Part 2: Priority Groundwater Data and Research Needs—KGS Perspective

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KGS Role in Groundwater Monitoring and Studies

Mission:
- We are a Research and Public Service Unit within UK.
- KGS Mission is to Characterize and Provide Information about Ky’s Geological, Mineral, Energy, and Water Resources.
- No Regulatory Responsibilities or Functions.

Legislative Mandates:
- KRS 151.035 “Official Repository for Groundwater Information.
- KRS 151.625 “Establishment of Long-Term Groundwater Monitoring Network”.
- KRS 151.113 Kentucky Water Resources Board (source of “technical assistance”).
All Groundwater Data Collected in Kentucky is Stored and Accessed by the Groundwater Data Repository (GWDR).

- Initiated in 1990 by legislative mandate (KRS 151:035) and maintained by KGS.
- Currently:
  - Over 92,000 water well records.
  - Approximately 5,100 spring records.
  - About 60,000 groundwater-quality analyses.
- Over 15 contributing agencies, including KDOW, USGS, and EPA Storet.
- Largest single source of data: Kentucky certified water-well driller records from KDOW.

http://kgs.uky.edu/kgsweb/DataSearching/watersearch.asp

http://www.uky.edu/KGS/water/index.htm
Priority Groundwater Data and Research Needs

- Statewide Long-term Groundwater Observation Network.
- Aquifer Delineation and Mapping.
- More Quantitative Data on Aquifer Yield and Hydraulic Properties.
- Development of Improved Groundwater Management Tools.
Priority Groundwater Data and Research Needs

Statewide Long-term Groundwater Observation Network

- Continuous monitoring of water levels in a suitable network of observations wells is needed to build a database capable of identifying and tracking trends in groundwater levels and assessing changes in groundwater recharge, storage, and discharge (withdrawals).

- Calculations of meaningful statistical parameters such as mean, maximum, and minimum groundwater levels will require at least 5 years of data.
Need for a Ky Groundwater-Level Observation Network

• Previously a statewide network of up to 64 wells was operated jointly by USGS and KGS from the mid-1950s to the early-1990s.

• Continual decreases in Federal and state funding steadily eroded the network over the years, eventually leaving only one well being continuously monitored in Kentucky by USGS as part of a national groundwater network.

• In recent decades, comparatively more effort has been given to the collection of groundwater-quality data, largely driven by the needs of state and federal regulators.

• Information about current groundwater conditions is unavailable in most parts of the state, and it is not uncommon for available water-level data to be 25 years or more out-of-date.
In 2015 KGS Started Work Rebuilding A Statewide Kentucky Groundwater Observation Network (KGON)

- Helps meet critical need for continuously updated groundwater-level data and re-establishment of a statewide long-term groundwater monitoring network.

- Helps fulfill KGS legislative mandate to establish a network “…for the purpose of characterizing the quality, quantity, and distribution of Kentucky’s groundwater resources.”

- “…in areas of demonstrated need.”.

- Wells serve as fixed monitoring sites representative of specific aquifers or aquifer types (e.g. karst, fractured sedimentary rock, etc.).

- “…support research efforts that develop models for groundwater systems…” and “…to determine and monitor trends…”. 
Capitalization

- KGS: App. $75K one-time internal funding contributed to establish initial network of up to 15 observation wells in critical areas and cover 12 mo. operations costs (implementation during 2015-16).

- Annual O&M costs (app. $30K) are presently anticipated to be covered by KGS for first 3 years; unanticipated cost increases, funding cuts, or resource re-allocation decisions could potentially affect this.

- Long-term maintenance, expansion or enhancement of network and data-collection activities, will require additional outside funding and partnerships.
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.
Status of KGS KY Observation Well Network (KGON) Sites As Of August 10, 2016

- Continuously-Monitored Observation Well (Data downloaded daily).
- Continuously-Monitored Observation Well (Data manually downloaded at 6-8 week intervals).
- Existing Well Being Evaluated for KGON.
- Priority Area for New Observation Well.

Map Courtesy of Rob Blair, KDOW, 2014

Groundwater Monitoring Sites Maintained By Other Agencies:

- KDOW-ITAC Periodic Groundwater-Quality Sampling Sites
- USGS National Climate-Response Network Well
KGS Drilled and Instrumented Two New Observation Well Clusters, and established a Third Observation Well at Benton.

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 near Benton.
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
Preliminary
JPA Hickman Well Cluster Hydrograph Data
KGS MSU Observation Well Cluster

at Murray, Calloway Co., KY

**SWL/TD**

**MSU #2** 45/150 FBLS

**MSU #1** 150/350 FBLS

![Well MSU#1 and Well MSU#2]
Preliminary JPA Murray Well Cluster Hydrograph Data
KGS Using Nationally Recommended Approach to Build a Synergistic Program for Groundwater Monitoring & Assessment

Groundwater Monitoring Network (Groundwater Level and Quality Data)

Surveillance (Synoptic) Sites
- For single or periodic measurement of water levels and groundwater quality at many locations (Snapshot-in-Time) data to complement Trend Sites data.

Special Studies
- Targeted groundwater investigations conducted to better map and quantify aquifer properties.

Trend Sites (Continuous sites)
- For continuous tracking of temporal changes (short and long term) at specially targeted locations. Subnetworks recommended for unstressed and impacted aquifers.

Baseline Monitoring Period of 5 years minimum recommended

Contributors: KDOW, USGS, other UK Departments (Earth and Environmental Sciences, Agriculture) and Ky Colleges
Additional Data Collection Activities Being Conducted by KGS to Support the KY Groundwater Observation Network:

- Well/borehole geophysical logging
- Aquifer tests
- Synoptic water-level measurements from additional wells. Limited groundwater quality sampling.
Priority Groundwater Data and Research Needs

Aquifer Delineation and Mapping

- Needed for Improved Groundwater Availability Assessment, and Resource Development and Management.
- Involves Collecting and Synthesizing Data From Multiple Sources including Geological Mapping Data (Stratigraphy and Structure), Geophysical Logs and Well Construction Records Obtained for Water, Oil, and Gas Wells.
- Also Requires Data on Aquifer Hydraulic Properties Obtained from Well Tests.
Present Aquifer Delineation Activity in western Jackson Purchase Area—

- Water well inventory and gamma-ray logging of selected irrigation and domestic wells.
- Digitizing scanned gamma-ray logs from Phillips Coal Company boreholes (ca. 1976).

Modified from Lloyd and Lyke, 1995
Gamma-Ray Logs of JPA Wells Raise Questions about Variations in Extent and Thickness of Aquifer Zones and Confining Units

Confining Unit identified by distinctive “kick-out” in log signature.

These Questions May Have Important Implications for Groundwater Monitoring and Groundwater and Surface Water Resources Management in the Area.
Example Hydrostratigraphic Cross Section
More Quantitative Data on Aquifer Yield and Hydraulic Properties—Example: Elizabethtown municipal well field

KGS is actively working with KY Rural Water and others to identify water wells for testing.
Aquifer Tests Performed by Kentucky Geological Survey

Cities mentioned in the image:
- Campton
- Greenville
- Salyersville
- Evarts
- Isom
- Vest
- Jackson
- Oakdale
- Hitchens
- Princeton
- Elizabethtown
- Greenville
- Benton
- Creekville
- Salyersville
- Isom
- Evarts
KGS Is Creating an Public-Accessible Aquifer Test Archive and Webpage Site
Priority Groundwater Data and Research Needs

Development of Improved Groundwater Management Tools

• To Be Determined


• This Objective Requires Access to Sufficient High-Quality Hydrogeological Data, and Proper Conceptualization of the Aquifer. Therefore Its Eventual Realization Depends on the Previous Priority Items We’ve Discussed.
Questions and Discussion

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