

Generalized Geologic Map for Land-Use Planning: Union County, Kentucky

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Flood Protection



The Uniontown levee was constructed to hold back Ohio River floodwaters. An earthen levee also protects the city of Sturgis. Photo by Glynn Beck, Kentucky Geological Survey.

Agriculture



Agriculture is a major part of the Union County economy. Of the 218,343 acres in Union County, 128,000 (59 percent) were planted with either corn or soybeans in 2002. Photo by Glynn Beck, Kentucky Geological Survey.

Oil and Gas



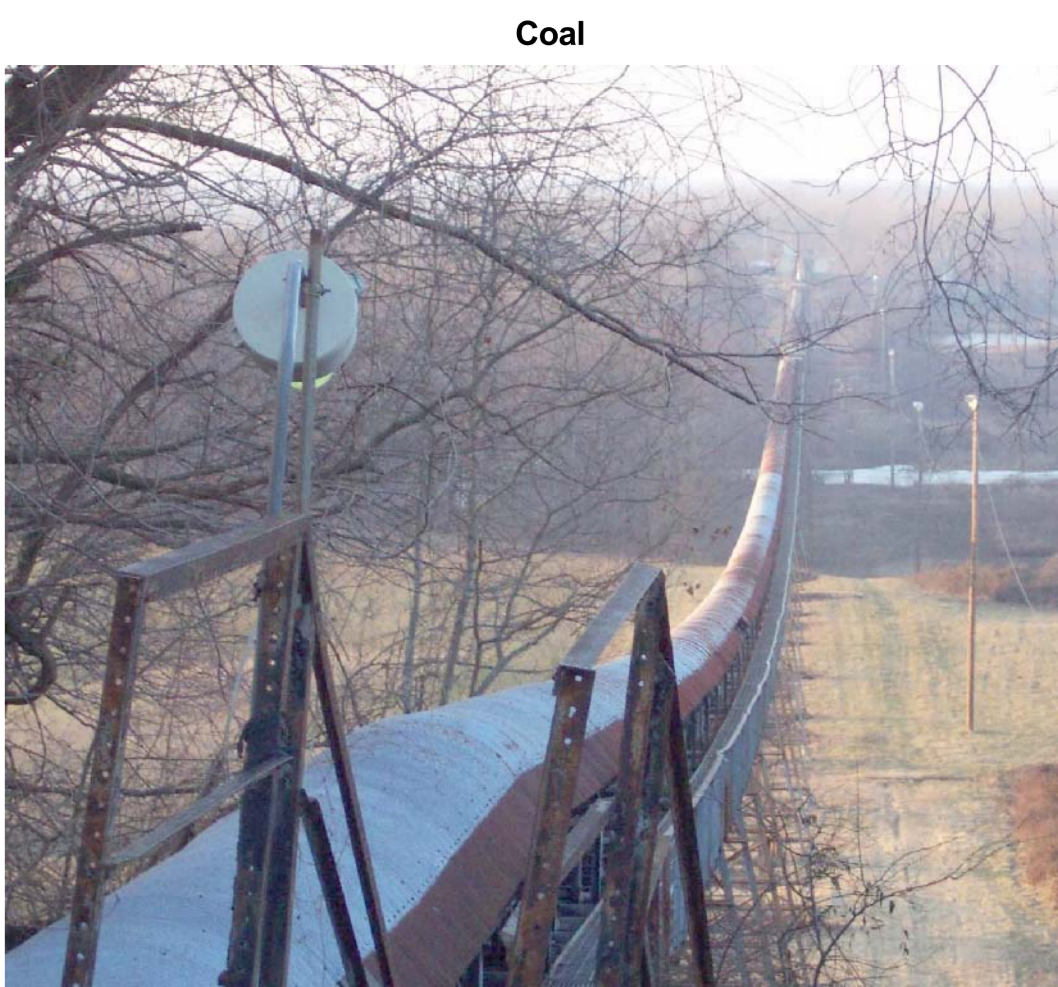
Oil well pump jacks are located throughout Union County. More than 1,100 producing oil and gas wells have been completed in Union County. Photo by Glynn Beck, Kentucky Geological Survey.

Acknowledgments

Bedrock geology adapted from Crawford (2004a, b), Solis and Hettinger (2000), Solis and Terry (2000), Solis and Venard (2000a-d), Tyra (2003), and Venard and Solis (2000). Thanks to Rankin Powell, Union County Agriculture and Natural Resources agent, and Gough Farms for photographic assistance.

For Planning Use Only

This map is not intended to be used for selecting individual sites. Its purpose is to inform land-use planners, government officials, and the public in a general way about geologic bedrock conditions that affect the selection of sites for various purposes. The properties of thick soils may supercede those of the underlying bedrock and should be considered on a site-to-site basis. At any site, it is important to understand the characteristics of both the soils and the underlying rock. For further assistance, contact the Kentucky Geological Survey, Western Kentucky Office, 1401 Corporate Drive, Henderson, KY 42420, phone 270.827.3414 or 827.3404. For more information, and to make custom maps of your local area, visit our Land-Use Planning Internet Mapping Web-Site at kgsmap.uky.edu/website/kyulplanviewer.htm.



Coal mining continues to be a vital part of the Union County economy. This conveyor was constructed by Nashville Coal in the early 1950's. The belt was started on March 3, 1953, and carried 15 tons per minute for a half mile through Union County. Nearly 3.8 million tons of coal were taken from underground mines in 2002. Photo by Glynn Beck, Kentucky Geological Survey.

Geologic Hazards

The most prominent geologic hazard for Union County is flooding. Areas underlain by alluvium (unit 1 on map) are often subject to flooding. Urban development exacerbates flooding, and therefore potential flooding should always be considered in urban development plans. Areas of steep-walled drainage, such as that formed in terrain underlain by units 3 through 6, are conducive to flash flooding, especially in developed areas. Maps of flood-prone areas may be obtained from the Kentucky Division of Water-Floodplain Management Branch, Federal Emergency Management Agency, or the U.S. Geological Survey.

None of the faults that occur in Union County are considered active; however, the proximity of active seismic zones, such as the New Madrid, Wabash, or East Tennessee, calls for precautions to be taken for earthquake damage mitigation. The presence of thick alluvium, which normally has a high water table, should also be treated with special concern because of the possibility of augmented shaking and liquefaction during a strong earthquake. In addition, alluvium often contains high amounts of clay minerals, which can give a soil a high shrink/swell capacity.

Steep slopes are present, especially along streams in areas underlain by units 3 through 6, throughout the county. Steep slopes can develop soil creep and landslides if not properly treated during development. Proper engineering techniques should be followed when developing on hillsides, and care should be taken not to affect property above and below a hillside site on a hillside.

Several underground coal mines are located in Union County. The locations of known mine workings and shafts are shown on the map. Precautions need to be taken when developing over old mined areas because of the possibility of subsidence. Mine subsidence insurance is available in Kentucky. Abandoned mine boundaries shown on the map are approximate and do not represent all the mining that has occurred in the county.

Soil piping, which may occur in various soil types, but particularly in alluvium and loess, produces small to large holes if left untreated. The only way to treat soil piping is to fill the holes with rock or soil to keep the holes from enlarging and to divert drainage from the area.

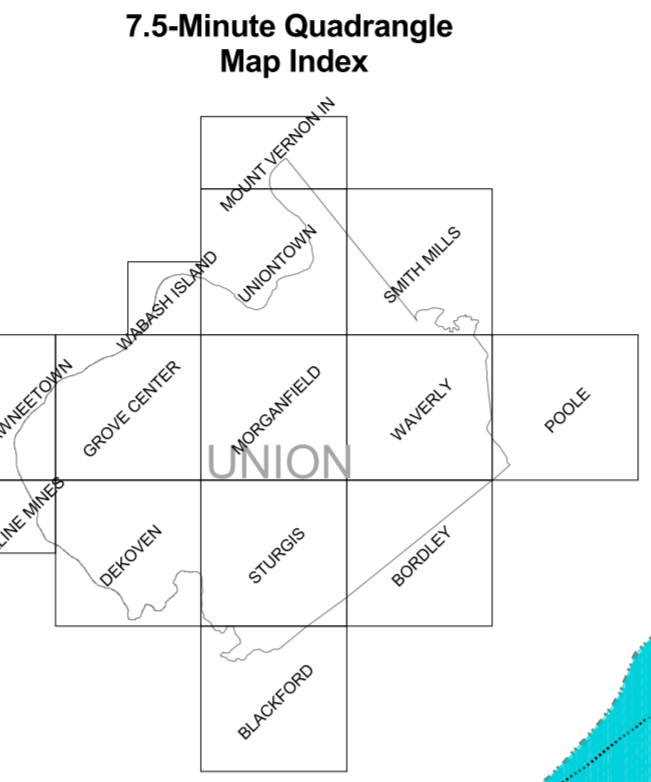


Cattle feeding shelters, like the one above located on Gough Farms, are being used by farmers in Union County to minimize manure concentrations on the land surface. These shelters help reduce nutrient contamination in surface water and groundwater. Photo by Glynn Beck, Kentucky Geological Survey.

Topography

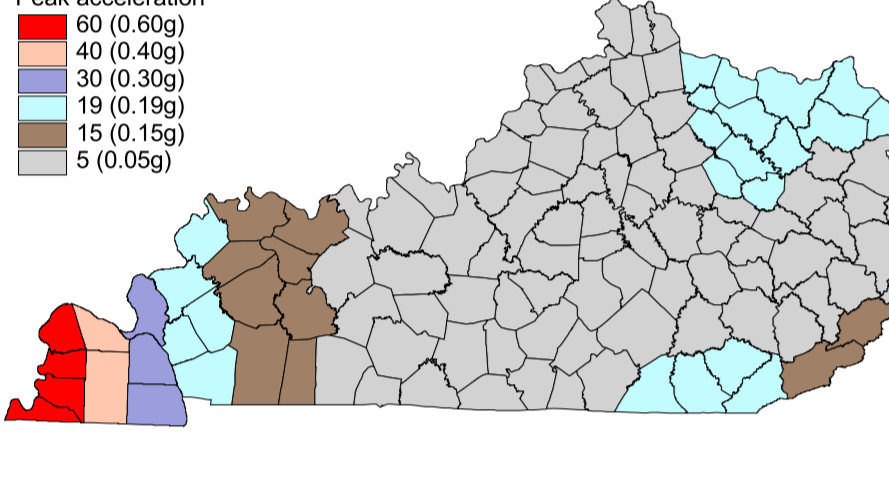


The topography of Union County ranges from flat bottomlands along the Ohio River to rolling uplands with steep slopes. Generally, steep slope areas are not suitable for row crops, and are used for pasture. In 2003 there were approximately 18,000 head of cattle in Union County. Photo by Glynn Beck, Kentucky Geological Survey.



Earthquake Hazard Information

Peak ground acceleration at the top of rock that will probably occur in the next 500 years in Kentucky



Although we do not know when and where the next major earthquake will occur, we do know that an earthquake will cause damage. Severity depends on many factors, such as earthquake magnitude, distance from the epicenter, and local geology. Information on earthquake effects is obtained by monitoring earthquakes and performing research. Such information is vital for earthquake hazard mitigation and risk reduction.

The most important information for seismic-hazard mitigation and risk reduction is ground-motion hazard. One way of predicting ground-motion hazard is by determining the peak ground acceleration (PGA) that may occur in a particular timeframe. The map above shows the PGA at the top of bedrock that will likely occur within the next 500 years in Kentucky (Street and others, 1996). It shows, as expected, that PGA would be greatest in far western Kentucky near the New Madrid Seismic Zone. Ground-motion hazard maps for the central United States and other areas are available from the U.S. Geological Survey. These maps are used to set general policies on mitigating damage. For example, maps produced by the USGS in 1996 were used to determine seismic design in building codes. For additional information about earthquake hazards, visit the Kentucky Geological Survey Web site at www.uky.edu/KGS/geologic/hazards/geologic/hazards.html.

PLANNING TABLE DEFINITIONS

FOUNDATION AND EXCAVATION
The terms "earth" and "rock" excavation are used in the engineering sense; earth can be excavated by hand tools, whereas rock requires heavy equipment or blasting to remove. The term "rippable" means excavation with a ripper attachment on a bulldozer.

LIMITATIONS
Slight—A slight limitation is one that commonly requires some corrective measure but can be overcome without a great deal of difficulty or expense.
Moderate—A moderate limitation is one that can normally be overcome but the difficulty and expense are great enough that completing the project is commonly a question of feasibility.
Severe—A severe limitation is one that is difficult to overcome and commonly is not feasible because of the expense involved.

LAND USES
Septic tank disposal system—A septic tank disposal system consists of a septic tank and a filter field. The filter field is a subsurface tile system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.
Residences—Ratings are made for residences with and without basements because the degree of limitation is dependent upon ease and required depth of excavation. For example, excavation in limestone has greater limitation than excavation in shale for a house with a basement.
Highways and streets—Refers to paved roads in which cuts and fills are made in hilly topography, and considerable work is done preparing subgrades and bases before the surface is applied.
Access roads—These are low-cost roads, driveways, etc., usually surfaced with crushed stone or a thin layer of blacktop. A minimum of cuts and fills are made; little work is done preparing a subgrade, and generally only a thin base is used. The degree of limitation is based on year-around use and would be less severe if not used during the winter and early spring. Some types of recreation areas would not be used during these seasons.
Light industry and malls—Ratings are based on developments having structures or equivalent load limit requirements of three stories or less, and large paved areas for parking lots. Structures with greater load limit requirements would normally need footings in solid rock, and the rock would need to be core drilled to determine presence of caverns, cracks, etc.
Intensive recreation—Athletic fields, stadiums, etc.
Extensive recreation—Camp sites, picnic areas, parks, etc.
Reservoir areas—The floor of the area where the water is impounded. Ratings are based on the permeability of the rock.
Reservoir embankments—The rocks are rated on limitations for embankment material.
Underground utilities—Included in this group are sanitary sewers, storm sewers, water mains, and other pipes that require fairly deep trenches.

EXPLANATION

- School
- Corporate boundary
- Water
- Abandoned underground mines
- Artificial fill
- Mine shaft
- Mine adit
- Watershed divide
- Concealed fault
- Fault
- Projected fault
- Gas well
- Oil, or oil and gas well
- Class II injection well
- Water wells**
 - Domestic
 - Agriculture
 - Industrial
 - Monitoring
- 20-foot elevation contour interval

Water Resources



Farmers use groundwater to irrigate their crops in bottomlands along the Ohio River. Photo by Glynn Beck, Kentucky Geological Survey.

Groundwater Availability

The alluvium along the Ohio River is the best source of groundwater in the county. In the northern and western edges of the county, nearly all drilled wells less than 150 feet deep in the alluvium of the Ohio River valley are adequate for domestic use. Most wells yield more than 50 gallons per minute, and some yield as much as 1,000 gallons per minute. In over half of Union County most wells that penetrate sandstone formations less than 300 feet are adequate for a domestic supply. In the highlands of the southeastern part of the county, in the old Camp Breckinridge area, and in the Grundy Hill area southwest of Uniontown, only a few wells yield enough water for a domestic supply. In a thin, highly faulted zone running east-west across the county between the towns of Givens and The Rocks, yields to drilled wells are unpredictable because of the faulting.

Generally, groundwater is hard to very hard, and iron and salt may be present in objectionable amounts. Often groundwater becomes saltier with depth.

For more information on groundwater resources in the county, see Carey and Stickney (2001).

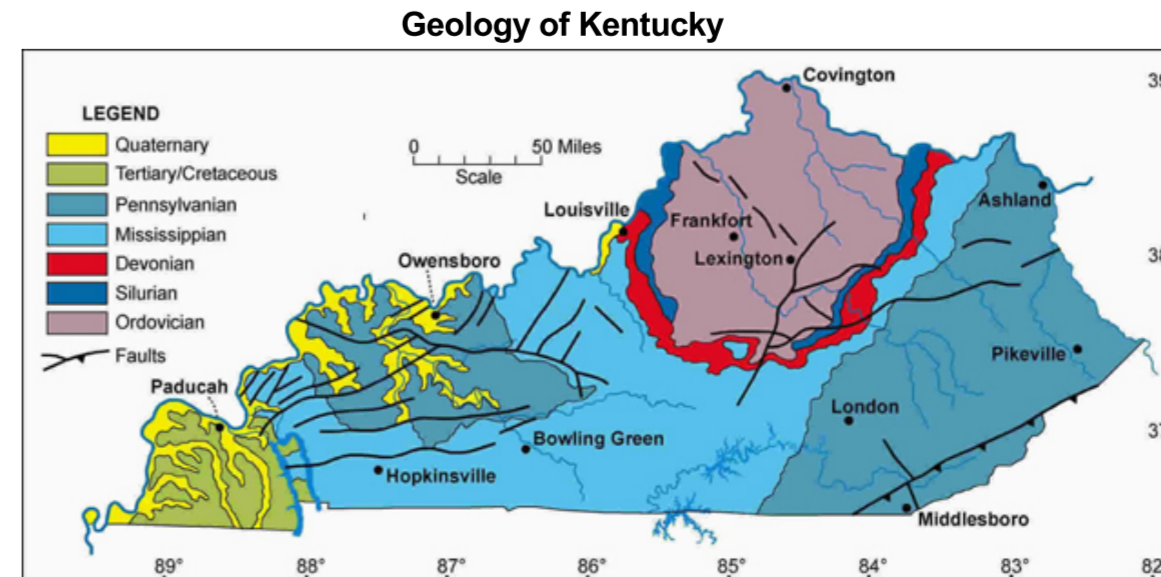
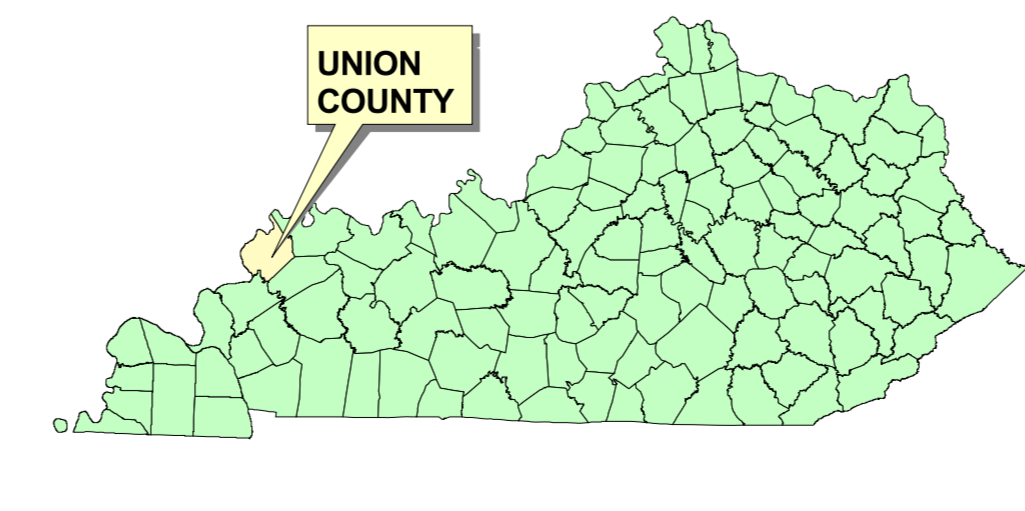
Surface-Water Drainage

Because of the large percentage of flat to gently sloping areas associated with the Ohio and Tradewater Rivers, development, such as subdivisions, can cause flooding if proper drainage designs are not implemented as part of the planning and development process. Watersheds can also be impaired from improper sewage treatment and urban and industrial runoff.

Additional Planning Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with land use planning issues in Union County:

- www.uky.edu/v2/—Union County Economic Development Foundation, Inc.
- ces.ca.uky.edu/union/—University of Kentucky Cooperative Extension Service
- www.gradd.org/—Green River Area Development District
- www.thinkkentucky.com/ky/crmy/cw015/—Kentucky Economic Development Information System
- www.uky.edu/KentuckyAtlas/21225.html—Kentucky Atlas and Gazetteer quickfacts.census.gov/facts/states/21/21225.html—U.S. Census data
- kgsweb.uky.edu/download/kgsplanning.htm—Planning Information from the Kentucky Geological Survey



Learn more about Kentucky geology at www.uky.edu/kgs/geoly/

Planning Guidance by Rock Unit Type

Rock Unit	Foundation and Excavation	Septic Tank Disposal System	Residence with Basement	Highways and Streets	Access Roads	Light Industry	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Alluvium	Fair to good foundation material. Easily excavated.	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).	Refer to soil report (Jacobs, 1981).
2. Loess	Fair to good foundation material. Easily excavated.	Slight to moderate limitations. Variable thickness and permeability.	Severe limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Shale, siltstone, sandstone, limestone, coal, and underclay*	Fair to good foundation material. Difficult excavation.**	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes. **	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes. **	Moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes. **	Slight to severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.**	Severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.
4. Sandstone	Fair to good foundation material. Difficult excavation.	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Slight to severe limitations. Steep slopes.	Slight to moderate limitations.	Moderate limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.
5. Sandstone, siltstone, limestone, and shale	Fair to good foundation material. Difficult excavation.	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Slight to severe limitations. Steep slopes.	Slight to moderate limitations.	Moderate limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.
6. Limestone and shale	Fair to good foundation material. Difficult excavation.	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Moderate limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rip-pable. Steep slopes.	Slight to severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.

*This unit may be overlain by loess.
**Coal beds and underclays should not be used for foundations or reservoir embankments because of the presence of expanding utilities in coal and underclays and the weakness of underclay when it becomes wet.

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For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call:
Public Information Center
853.257.3899
877.778.7827 (toll free)
View the KGS World Wide Web site at www.uky.edu/kgs

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