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

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

Daniel I. Carey
Kentucky Geological Survey

John Storm
University of Kentucky

Acknowledgments

Geology adapted from Johnson (2003), Curl and Stidham (2006), Duncan (2006), Hettinger and Stidham (2006), Miller and others (2006), Murphy and Stidham (2006), Nelson and others (2006a-c), Patton and Stidham (2006), Sparks and Stidham (2006a, b), and Yang and Stidham (2006a-d). Thanks to Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service, for landslide illustrations. Thanks to Kim and Kent Anness, Kentucky Division of Geographic Information, for base-map data.

MAP AND CHART 165
Series XII, 2007

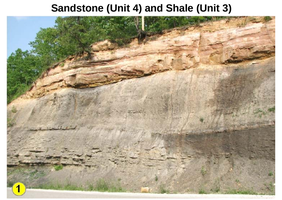
Laurel County Courthouse at London

Laurel County, an area of 436 square miles in the Eastern Kentucky Coal Field, was formed in 1826. The Rockcastle River forms the western and northern boundaries of the county. The lowest elevation, 723 feet, is where the Rockcastle joins the Cumberland River. The highest elevation, 1,760 feet, is a peak in the southeast on the Knox County line. The 2006 population of 56,979 was 8.1 percent greater than that of 2000. Photo by Dan Carey, Kentucky Geological Survey.

Recreation

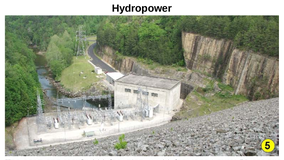
The 19.2-mile-long Laurel River Lake provides 5,600 acres and 206 miles of shoreline for outdoor recreation and family outings (below). The average depth of the lake is 65 feet. Photos by Dan Carey, Kentucky Geological Survey.

Sandstone (Unit 4) and Shale (Unit 3)



Sandstone (unit 4) atop the shale, siltstone, and sandstone of unit 3 in a roadcut on Ky. 909. Seepage occurs when downward-percolating water encounters the impermeable shale. Photo by Dan Carey, Kentucky Geological Survey.

Hydropower



The earth and rockfill 282-foot-high, 1,420-foot-long Laurel River Lake dam was built in 1964—74 by the U.S. Army Corps of Engineers to provide recreation, drinking water, and hydropower. The average annual energy production is 67 million kilowatt hours.

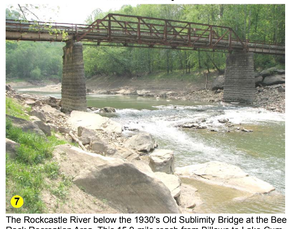
Transportation

The Hal Rogers and Cumberland Gap Parkways and I-75 provide major transportation arteries for local industry. Photo by Dan Carey, Kentucky Geological Survey.

Waste Management

The Laurel Ridge Landfill, operated by Waste Connections Inc., can produce 4.8 megawatts of electricity from landfill methane gas at its Eastern Kentucky Power Cooperative unit. Photo courtesy of WCI of Kentucky.

Scenic Beauty



The Rockcastle River below the 1930's Old Sublimity Bridge at the Bee Rock Recreation Area. This 15.9-mile reach from Billows to Lake Cumberland is part of the Kentucky Wild Rivers Program. Photo by Dan Carey, Kentucky Geological Survey.

Groundwater

About 5,100 people in Laurel County rely on private domestic water supplies: about 4,800 use wells and 400 use other sources. Some of the drilled wells in valley bottoms and a few wells on hillsides and ridges in the eastern third and northwestern quarter of Laurel County are adequate for domestic supply. In the rest of the county more than three-quarters of the drilled wells in valleys, most of the wells on hillsides, and about half the wells on ridges are adequate for a domestic supply. Deep wells penetrating greater than 500 feet of sandstone may yield enough water for small municipal or industrial supplies. Water obtained from most wells in this area is soft or moderately hard and contains noticeable amounts of iron. Only occasionally is salty water found in drilled wells. A few springs supply sufficient quantities of 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).

Industry

AISIN Automotive Casting LLC near Lily has received numerous awards for product quality and commitment to environmental protection. Its 650 employees produce over $200 million worth of cast aluminum automotive parts annually. Photo by Dan Carey, Kentucky Geological Survey.

EXPLANATION

- School
- Oil well
- Gas well

Water wells
- Mining
- Domestic
- Monitoring
- Agriculture

- Spring
- Railroad
- Abandoned railroad
- County line
- Watershed boundary
- Public lands
- Source-water protection area, zone 1
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Incorporated city boundary
- 100-foot contour interval
- 4 Photo location

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.

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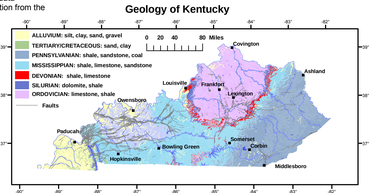
Yang, X.Y., and Stidham, M., 2006d, Spatial database of the Parrot quadrangle, Kentucky: Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-236. Adapted from Crowder, D.F., 1963, Geology of the Parrot quadrangle, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-236, scale 1:24,000.

7.5-Minute Quadrangle Map Index

Geology of Kentucky



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

Additional Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with land-use planning issues in Laurel County:
www.laurelkytourism.com Laurel County Tourism
www.londonky.com London
www.londonlaurelchamber.com London/Laurel Chamber of Commerce
www.chickenfestival.com World Chicken Festival
www.kyhometown.com/london/ London/Laurel County
www.sentinel-echo.com The Sentinel Echo
ces.ca.uky.edu/laurel/ University of Kentucky Cooperative Extension Service
www.cvadd.org/ Cumberland Valley Area Development District
www.thinkkentucky.com/edis/cmnty/cw/cw005/ Development Information System
www.uky.edu/KentuckyAtlas/21125.html Kentucky Atlas and Gazetteer, Laurel County
quickfacts.census.gov/qfd/states/21/21125.html U.S. census data
kgsweb.uky.edu/download/kgsplanning.htm Planning information from the Kentucky Geological Survey

Stream Valleys (Units 1 and 2)

Wide stream valleys characteristic of alluvial areas underlain by shale (units 1 and 2) provide level land and soils for row-crop agriculture and rural residential development (below). Photos by Dan Carey, Kentucky Geological Survey.

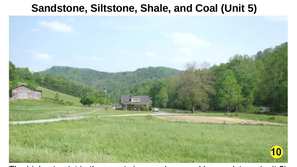
Shale, Siltstone, Sandstone, Coal (Unit 2)

Shale is predominant in unit 2 along the Hal Rogers Parkway. Photo by Dan Carey, Kentucky Geological Survey.

Terrain

Except for the hills of unit 5, the terrain in the south and east (units 2, above, and 4) is less rugged than in the west and north (unit 3). Ponds are common on unit 2 (below). Photos by Dan Carey, Kentucky Geological Survey.

Sandstone, Siltstone, Shale, and Coal (Unit 5)



The highest point in the county is a peak capped by sandstone (unit 5) southeast of Blackwater. Photo by Dan Carey, Kentucky Geological Survey.

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.

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

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.

What Are the Factors That Cause Landslides?

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

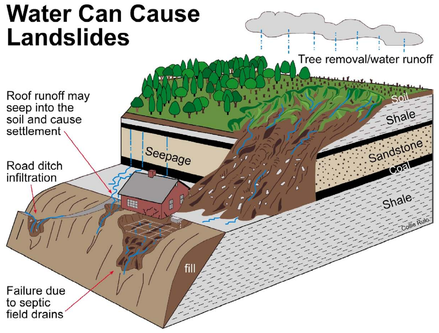
1. Steep slopes: Avoid when choosing a building site.
2. Water: Slope stability decreases as water moves into the soil. Springs, seeps, roof runoff, gutter downspouts, septic systems, and site grading that cause ponding or runoff are sources of water that often contribute to landslides.
3. Changing the 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.

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)

Water Can Cause Landslides



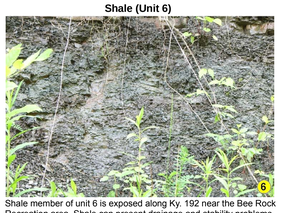
Landslides

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.

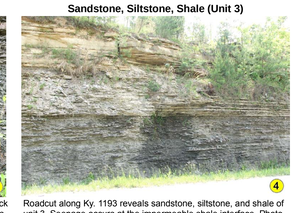
Hillside construction can cause earth movements if not properly planned. Photos by Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service.

Shale (Unit 6)



Shale member of unit 6 is exposed along Ky. 192 near the Bee Rock Recreation area. Shale can present drainage and stability problems. Photo by Dan Carey, Kentucky Geological Survey.

Sandstone, Siltstone, Shale (Unit 3)



Roadcut along Ky. 1193 reveals sandstone, siltstone, and shale of unit 3. Seepage occurs at the impermeable shale interface. Photo by Dan Carey, Kentucky Geological Survey.

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 (Ross and others, 1981).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Ross and others, 1981.)	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Ross and others, 1981).	Pervious material. Seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).	Fair stability. Fair compaction characteristics. Piping hazard. Refer to soil report (Ross and others, 1981).	Slight limitations, in general, except for seasonal high water table. Subject to flooding. Refer to soil report (Ross and others, 1981).
2. Shale, siltstone, sandstone, 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. Reservoir may leak where rocks, including coal, are jointed or fractured.	Moderate limitations. Reservoir may leak where rocks are fractured.	Slight to moderate limitations. Thin soils. Possible rock excavation.
3. Sandstone, siltstone, and shale	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 rock are jointed or fractured.	Moderate limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
4. Sandstone	Excellent foundation material; difficult to excavate.	Severe limitations. Thin soils.	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 moderate limitations, depending on activity and topography. Slight limitations for forest or nature preserve.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation. Thin soils.
5. Sandstone, siltstone, shale, and 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. Steep slopes.	Moderate to severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Moderate to severe limitations, depending on activity and topography. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation. Thin soils.
6. Shale, sand-stone, silt-stone, and limestone	Fair to good foundation material; difficult to excavate. Expansive shales.	Severe limitations. Impermeable rock.	Severe to moderate limitations. Rock excavation may be required. Possible expansion of shales.	Severe to moderate limitations. Rock excavation may be required. Possible expansion of shales.	Moderate to severe limitations. Rock excavation may be required. Drainage management required.	Severe to moderate limitations. Rock excavation may be required. Possible expansion of shales. Drainage management required.	Slight to moderate limitations, depending on activity and topography.	Slight limitations, depending on activity and topography.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Moderate limitations. Reservoir may leak where rocks are fractured.	Moderate limitations. Highly variable amount of earth and rock excavation.
7. Limestone	Excellent foundation material; difficult to excavate.	Severe limitations. Impermeable rock. Danger of ground-water contamination.	Severe limitations. Rock excavation may be required.	Severe limitations. Rock excavation.	Moderate to severe limitations. Rock excavation possible.	Moderate to severe limitations. Rock excavation possible.	Slight to moderate limitations, depending on activity.	Slight limitations, depending on activity.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation.