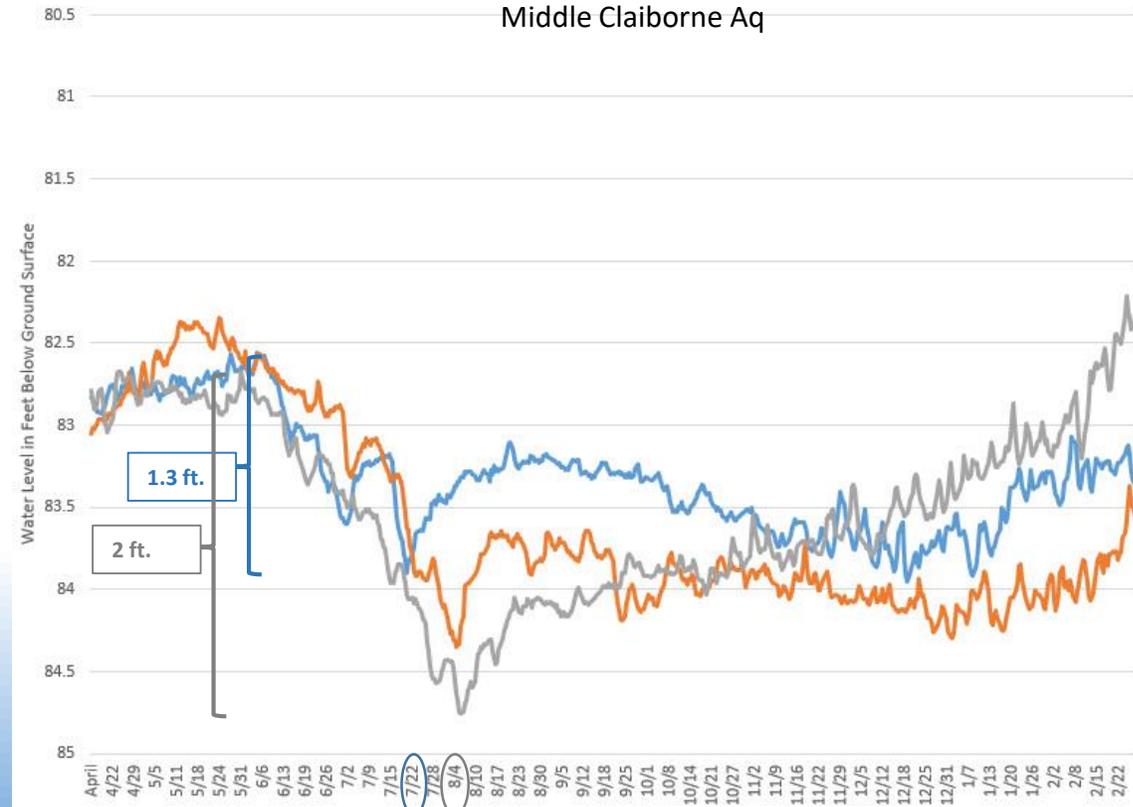
The network has produced the following annual summaries and descriptions of network activities:

### Monitoring Network Framework Document

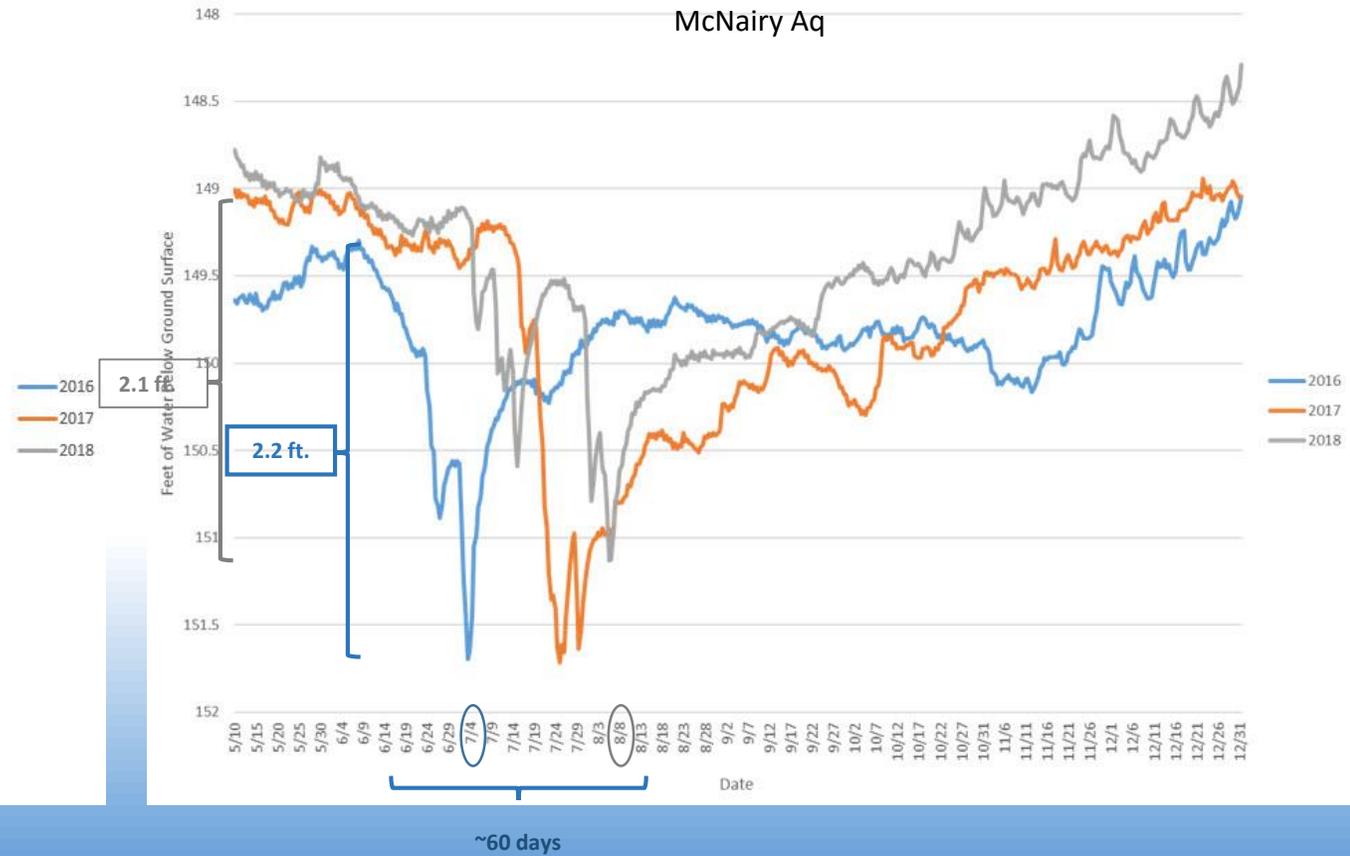
- » Framework for the Kentucky Groundwater Monitoring Network: A Report of the Interagency Technical Advisory

# Interesting Water-Level Trends Emerging in KGON-JPA Deep Wells

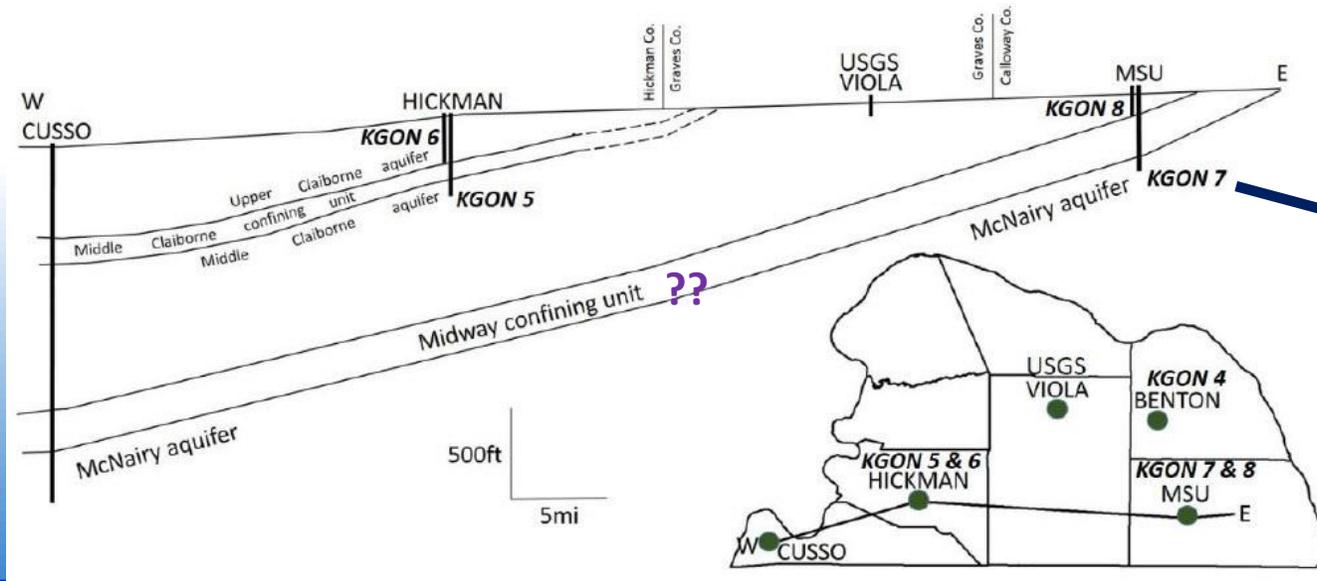
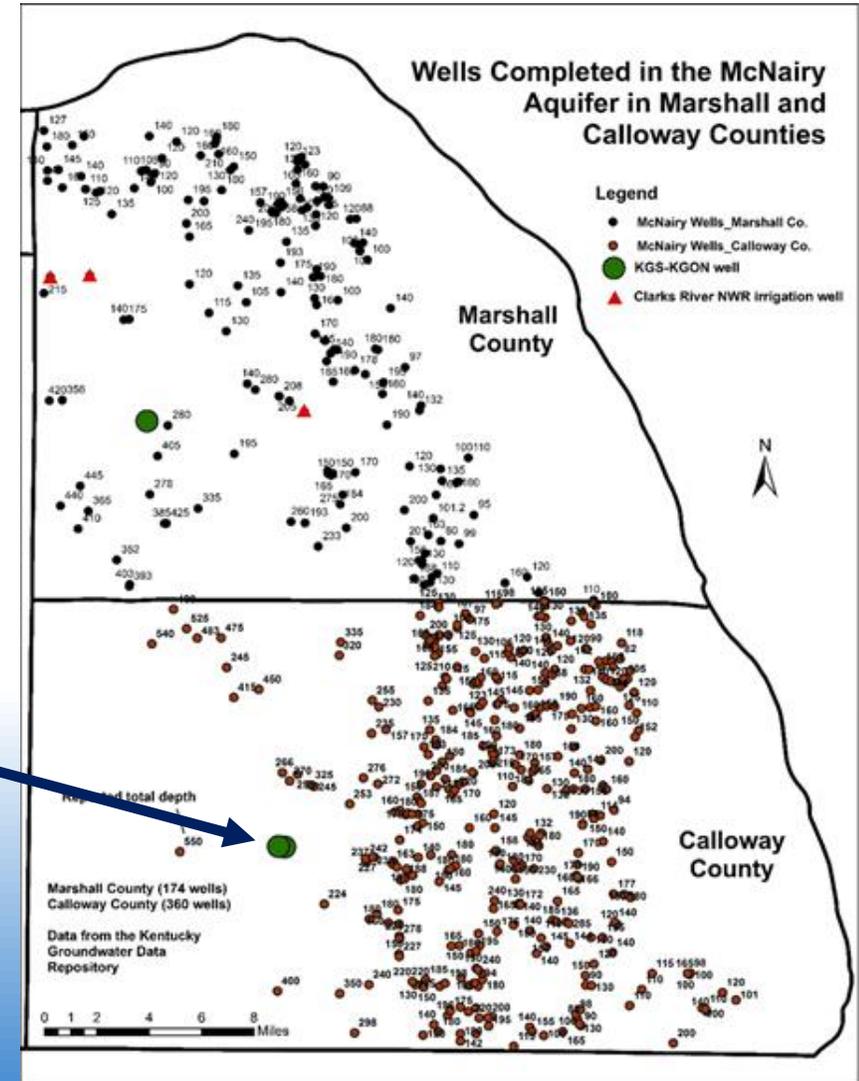
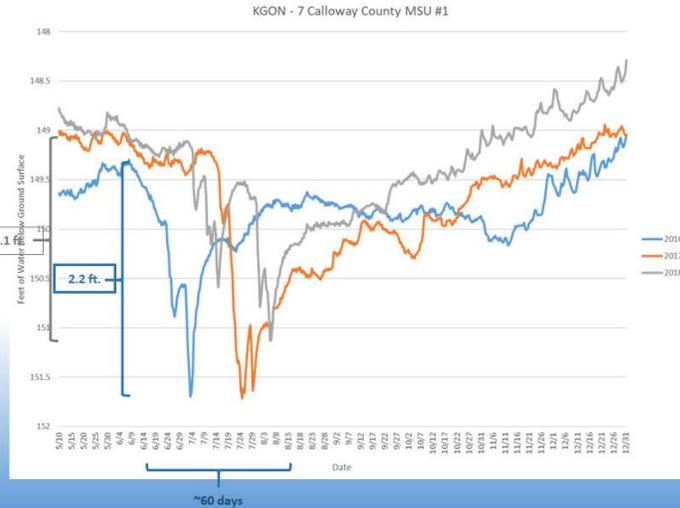
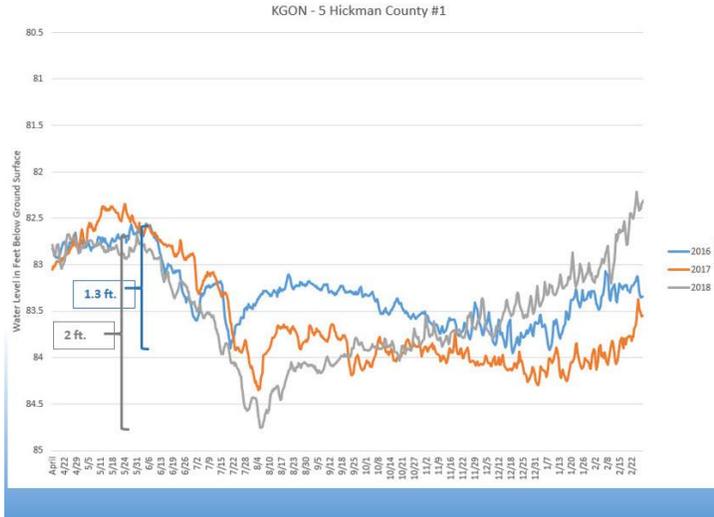
KGON - 5 Hickman County #1  
Middle Claiborne Aq



KGON - 7 Calloway County MSU #1  
McNairy Aq

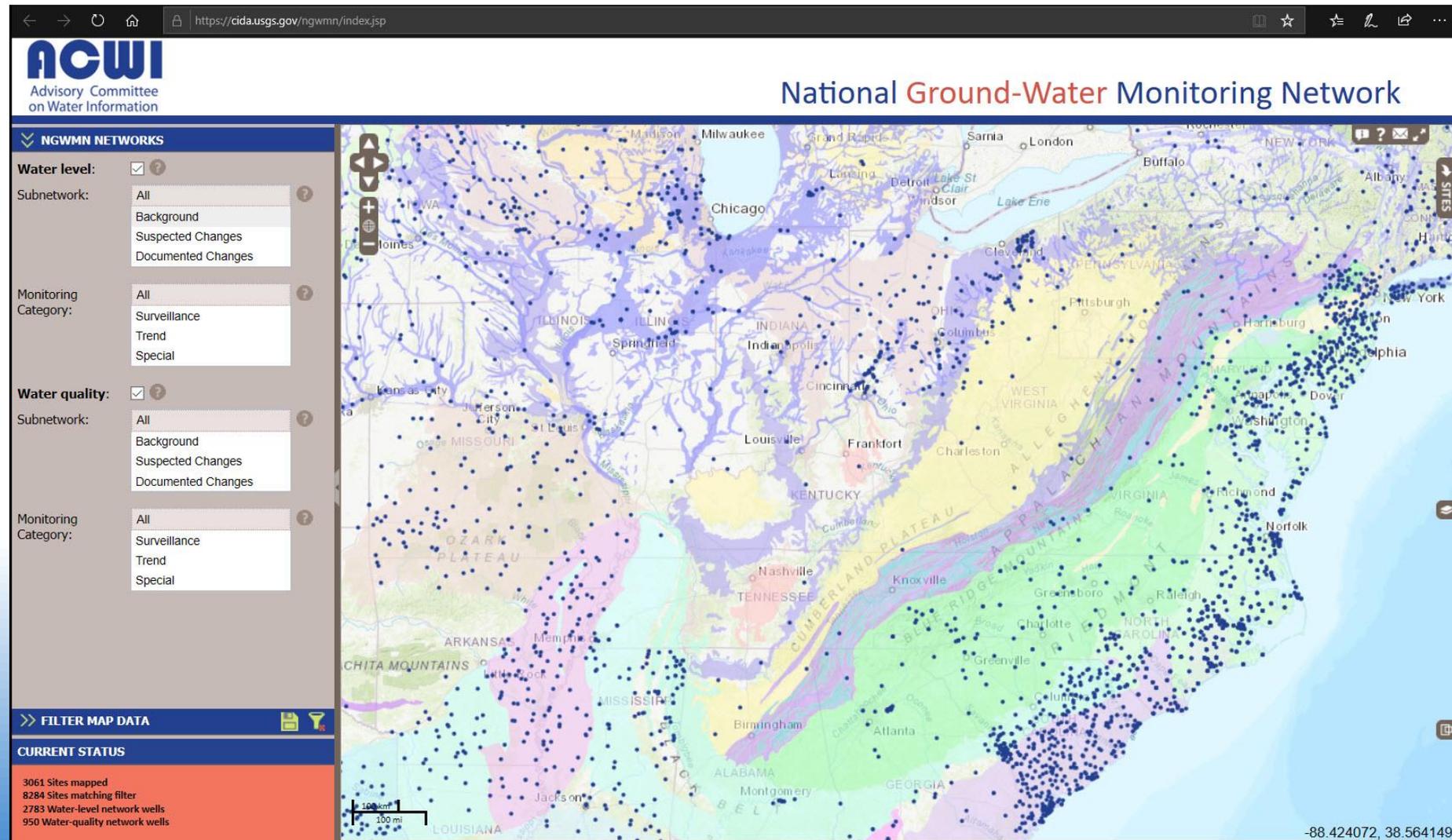


# Question: What Are the Causes of This Regional Pattern?



# Inclusion of KGS KGON sites in the National Groundwater Monitoring Network

- Grant awarded by USGS in spring 2019.
- 2-year project to set-up as new data provider will begin in December, 2019.
- Will contribute water-level data continuously measured at 8 KGS-KGON sites.
- Status as NGMN data provider opens door to future funding support for ground-water monitoring network enhancement.



# Ongoing and Future Activities

- Complete the current KGS Water Website revisions and “go live” with Groundwater Monitoring Networks and Aquifer Designation web page content.
- Add more content to the Aquifer Designation web page:
  - Continue working content for the Ohio River alluvial aquifer page.
  - Complete the data set needed for irrigation wells.
  - Physical hydrogeology and characteristics of Kentucky aquifers.
  - Aquifer test data.
- Karst hydrogeological database and webpage.
- Develop new interactive tools to improve groundwater data management, visualization, and analysis.