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

Daniel I. Carey
University of Kentucky, carey@uky.edu

Sally Sloan
University of Kentucky

Kentucky Geological Survey
James C. Cobb, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

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Water Resources

The North Fork of the Kentucky River (above) provides water for the Jackson Municipal Water Works. The Middle Fork of the Kentucky River and Buckhorn Lake are also potential sources of water. The North Fork is seen here during a severe drought. The 98-acre Pan Bowl Lake in Jackson (below), reknowned for its largemouth bass, was created when the embankment for Ky. 15 cut off an old oxbow meander of the North Fork. Photos by Dan Carey, Kentucky Geological Survey.

Justice Center at Jackson

Breathitt County, 495 square miles in the Eastern Kentucky Coal Field, was formed in 1839. The topography is rugged, with flat areas along stream valleys. The highest elevation in the county, 1,621 feet, is on a ridge at the north end of Robinson Forest. The lowest elevation, 643 feet, is where the North Fork of the Kentucky River leaves the county. The population in 2006, 15,881, was 1.4 percent smaller than that of 2000. Photo by Dan Carey, Kentucky Geological Survey.

Kudzu

Kudzu, named after the area of its origin in Japan, grows to impressive displays throughout southeastern Kentucky. It may grow 12 inches in a day, or 60 feet in a season. The nonwoody parts are edible. Photo by Dan Carey, Kentucky Geological Survey.

Acknowledgments

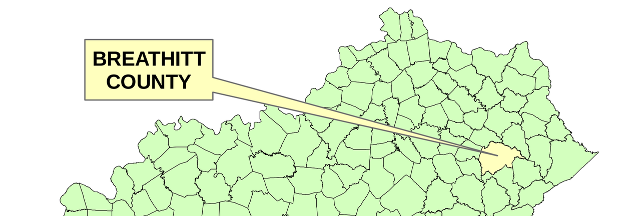
Geology adapted from Murphy (2004, 2005), Andrews and others (2005), Ciszak and others (2005), Cordiviola and others (2005), Morris and others (2005a–e), Sparks and others (2005a–e), Sullivan and Lambert (2005a, b), and Sullivan and others (2005a–c). Thanks to Meg Smath, Kentucky Geological Survey, for editorial improvements. Thanks to Bart Davidson, Kentucky Geological Survey, for photo assistance. Thanks to Kim and Kent Anness, Kentucky Division of Geographic Information, for base-map data.

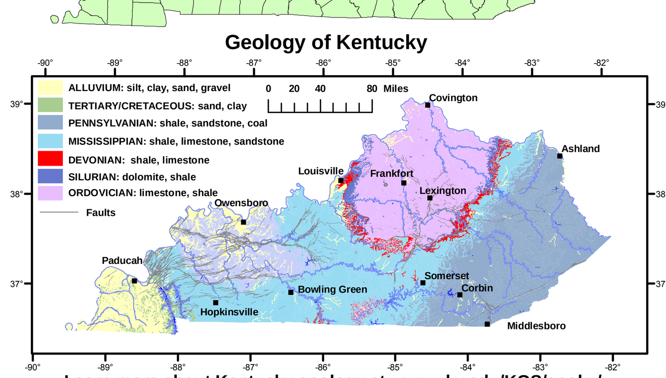
Drought

Drought conditions reduce Puncheon Camp Creek to a sandstone (unit 3) roadbed. Photo by Dan Carey, Kentucky Geological Survey.

Groundwater

About 10,500 people in Breathitt County rely on private domestic water supplies; nearly all use water wells. Most wells drilled in valley bottoms are adequate for a domestic water supply. Fewer than half the wells drilled on hillsides are adequate for a modern supply, and wells on hilltops yield less water. In the easternmost quarter of the county, groundwater is slightly more plentiful, and has the potential to serve small municipalities or industry from wells 200 feet or deeper. Most of the water obtained from drilled wells is extremely hard and contains noticeable amounts of iron. Salty water may be found from 50 to several hundred feet below the level of the principal valley bottoms. A few springs supply enough water for domestic use. Almost all springs yield less than 5 gallons per minute. For more information on groundwater in the county, see Carey and Stickney (2005). Photo by Dan Carey, Kentucky Geological Survey.





Learn more about Kentucky geology at www.uky.edu/KGS/geoky/

Sandstone (Unit 6)

Potential excavation difficulties are obvious in this massive bed of sandstone (unit 6) exposed along Cedar Bend Road. Photo by Dan Carey, Kentucky Geological Survey.

Sandstone and Shale (Unit 3)

Characteristic crumbly appearance of shale and erosion resistance of sandstone are seen in this roadcut on Ky. 15. Photo by Dan Carey, Kentucky Geological Survey.

Construction on Shale

Roadbed support to prevent pavement failure is common for roads like Ky. 1110 near Haddix constructed on shale (unit 2 in this case). Photo by Dan Carey, Kentucky Geological Survey.

Sandstone, Siltstone, Shale, and Coal (Units 3 and 4)

Sandstone, siltstone (light), shale, and coal (dark) of units 3 and 4 are exposed at this impressive roadcut (right) along Ky. 15. Photo by Dan Carey, Kentucky Geological Survey.

Landslides

Hillside construction can cause earth movements if not properly planned. Photos by Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service.

Landslides

Virtually all units containing shale on slopes are subject to landslides. Shales will break down and weather rapidly when exposed to air and water. Gravity is the main driving force, but water nearly always plays a critical role by adding weight and lubricating the shale. Cutting into or overloading a slope with structures and fill can also be major contributing factors. The failure of the slope may be rapid, but more commonly is a slow, almost imperceptible movement, called creep, of a few inches per year. Whether rapid or slow, the end results and damage are similar and costly: broken plumbing, cracked walls and foundations, cracked streets and sidewalks, and commonly, total loss of the structures.

Precautions include taking care of all surface-water runoff by making certain that all runoff from roofs, gutters, patios, sidewalks, and driveways is carried well away from and not toward the house; diverting drainage from areas sloping toward the house; cutting into natural slopes as little as possible and avoiding the use of fill; and trying to place the foundation of the structure on undisturbed bedrock. When in doubt, consult an engineering geologist or a geotechnical engineer.

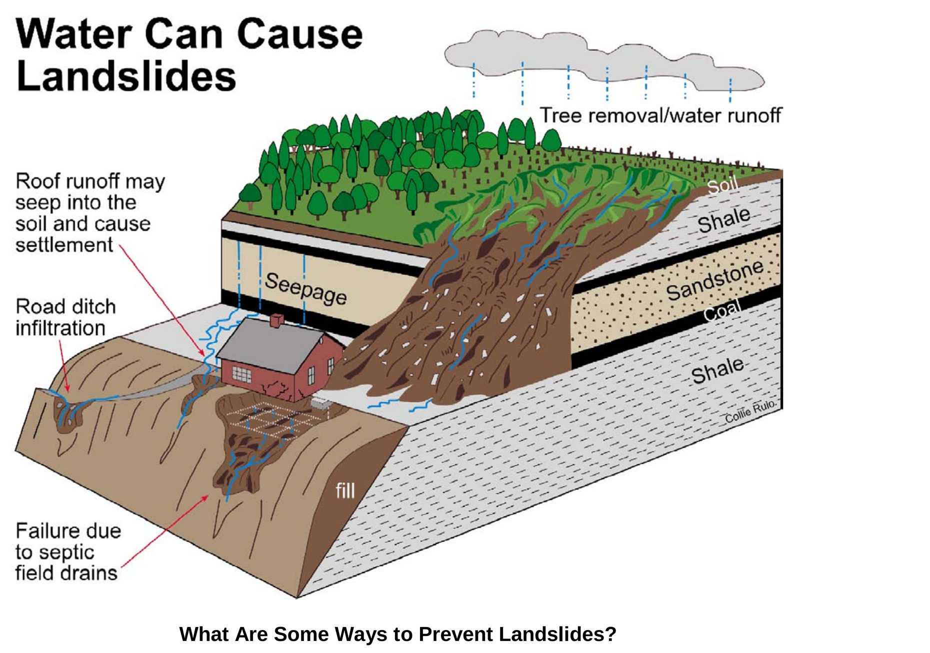
What Are the Factors That Cause Landslides?

Many factors contribute to landslides. The most common in eastern Kentucky are:

1. Steep slopes: Avoid when choosing a building site.
2. Water: Slope stability decreases as water moves into the soil. Springs, seeps, roof runoff, gutter downspouts, septic systems, and site grading that cause ponding or runoff are sources of water that often contribute to landslides.
3. Changing the natural slope by creating a level area where none previously existed.
4. Poor site selection for roads and driveways.
5. Improper placement of fill material.
6. Removal of trees and other vegetation: Site construction often results in the elimination of trees and other vegetation. Plants, especially trees, help remove water and stabilize the soil with their extensive root systems.

Mapped Surface Faults

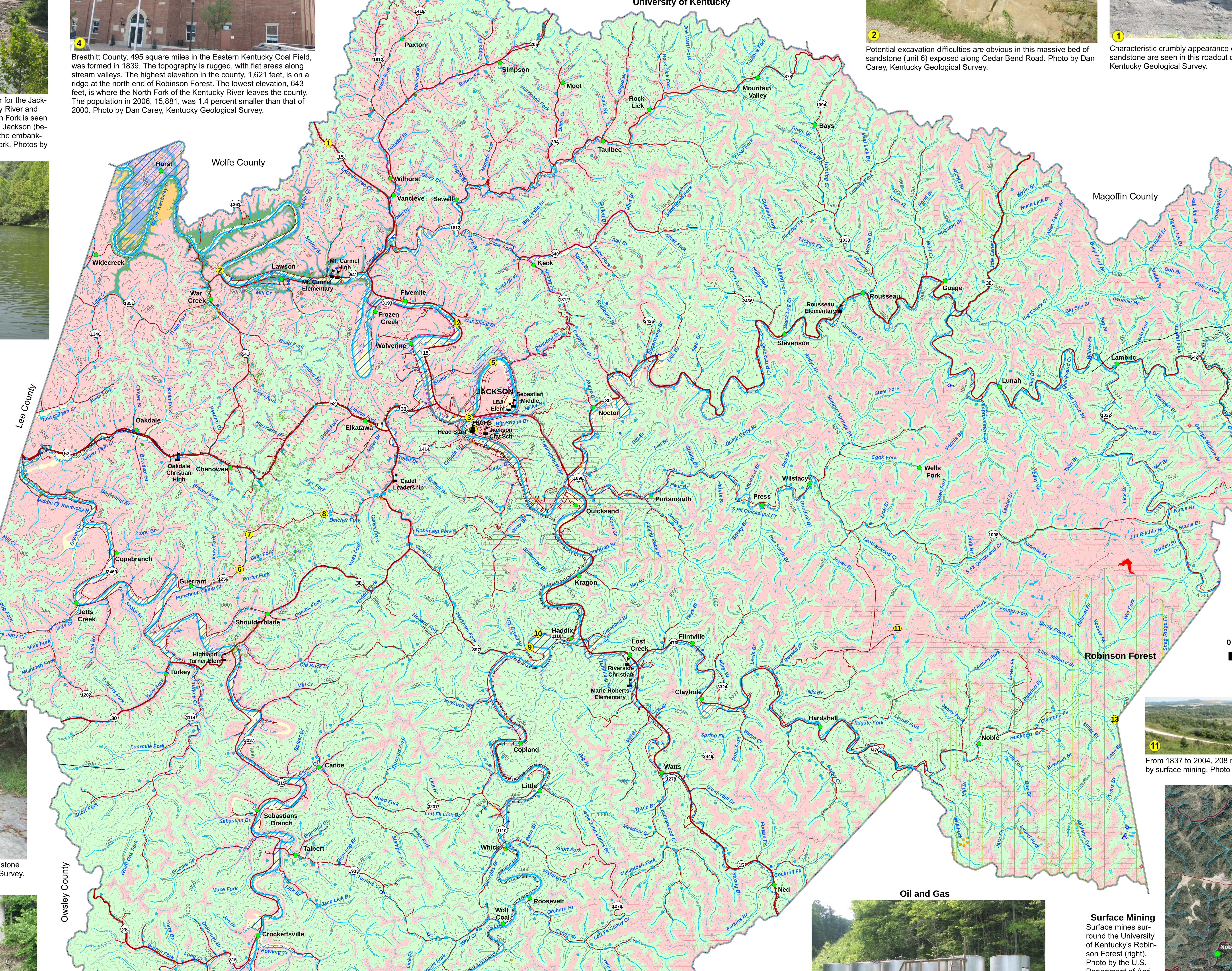
Faults are common geologic structures across Kentucky, and have been mapped in many of the commonwealth's counties. The faults shown on this map represent seismic activity that occurred several million years ago at the latest. There has been no activity along these faults in recorded history. Seismic risk associated with these faults is very low. Faults may be associated with increased fracturing of bedrock in the immediately adjacent area. This fracturing may influence slope stability and groundwater flow in these limited areas.



What Are Some Ways to Prevent Landslides?

1. Seek professional assistance prior to construction.
2. Proper site selection: Some sloping areas are naturally prone to landslides. Inspect the site for springs, seeps, and other wet areas that might indicate water problems. Take note of unusual cracks or bulges at the soil surface. These are typical signs of soil movement that may lead to slope failure. Also be aware of geologically sensitive areas where landslides are more likely to occur.
3. Alter the natural slope of the building site as little as possible during construction. Never remove soil from the toe or bottom of the slope or add soil to the top of the slope. Landslides are less likely to occur on sites where disturbance has been minimized. Seek professional assistance before earth-moving begins.
4. Remove as few trees and other vegetation as possible. Trees develop extensive root systems that are very useful in slope stabilization. Trees also remove large amounts of groundwater. Trees and other permanent vegetative covers should be established as rapidly as possible and maintained to reduce soil erosion and landslide potential.
5. Household water disposal system: Seek professional assistance in selecting the appropriate type and location of your septic system. Septic systems located in fill material can saturate soil and contribute to landslides.
6. Proper water disposal: Allowing surface waters to saturate the sloping soil is the most common cause of landslides in eastern Kentucky. Properly located diversion channels are helpful in redirecting runoff away from areas disturbed during construction. Runoff should be channeled and water from roofs and downspouts piped to stable areas at the bottom of the slope.

(From U.S. Department of Agriculture, Natural Resources Conservation Service, no date)



N
1:63,360
1 inch = 1 mile
0 0.5 1 2 3 4 Miles

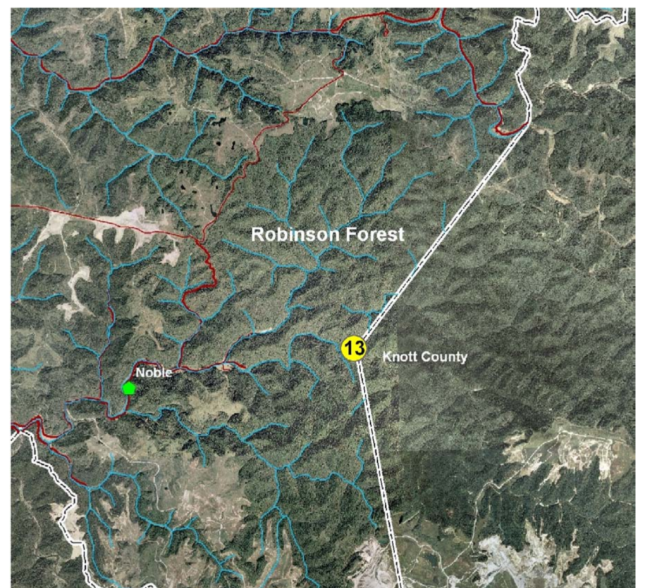
EXPLANATION

School
Gas well
Oil well
Enhanced recovery well
Water wells
Domestic
Industrial
Monitoring
Public
Livestock
Spring
County line
Watershed boundary
Railroad
Abandoned railroad
Mapped mined areas (does not include all mining)
Incorporated city boundaries
Artificial fill
Public lands
Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
Source-water protection area, zone 1
Designated flood zone* (FEMA, 2005)
Mine dump or spoil
200-foot contour interval
Photo location

*Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, www.water.ky.gov/floods/.

Coal

From 1837 to 2004, 208 million tons of coal was mined in Breathitt County, 192 million by surface mining. Photo by Dan Carey, Kentucky Geological Survey.



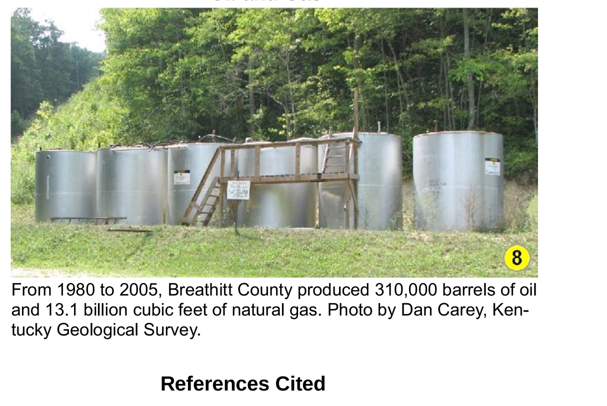
Surface Mining

Surface mines surround the University of Kentucky's Robinson Forest (right). Photo by the U.S. Department of Agriculture, Farm Services Administration, National Agricultural Imagery Program (2004).

Source-Water Protection Areas

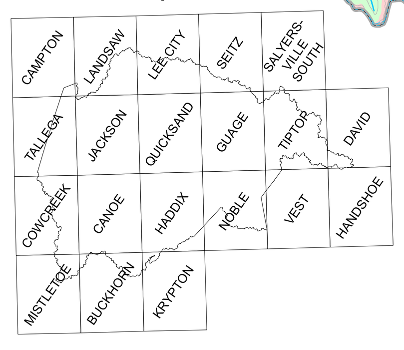
Source-water protection areas are those in which activities are likely to affect the quality of the drinking-water source. For more information, see kgsweb.uky.edu/download/water/swapp/swapp.htm.

Oil and Gas



From 1980 to 2005, Breathitt County produced 310,000 barrels of oil and 13.1 billion cubic feet of natural gas. Photo by Dan Carey, Kentucky Geological Survey.

7.5-Minute Quadrangle Map Index



For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call our Public Information Center at 859.257.3896 or 877.778.7827 (toll free).

Visit the KGS World Wide Web site at: www.uky.edu/KGS

For Planning Use Only

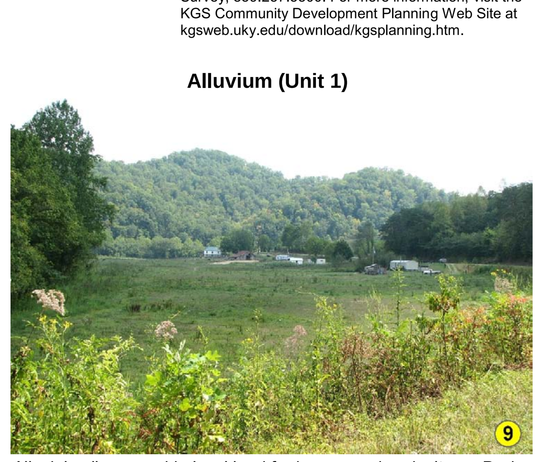
This map is not intended to be used for selecting individual sites. Its purpose is to inform land-use planners, government officials, and the public in a general way about geologic bedrock conditions that affect the selection of sites for various purposes. The properties of thick soils may supersede 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, 859.257.5500. For more information, visit the KGS Community Development Planning Web Site at kgsweb.uky.edu/download/kgsplanning.htm.

Additional Resources

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

www.kyhometown.com/jackson/ Jackson and Breathitt County
www.jacksonkytourism.com/ Jackson Tourism
www.breathittmuseum.com/ Breathitt County Museum
www.breathitt.k12.ky.us/ Breathitt County Schools
www.breathittcountyhoneyfestival.com/ Breathitt County Honey Festival
ces.ca.uky.edu/Breathitt/ University of Kentucky Cooperative Extension Service
www.kradd.org/ Kentucky River Area Development District
www.thinkkentucky.com/edis/cmnty/index.aspx?cw=105 Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21025.html Kentucky Atlas and Gazetteer, Breathitt County
quickfacts.census.gov/qfd/states/21/21025.html U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm Planning information from the Kentucky Geological Survey

Alluvium (Unit 1)



Alluvial valleys provide level land for homes and agriculture. Drainage and flooding problems must be properly addressed. Photo by Dan Carey, Kentucky Geological Survey.

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LAND-USE 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.

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 soil.

Residences—Ratings are made for residences with 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 the 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.

Planning Guidance by Rock Unit Type

Rock Unit	Foundation and Excavation	Septic System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Clay, silt, sand, and gravel (alluvium)	Fair foundation material; easy to excavate. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1998).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1998).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1998).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1998).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1998).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1998).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Hayes, 1998).	Slight to severe limitations, depending on type of activity. Subject to flooding. Refer to soil report (Hayes, 1998).	Pervious material. Seasonal high water table. Refer to soil report (Hayes, 1998).	Fair stability. Fair compaction characteristics. Piping hazard. Refer to soil report (Hayes, 1998).	Slight limitations, in general, except for seasonal high water table and flooding. Refer to soil report (Hayes, 1998).
2. Shale, siltstone, sandstone, and thin coal	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays.	Severe limitations. Thin soils and impermeable rock associated with shales.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
3. Sandstone, siltstone, shale, coal, and underclay	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays.	Severe limitations. Thin soils and impermeable rock associated with shales.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
4. Siltstone, shale, sandstone, coal, limestone	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays. Possibility of mine works.	Severe limitations. Thin soils and impermeable rock associated with shales.	Severe to moderate limitations. Rock excavation may be required.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
5. Silt, clay, sand, and gravel (ancient river deposits)	Fair foundation material; easy to excavate.	Severe to slight limitations, depending on amount of soil cover.	Moderate to slight limitations, depending on slope.	Slight limitations.	Slight limitations, depending on slope.	Slight limitations, depending on slope.	Moderate to slight limitations, depending on activity and topography.	Moderate to slight limitations, depending on activity and topography.	Pervious material. Not recommended.	Slight to moderate limitations. Unstable steep slopes.	Slight limitations.
6. Sandstone and shale	Excellent foundation material; difficult to excavate.	Severe limitations. Thin soils.	Severe to moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations, depending on activity and slope.	Slight to severe limitations, depending on activity and topography. Slight limitations for forest or nature preserve.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation.