Water Monitoring Activities in Kentucky: Progress and Needs

Kentucky Farm Bureau

January 28, 2016

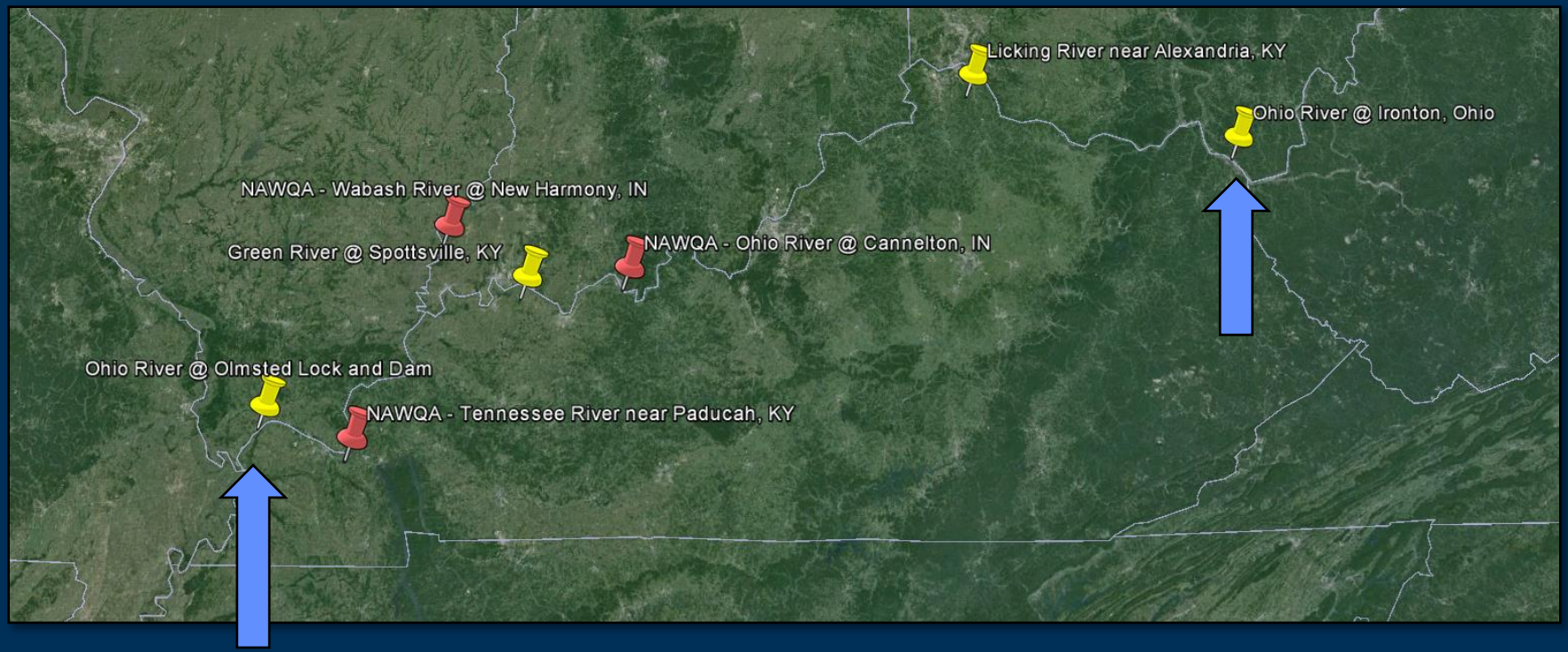
Surface-water quality

USGS

Current USGS Site Locations –

"What's coming in and what's going out?"

Incoming



Outgoing

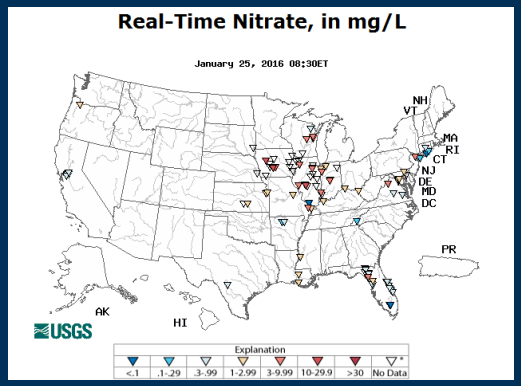
Yellow – Real-time USGS Super Gage

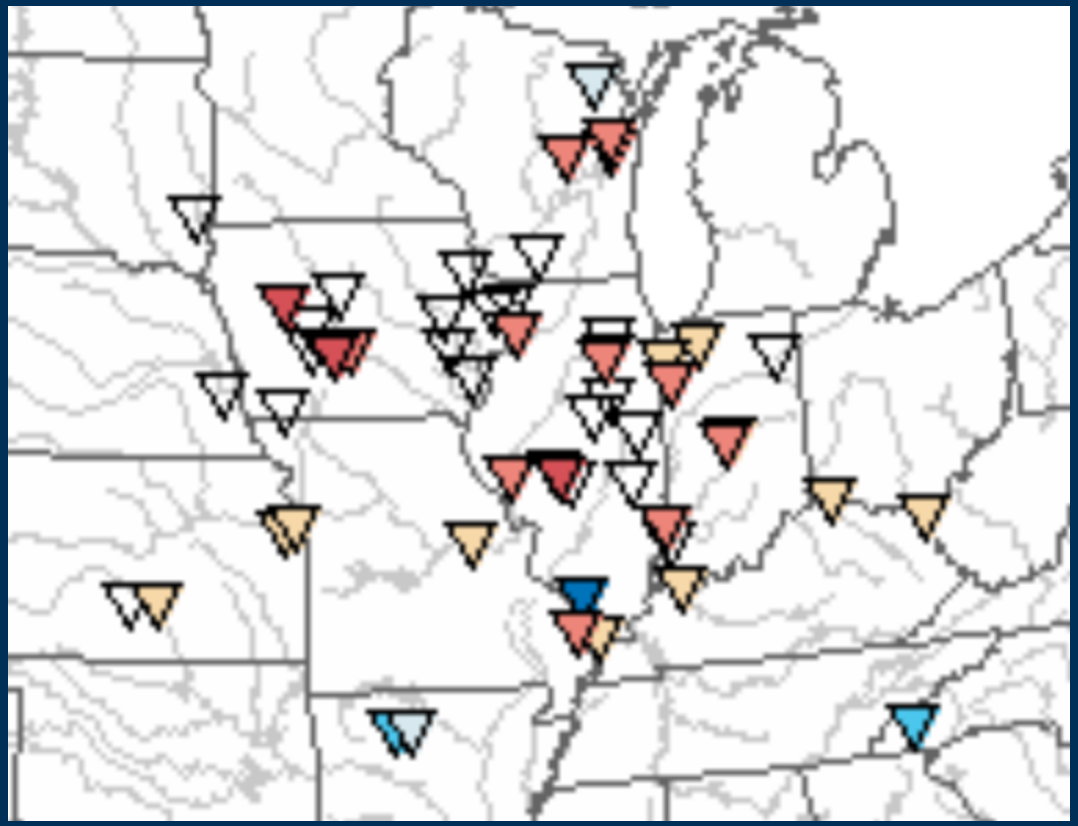
Red – USGS NAWQA sampling site

USGS

National Perspective

KY sites currently ~ 1 mg/L





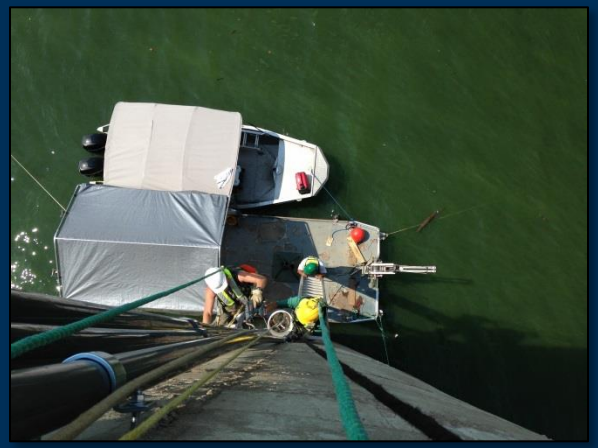
Real-time data as of 1/25/2016

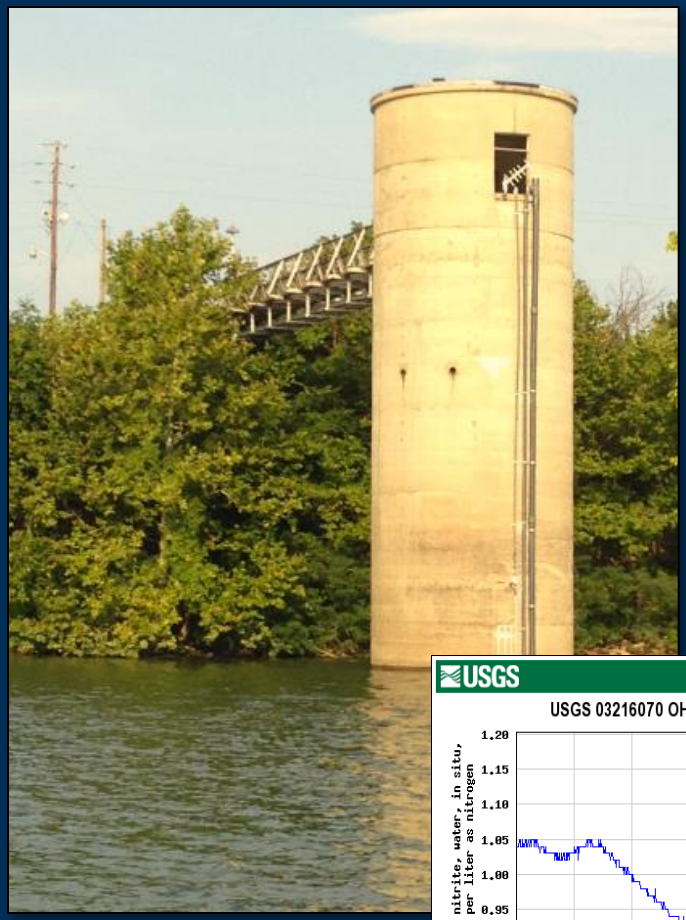
Explanation							
<.1	.1-.29	.3-.99	1-2.99	3-9.99	10-29.9	>30	No Data

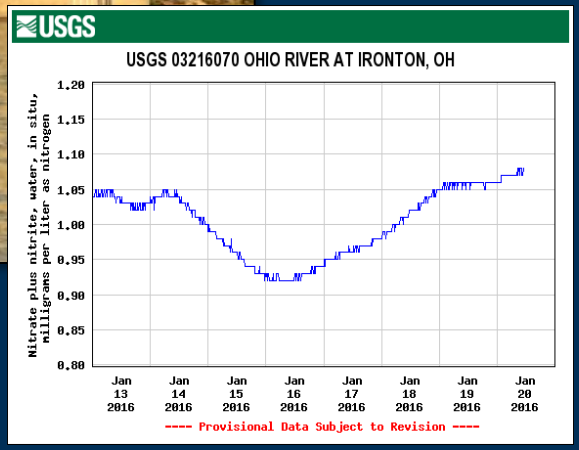
USGS

http://waterwatch.usgs.gov/wqwatch/

Ohio River at Ironton, OH







USGS

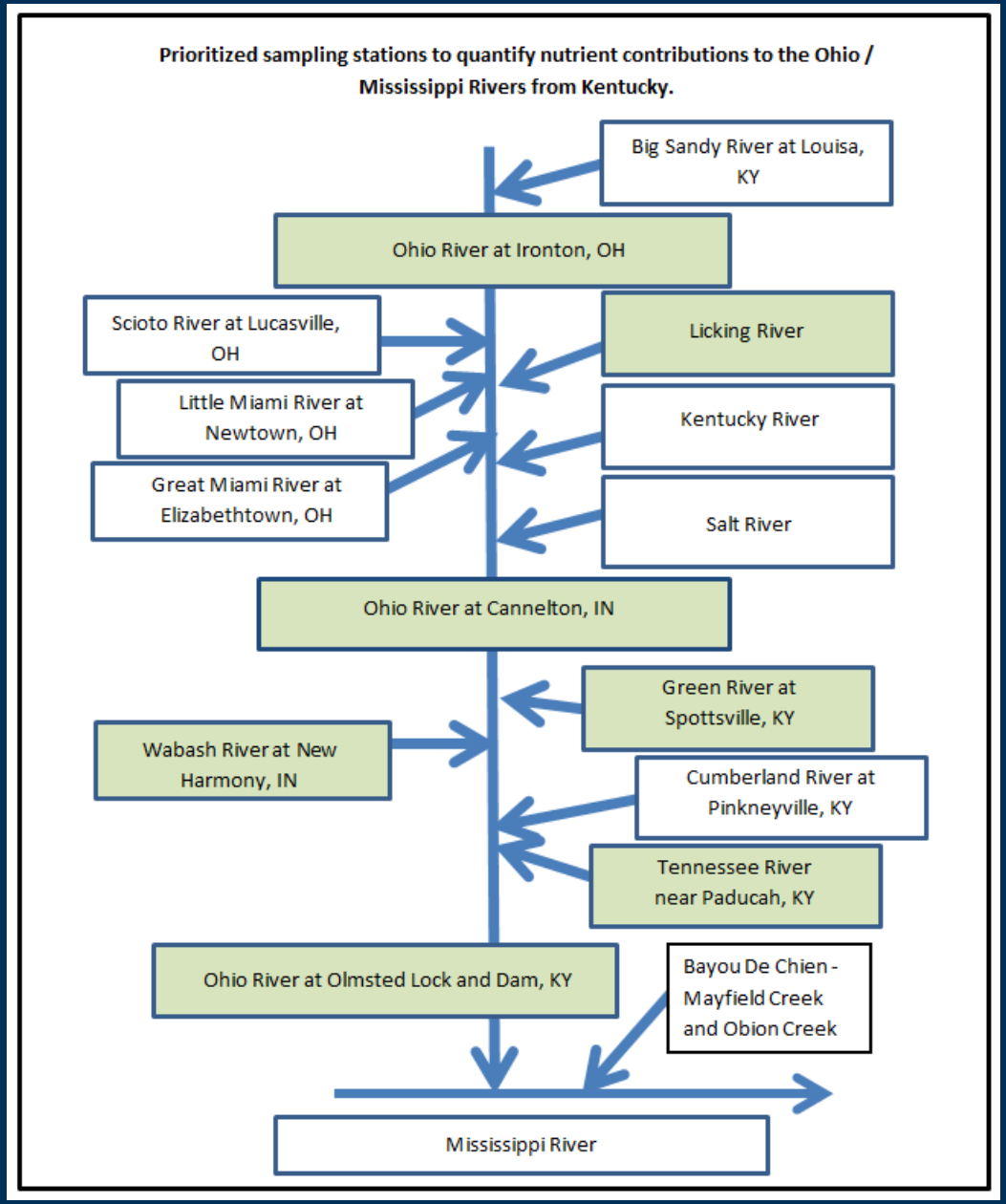
Future needs

* Shaded sites are operational (super gage or can compute defensible loads).

* Sites on all major river basins is ideal.

*Need to work with partners on other side of the river.

* Sustainable funding required; 3 sites are scheduled to lose funding in 2018 and will be shut down.



USGS

Future needs – estimated costs (1-2016)

Component	Required
ONE-TIME Construction of new station and first year operation for streamflow – assuming a large river and the use of acoustic sensors for real-time velocity data.	$40,000
ONE-TIME Cost of 5-parameter water-quality sonde and installation	$18,500
ONE-TIME Cost of nitrate sonde and installation	$29,000
ONE-TIME Cost of phosphate sonde and installation	$28,000
ANNUAL Operation and Maintenance of surface-water gage – using acoustic sensors for real-time velocity data	$24,000 (year 1&2) $14,000 (year 3+)
ANNUAL Operation and Maintenance of 5-parameter water-quality sonde	$27,000
ANNUAL Operation and Maintenance of nitrate sonde	$12,000
ANNUAL Operation and Maintenance of phosphate sonde	$14,000
ANNUAL Collection of other discrete water-quality samples (if desired – see above for examples)	TBD – site specific
ANNUAL Laboratory fees for discrete water-quality analyses (if desired – see above for examples)	TBD – site specific

USGS

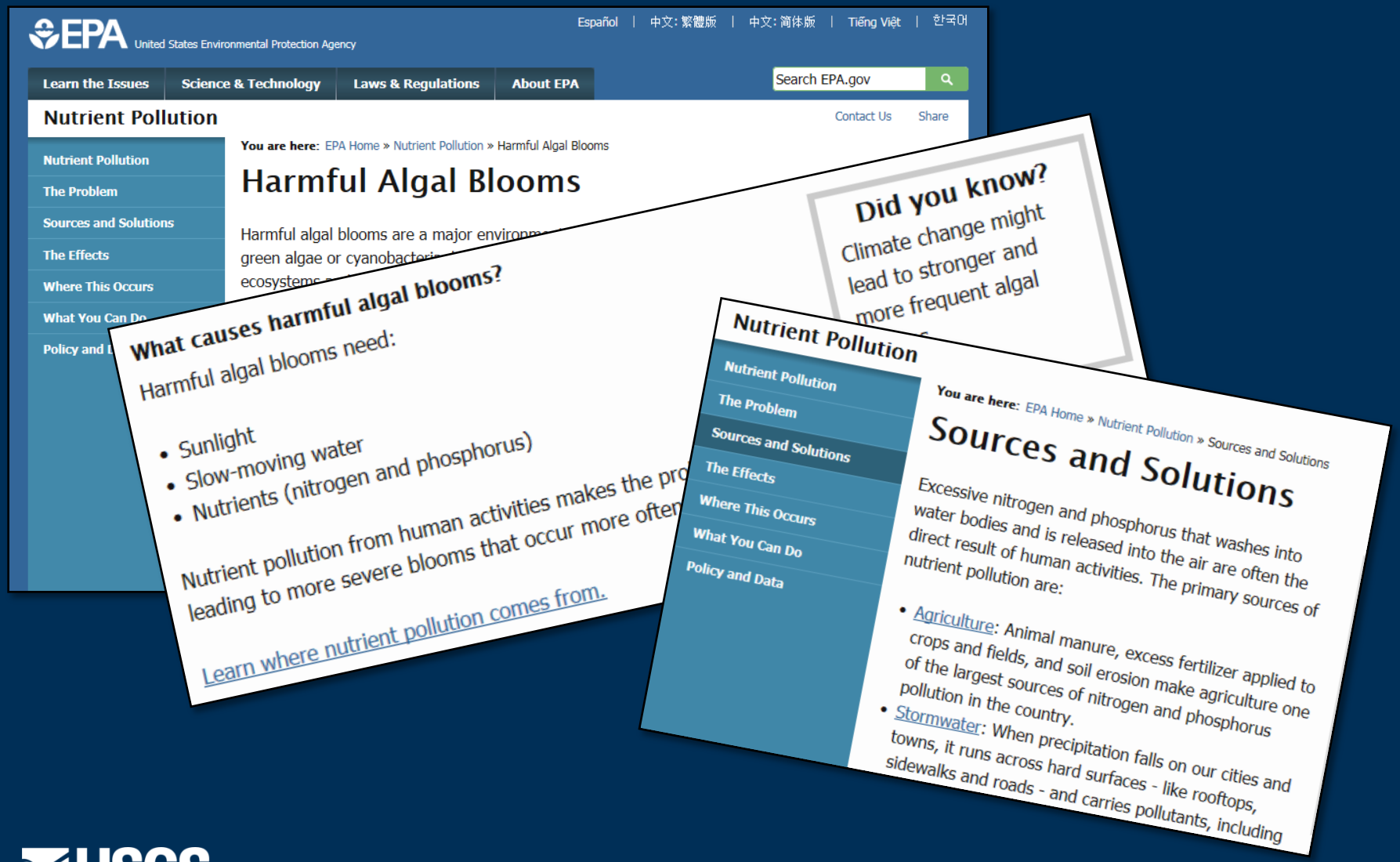
Harmful Algal Blooms (HABs)

This is a BRIEF description of current monitoring as it relates to, and works in coordination with, existing agricultural-monitoring projects.

Note that there are many concurrent activities and responsible agencies - references will be provided for relevant sources of information.

USGS

Harmful Algal Blooms (HABs)

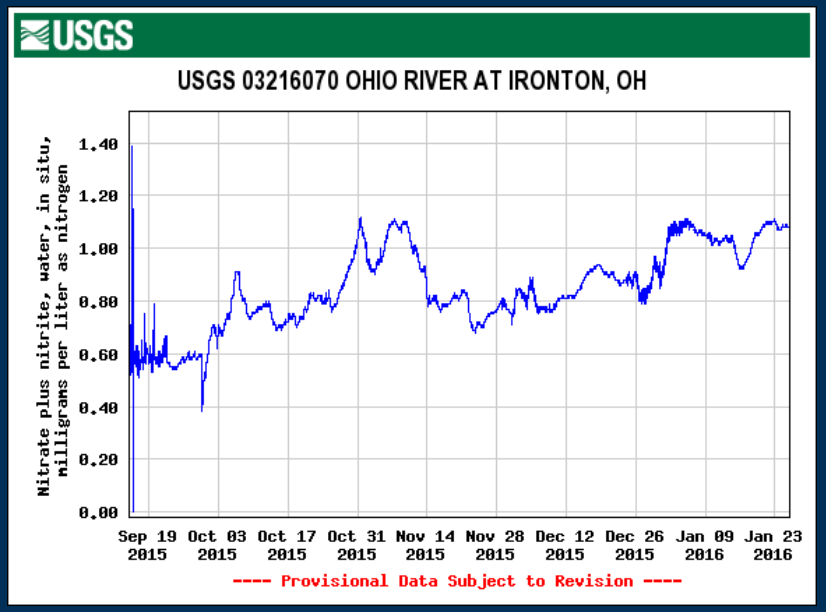


USGS

http://www.epa.gov/nutrientpollution/harmful-algal-blooms

Harmful Algal Blooms (HABs)

9-2015 Ohio River at Ironton, OH



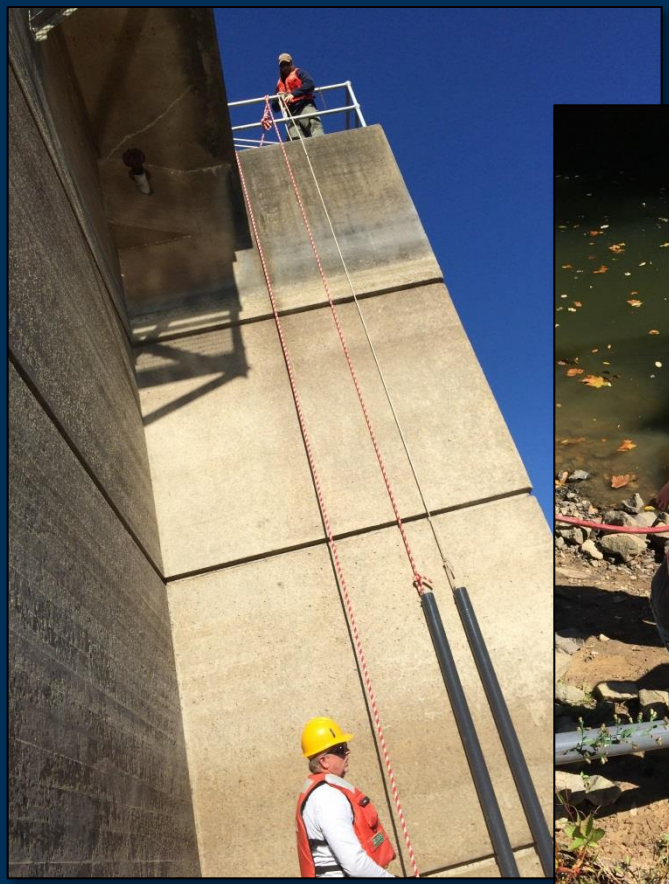
Existing USGS supergages already monitor nutrients and can easily include HABs-related constituents.

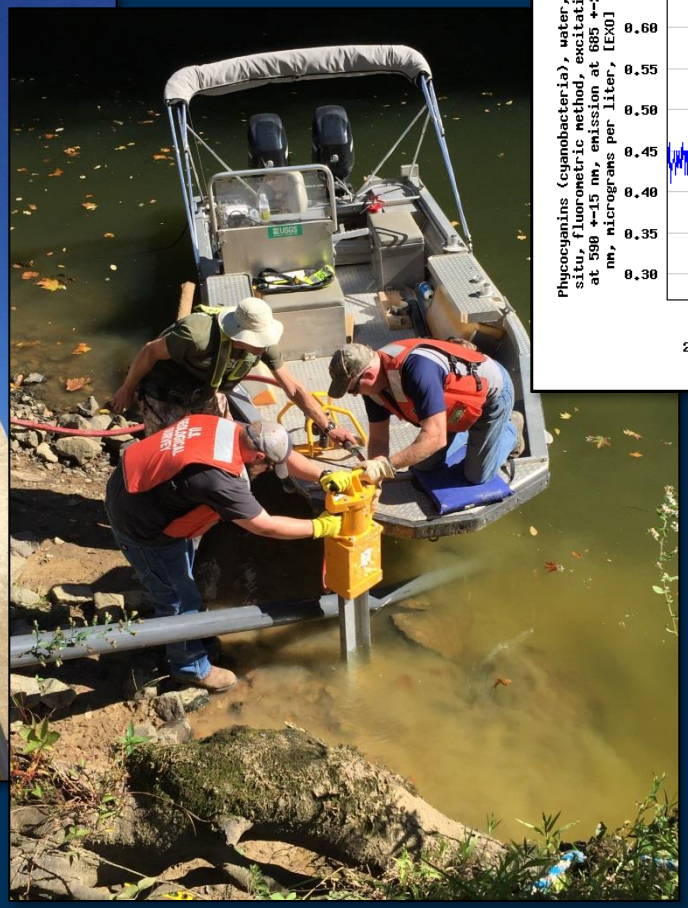
At the time of the HAB event, the Ohio R. nitrate conc. was ~0.60 mg/L

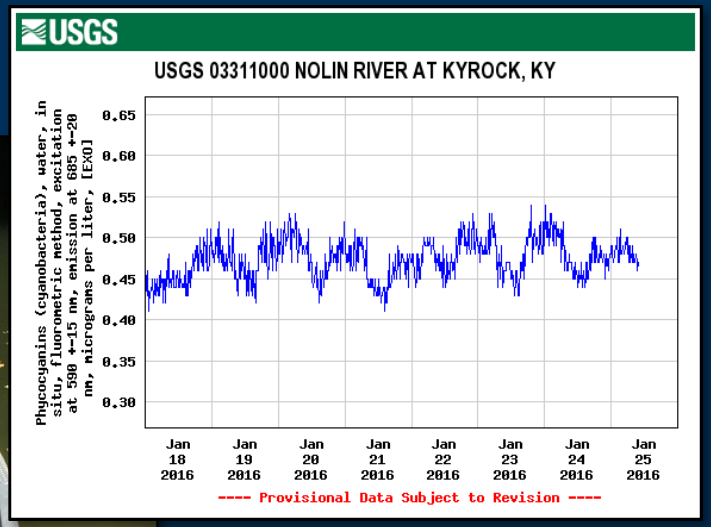
USGS

Harmful Algal Bloom (HABs) super gages

Similar but with additional sensors







USGS

Future needs – estimated costs to add HABs parameters to a USGS supergage (1-2016)

Component	Required
ONE-TIME Cost of total algae (phycocyanin and chlorophyll) sonde and installation	$ 4,000
ANNUAL Operation and Maintenance of total algae (phycocyanin and chlorophyll) sonde	$ 14,000

USGS

Resources for HABs information

Kentucky Division of Water:

http://water.ky.gov/waterquality/pages/HABS.aspx

Louisville US Army Corps of Engineers:

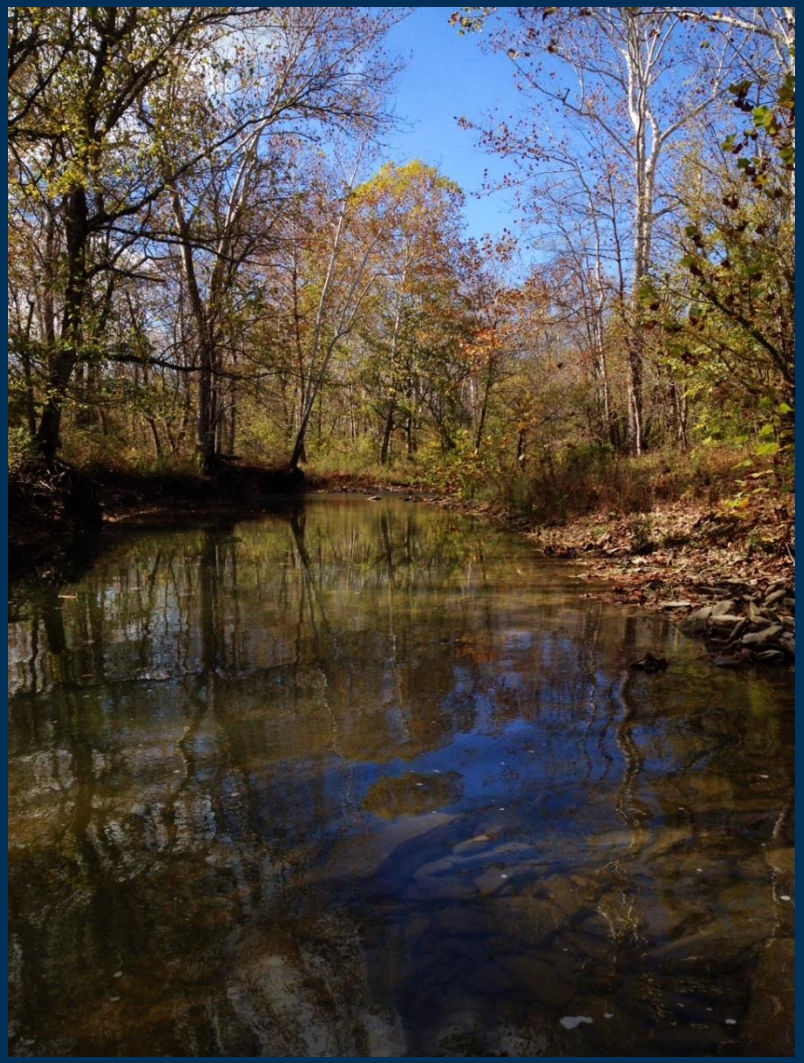
http://www.lrl.usace.army.mil/Missions/CivilWorks/WaterInformation/HABs.aspx

USGS resources:

- http://water.usgs.gov/coop/products/qw/cyanobacteria_habs.html
- https://pubs.er.usgs.gov/publication/ofr20151164

USGS

Surface-water availability



USGS

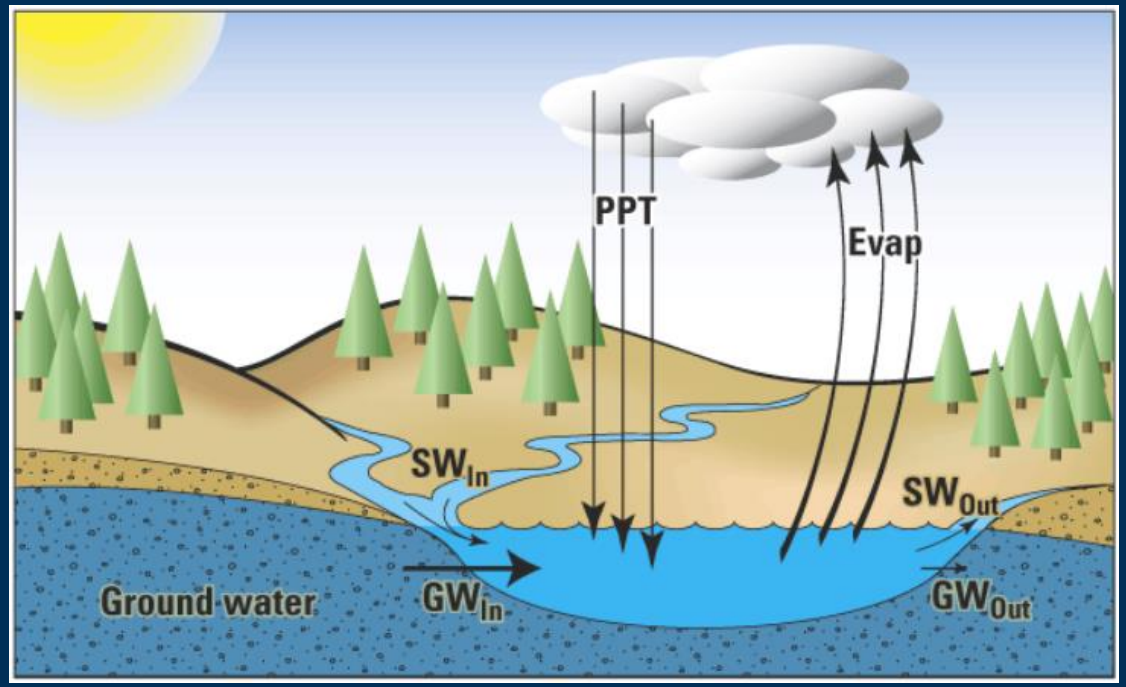
Surface-water availability

USGS gage data is a critical piece of the basic water budget:

Precipitation = ET + **Streamflow** + ΔGW + ΔSM + ΔRSV ± Diversions

Where you want to quantify the hydrologic cycle, you need these pieces of information.

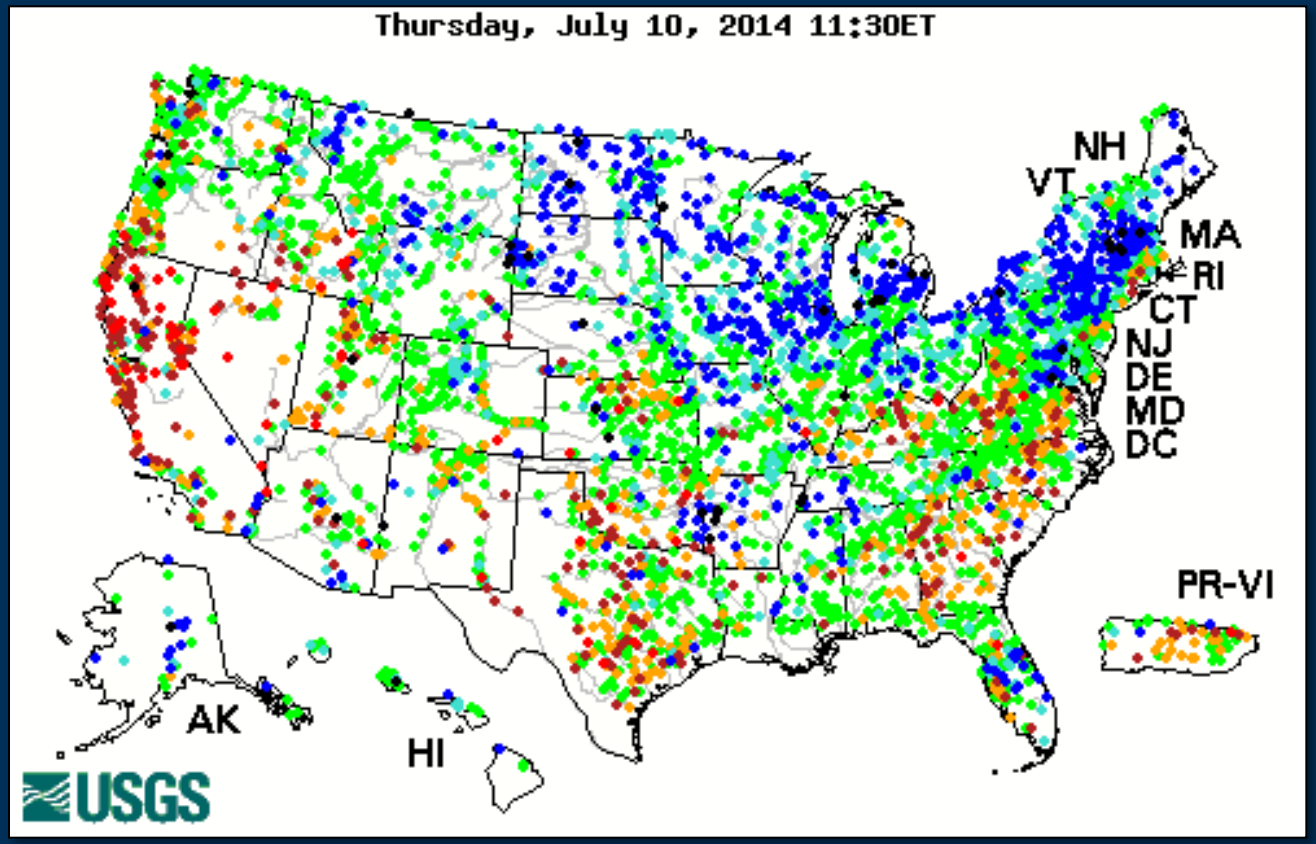
Note groundwater, soil moisture, and other parameters that are also included here!



USGS

Real-Time Streamgages

USGS operates approximately 14,800 sites nationally with real-time streamflow data. This national network allows local data to be quickly scaled-up to a regional or national context to assess conditions – but it may NOT be locally optimized for specific uses.

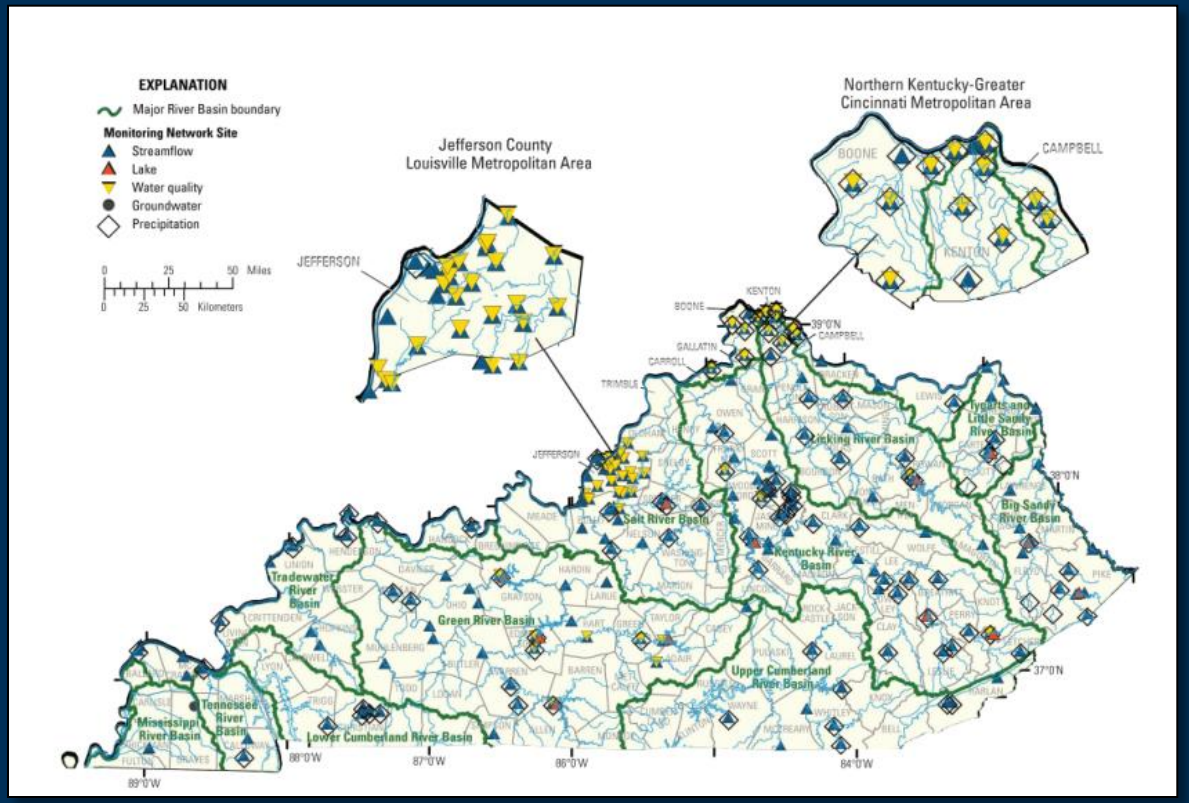


USGS

USGS IN-KY WSC has over 200 sites with real-time data in Kentucky

USGS continually assesses the statistical strength of the network; we already see a loss of statistical strength in rural areas as static funding is shifted to urban areas to address changing priorities.

Notably, gaps exist in the Western KY and the Cumberland River Basins.



USGS

Future needs – current costs for a BASIC USGS streamgage (1-2016)

Component	Required
ONE-TIME Cost of installation and first year's O&M for a basic (non-acoustic) streamgage	$ 26,000
ANNUAL Operation and Maintenance for year 2+	$ 14,000

USGS

KGS Progress Toward Improved Statewide Groundwater Monitoring and Research

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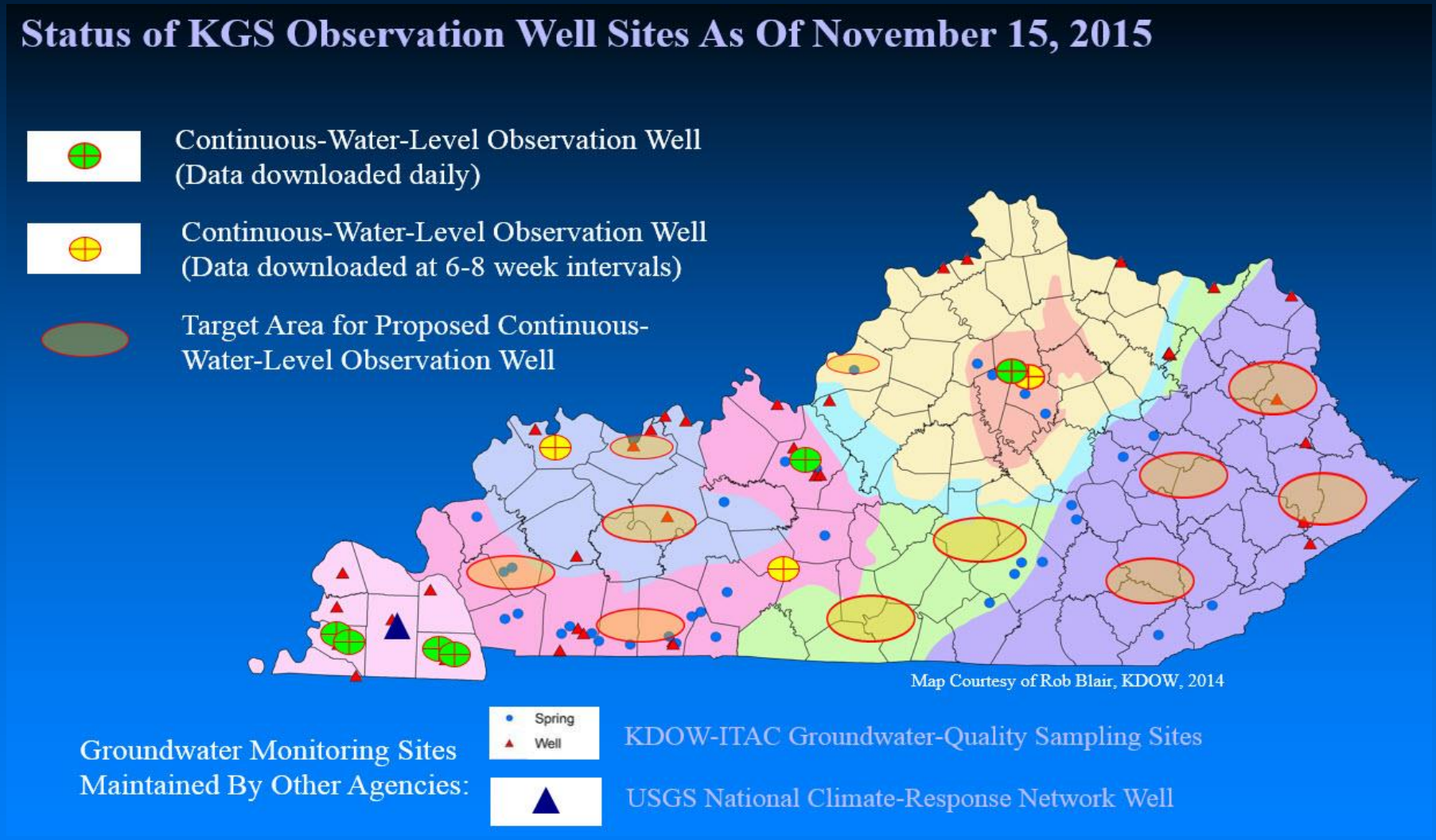
Kentucky Geological Survey

Re-Establishing a Groundwater-Level Observation Network



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Equipment Installation At the Network's 1st Observation Well

Monitoring a fractured-karstic limestone aquifer at Kentucky Horse Park, Scott Co.

Clockwise from upper left:

1. Preparation of anchor point (datum) for pressure transducer.
2. Measuring out transducer data cable length.
3. Inserting transducer and cable into well.
4. Final field check of transducer and telemetry equipment.
5. Well integrity must also be quantified on regular intervals.

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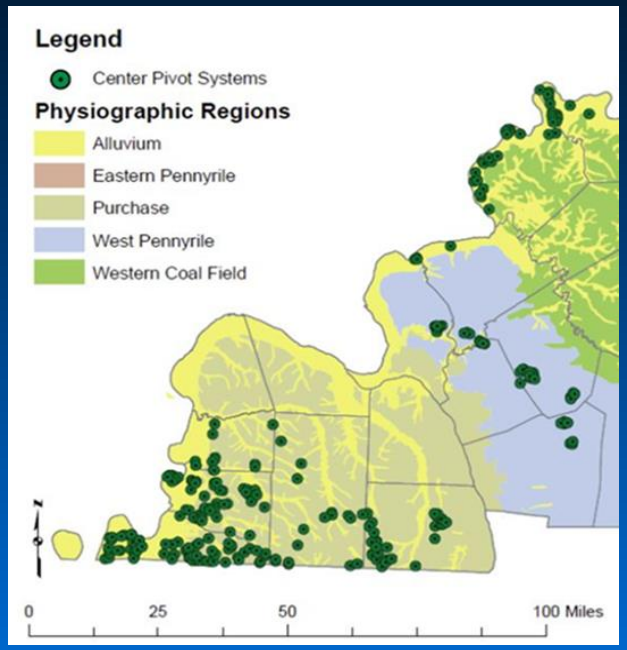
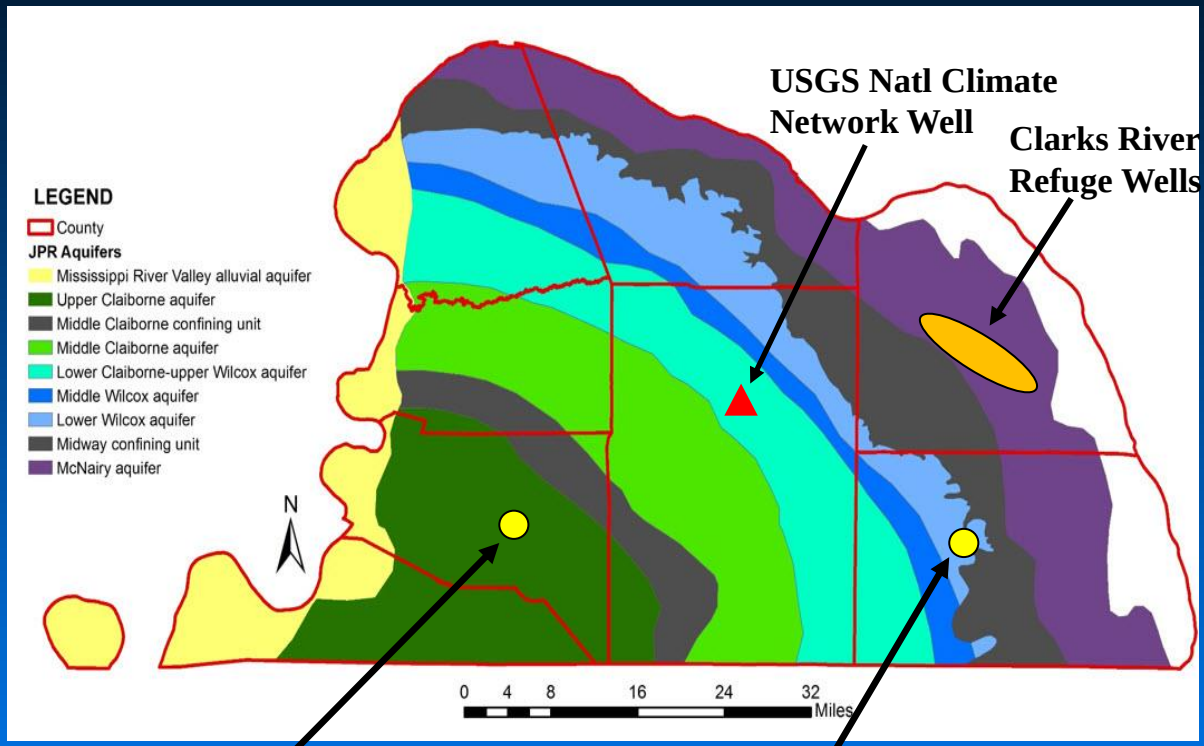
KGS Research & Monitoring Activity in the Purchase Area



Center Pivot Wells Inventoried by KDOW & KGS in 2014



- ✓ KGS Drilled and Instrumented Two New Observation Well Clusters.
- ✓ Collecting Natural Gamma Logs, and other Geophysical Data, to Improve Identification of Subsurface Aquifer Boundaries and Confining Units.
- ✓ Collected Additional GWL Measurements and Water Well Data, and Conducted Specific Capacity Tests of Irrigation Wells at Clarks River Wildlife Refuge.

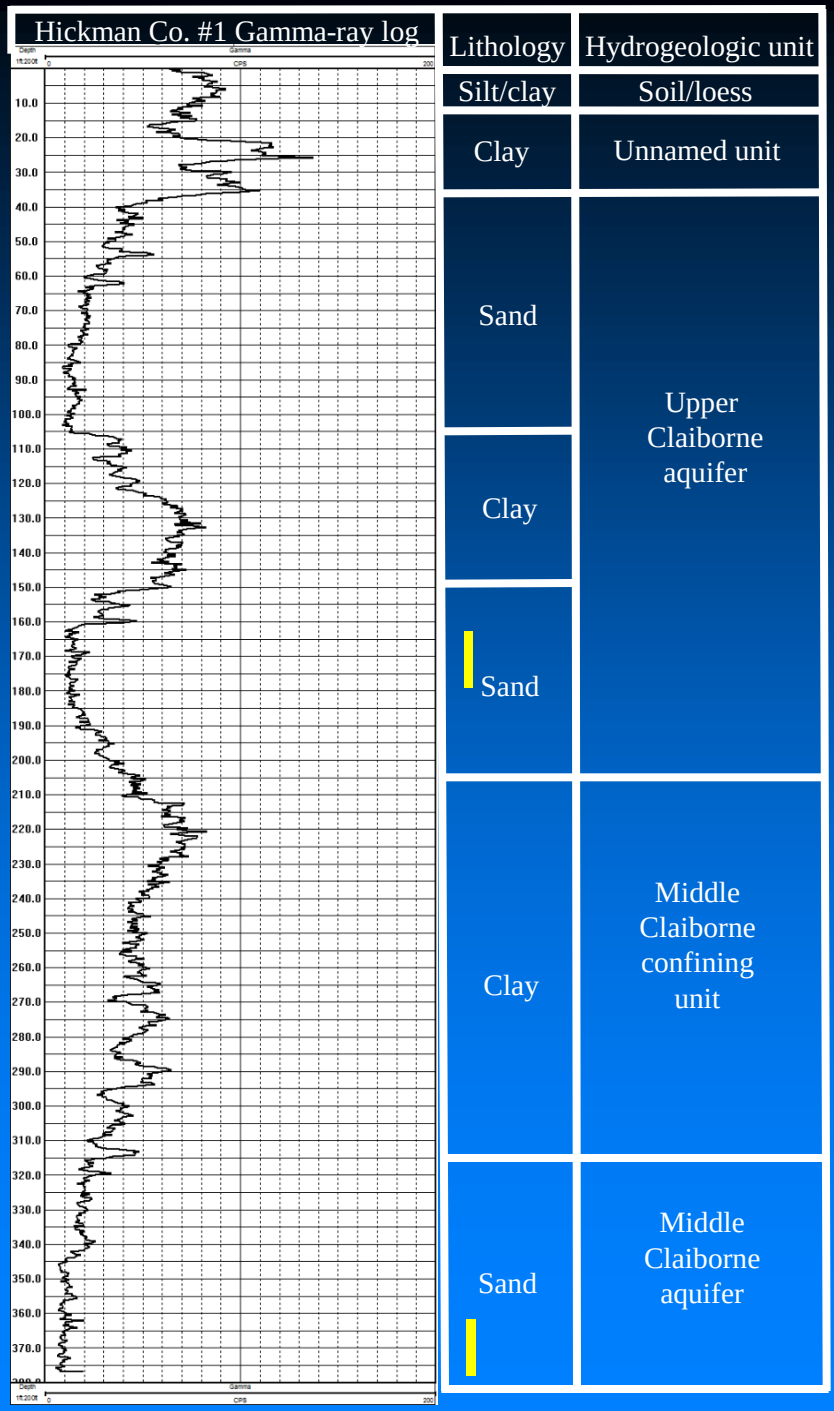
KGS Hickman Co. Observation Well Cluster

near Clinton, KY

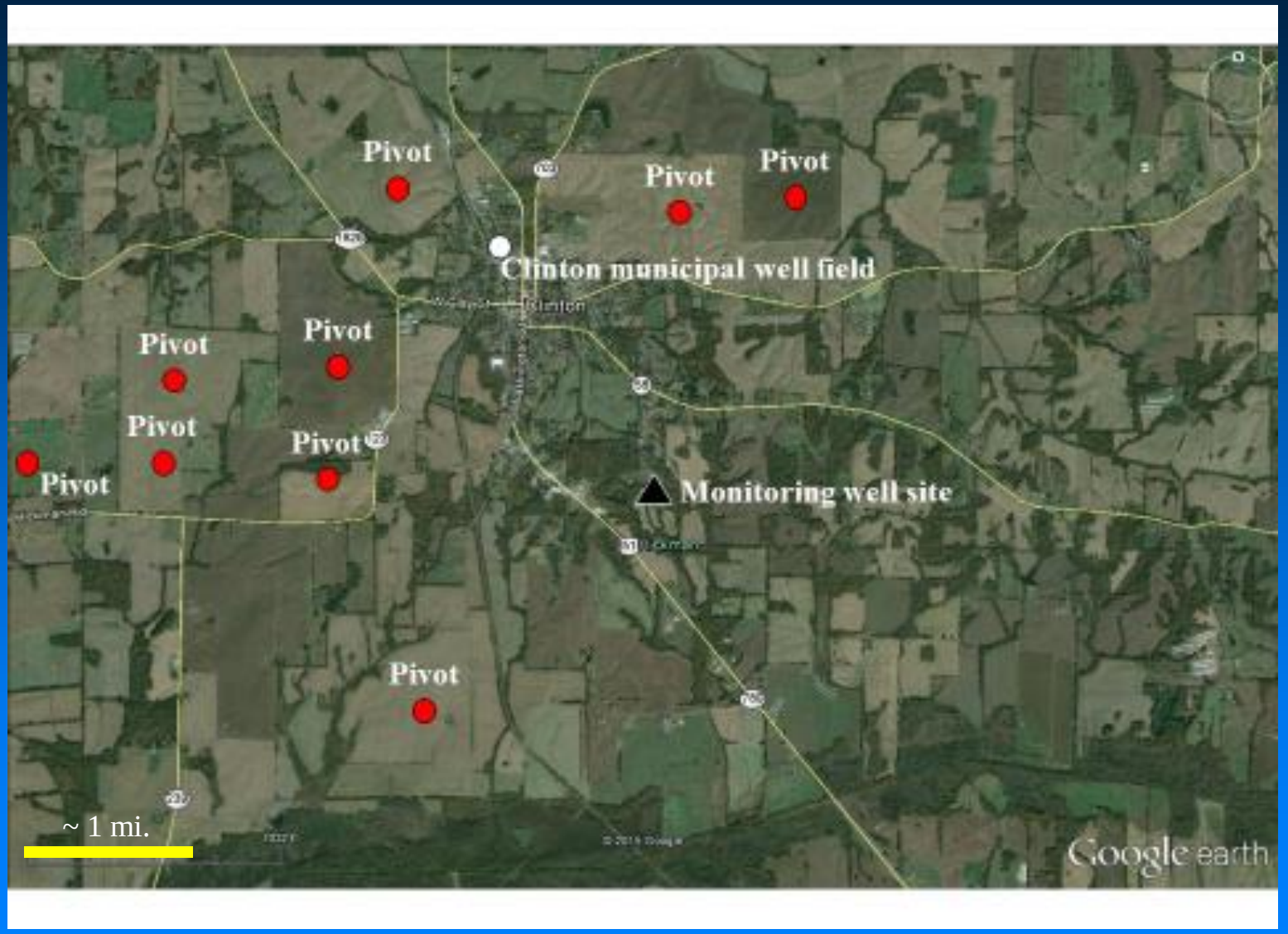
SWL/TD:

HICKMAN #2 81/180 FBLS

HICKMAN #1 84/380 FBLS

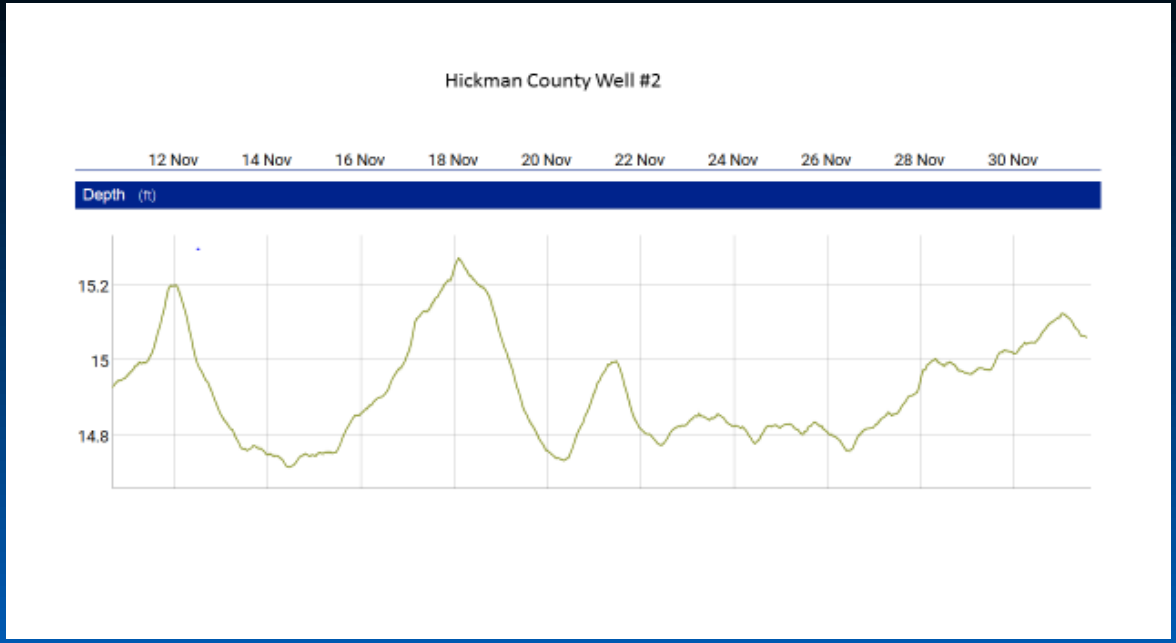


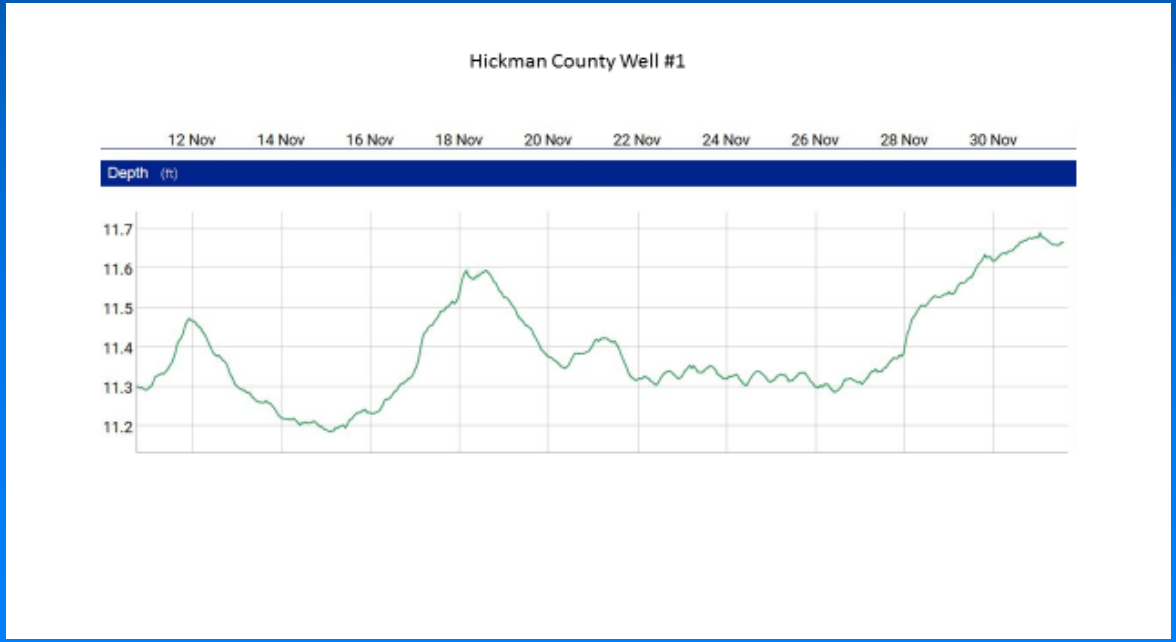
Location of the Hickman Observation Cluster Relative to Some High-Yield Water Wells



First Hydrographs for Hickman Co. Observation Wells #1 and #2

(Raw data, feet above transducer)





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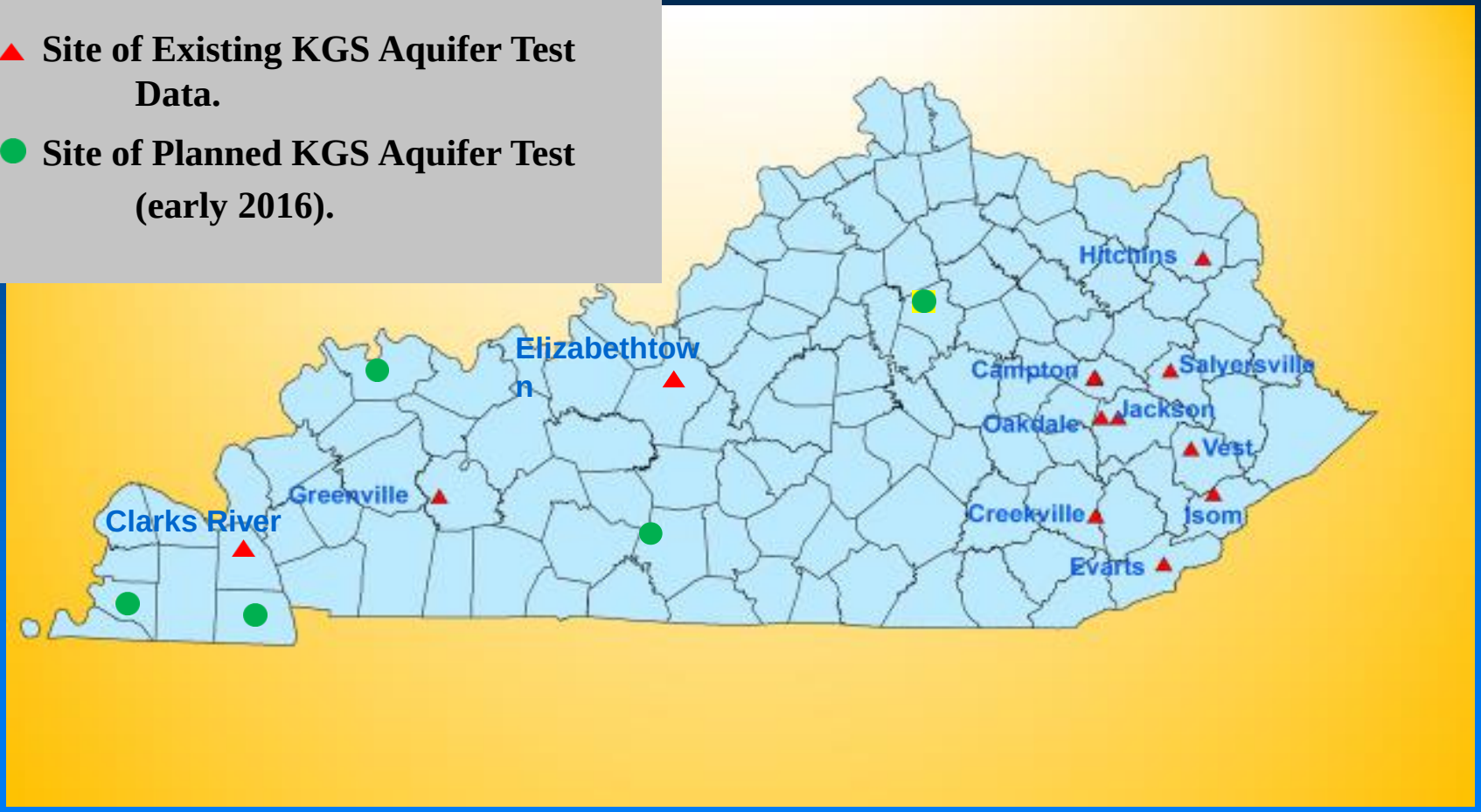
Creating a Public Aquifer Test Archive and Webpage

Aquifer Test Data Compiled by KGS

- ▲ **Site of Existing KGS Aquifer Test Data.**
- ● **Site of Planned KGS Aquifer Test (early 2016).**



KGS intends to collaborate with USGS, among others, to obtain and compile additional existing aquifer test data.

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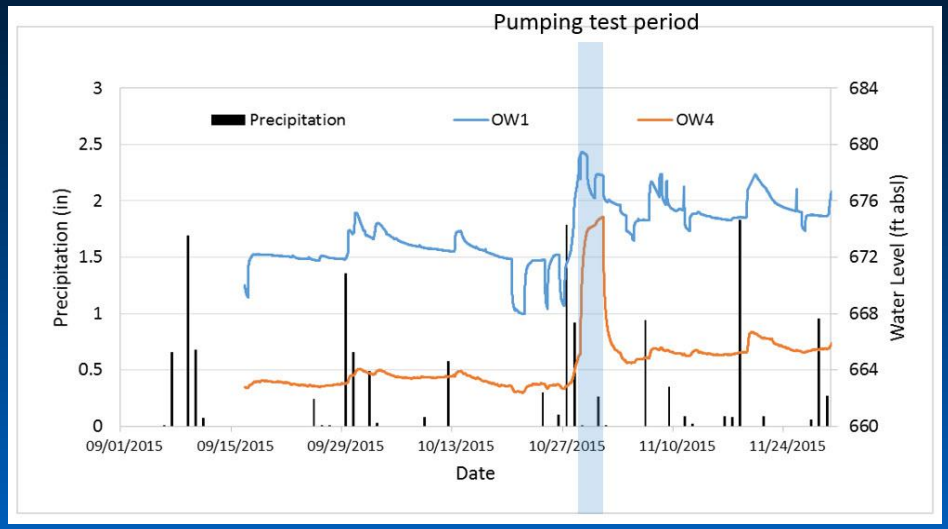
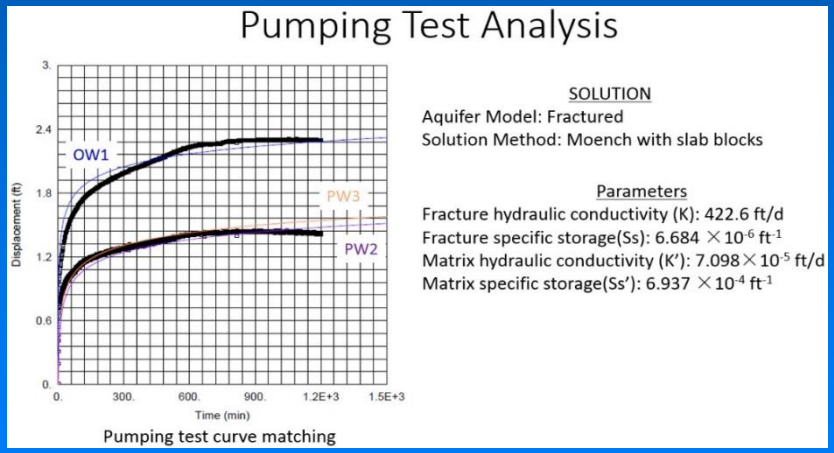
Recent KGS Aquifer Test—Elizabethtown well field





Municipal supply wells completed in a karstic limestone aquifer

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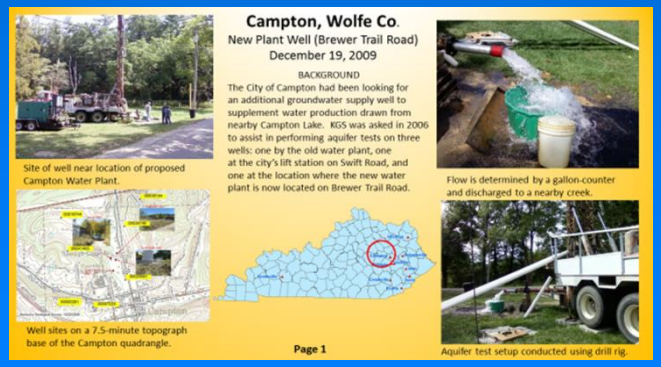
Summary: KGS Activities to Improve GW Monitoring

- ✓ Began re-establishing statewide network of long-term water-level observation sites.
- ✓ Conducting focused groundwater research to better characterize the aquifer system in the Jackson Purchase Area.
- ✓ Conducting aquifer tests to enable better assessment of groundwater availability.
- ✓ Creating new webpages needed to enhance public access to groundwater data.
- ✓ Conducting targeted sub-regional groundwater-quality assessments.



Climate and soil-moisture data

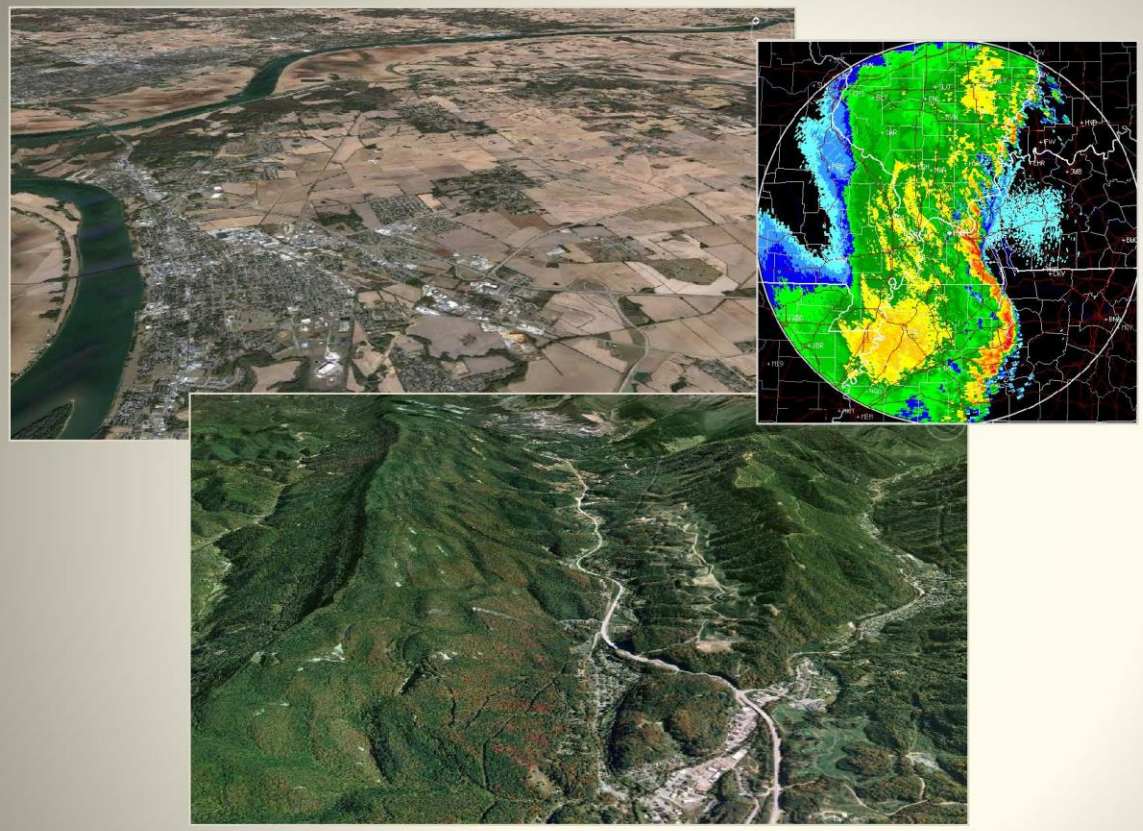
KENTUCKY CLIMATE CENTER

Climate and soil-moisture data

KENTUCKY CLIMATE CENTER

"First, we recently launched our 66th station. This one is located in Butler County and was funded through local partnerships and the KADF. It also includes a commitment for annual operating support. Second, we are in the process of developing a proposal for KADF funds to replace modems and relative humidity probes across our network and to replace some of our precipitation gauges. We hope to submit by the end of January."

Climate and soil-moisture data

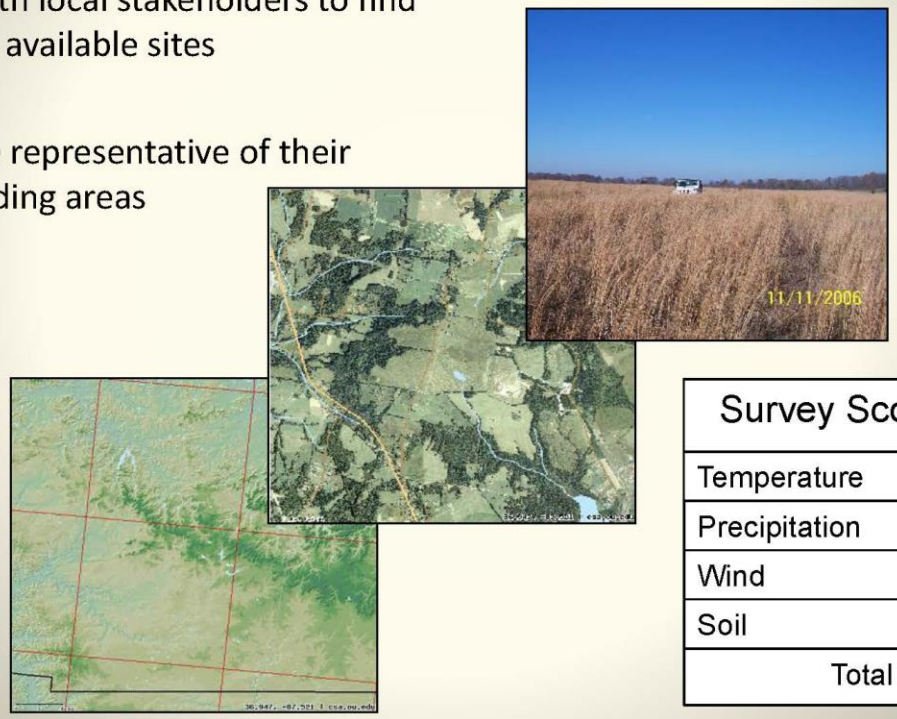


Kentucky's diverse terrain creates distinct local vulnerabilities to weather and climate

Climate and soil-moisture data

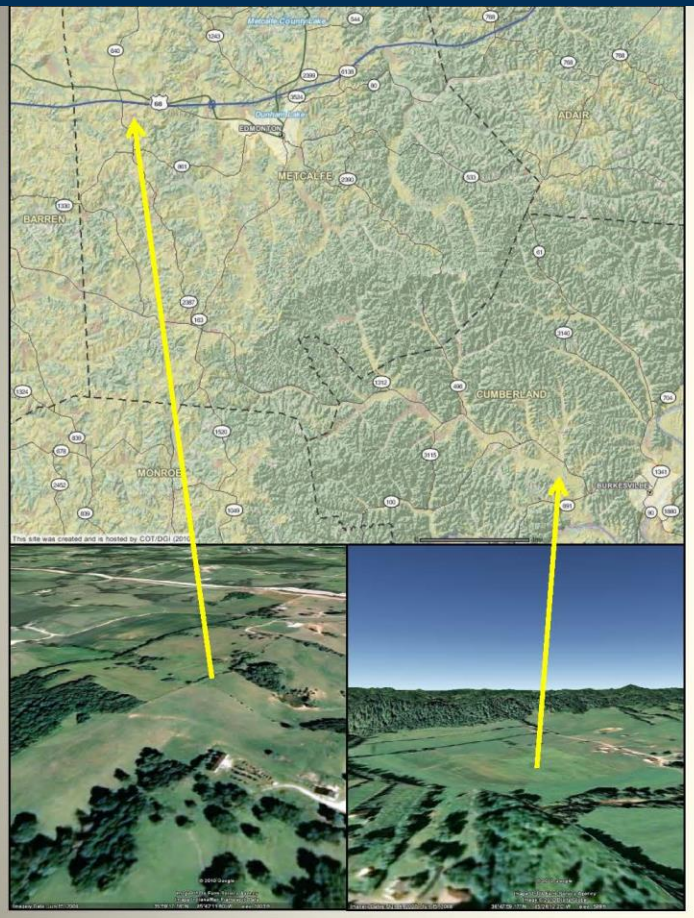
High-Quality Sites for High-Quality Data

- Work with local stakeholders to find the best available sites
- Sites are representative of their surrounding areas



Survey Scores	
Temperature	40
Precipitation	30
Wind	12
Soil	15
Total	97

Climate and soil-moisture data



Plateau , 1003’ Valley, 554’

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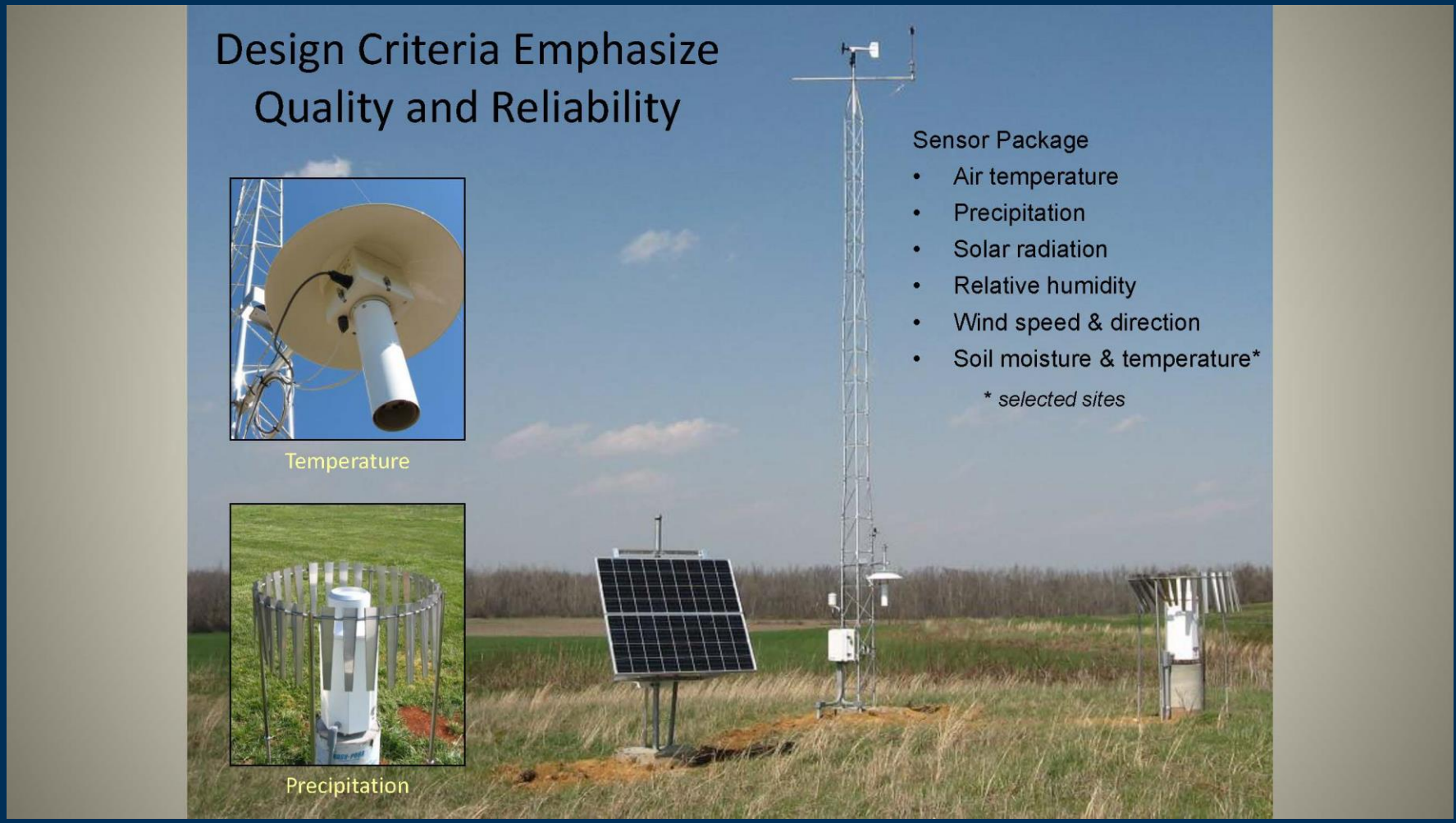
Paired-Sites

- Areas of complex topography cannot be well represented by a single site
- The most representative site may not be the nearest site
- An example is provided by the paired stations in Metcalfe County (plateau) and Cumberland County (valley)

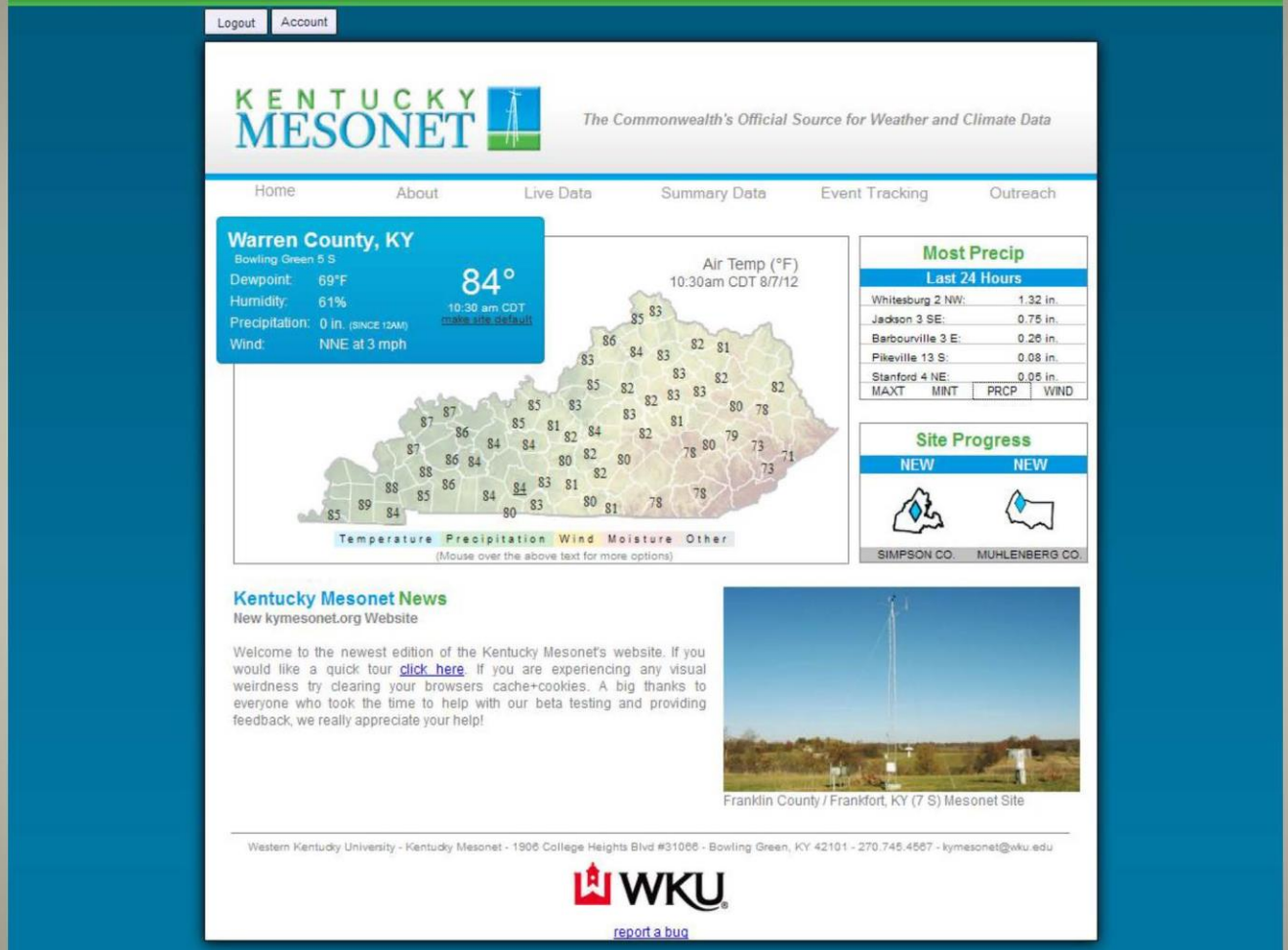
Climate and soil-moisture data



Climate and soil-moisture data –

Mesonet database and web-based access.

http://www.kymesonet.org/



Climate and soil-moisture data

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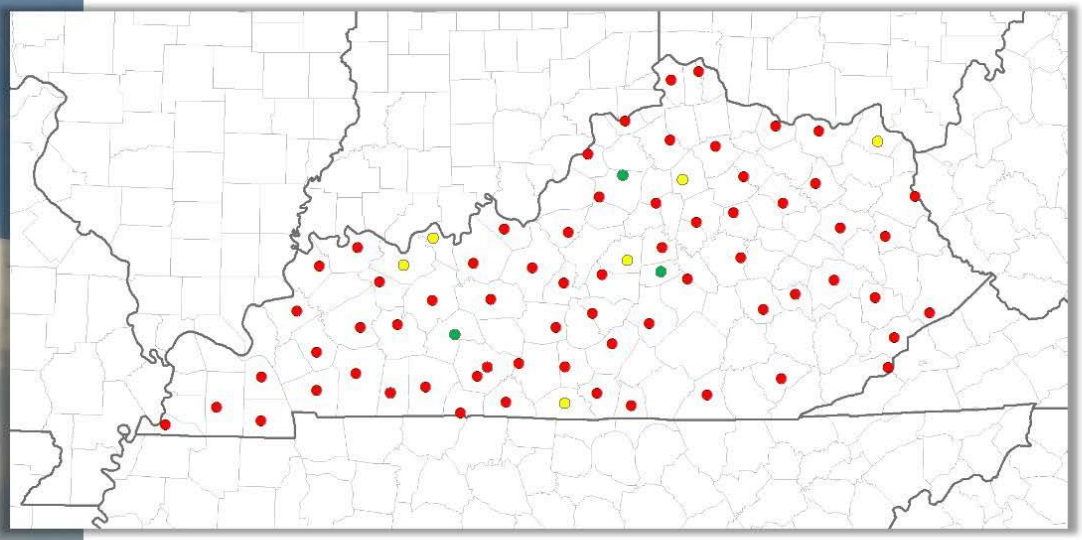
Kentucky Mesonet Coverage Map



- 65 - Existing stations in the Kentucky Mesonet
- 3 – Local governments have secured funding to acquire a new station
- 6 – Local governments are evaluating options to acquire a new station

Questions?

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