2007

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

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

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

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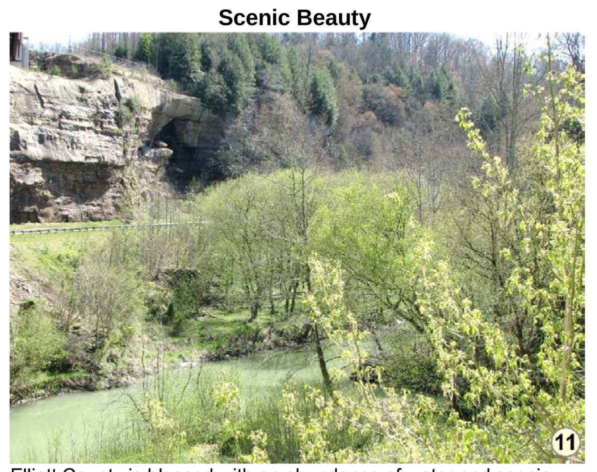
https://doi.org/10.13023/kgs.mc161.12
MAP AND CHART 161
Series XII, 2007

Elliott County Courthouse at Sandy Hook

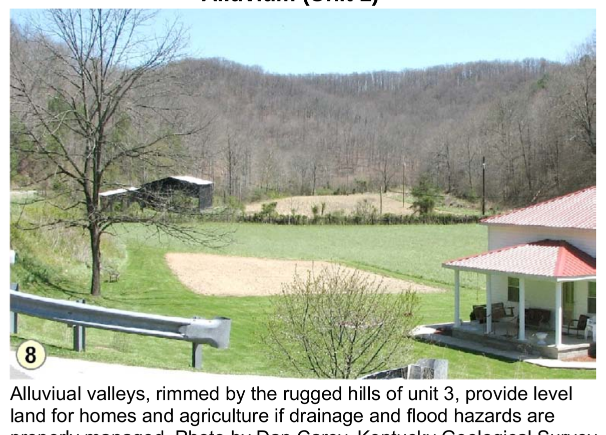
Elliott County, an area of 234 square miles in the Eastern Kentucky Coal Field, was formed in 1869. The highest elevation, 1,340 feet, is a knob in the headwaters of Pruetts Fork and Wells Creek. The lowest elevation, 645 feet, is the normal pool level of Grayson Lake. The 2005 population was 6,960, 3.1 percent greater than that of 2000. Photo by Dan Carey, Kentucky Geological Survey.

Scenic Beauty



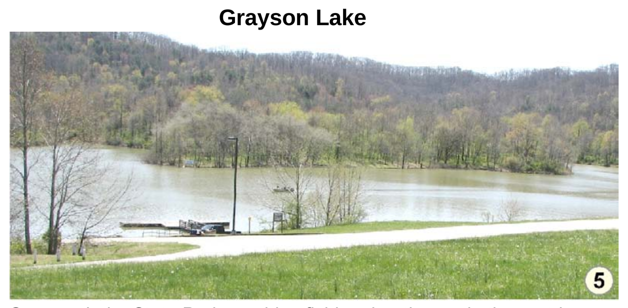
Elliott County is blessed with an abundance of water and scenic beauty. A trip down the Little Sandy River provides canoeists with many breathtaking views, including the spectacular sandstone cliffs of Laurel Gorge. Photo by Dan Carey, Kentucky Geological Survey.

Alluvium (Unit 1)



Alluviual valleys, rimmed by the rugged hills of unit 3, provide level land for homes and agriculture if drainage and flood hazards are properly managed. Photo by Dan Carey, Kentucky Geological Survey.

Grayson Lake



Grayson Lake State Park provides fishing, boating and other outdoor recreational activities. Photo by Dan Carey, Kentucky Geological Survey.

Wetlands

In addition to streams and lakes, the county has 55 natural wetlands ranging in size from 1 to 27 acres. Photo by Dan Carey, Kentucky Geological Survey.

Groundwater

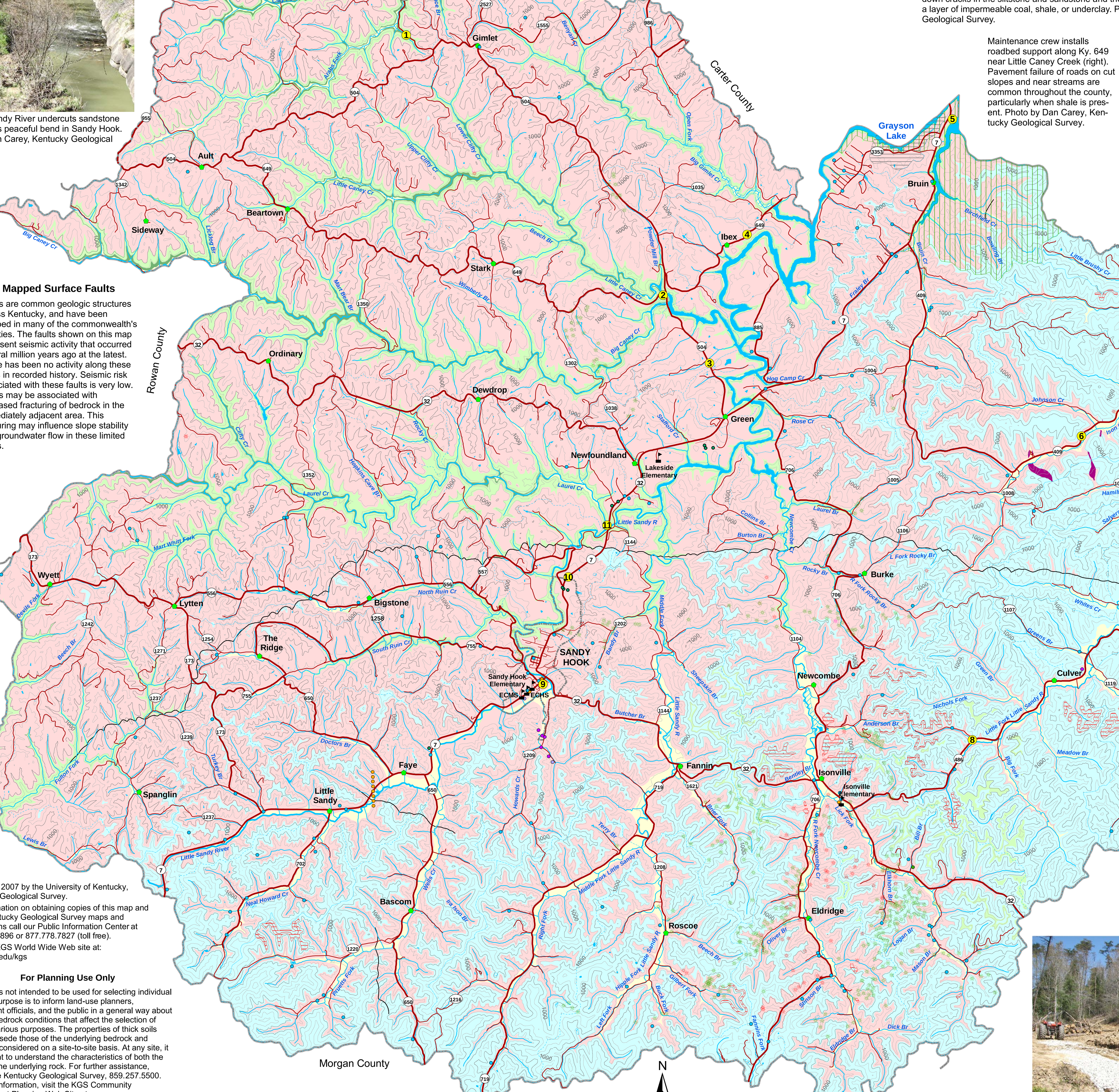
About 4,200 residents of Elliott County rely on private domestic water supplies: 3,500 use wells and 700 use other sources. Most wells in valley bottoms are adequate for a domestic supply. In the southeastern part of the county, fewer than half of the wells on hillsides are adequate for domestic use, and wells on hilltops produce smaller quantities of water. In the northwestern part of the county, most of the wells drilled on hillsides are adequate for a domestic supply, and about half the wells on hilltops and ridges are adequate for a domestic supply. Deep wells penetrating thick sections of sandstone may yield enough water for small municipal or industrial supplies. Water obtained from most wells of the northwestern part of the county is soft or moderately hard, whereas most water from the southeastern part of the county is extremely hard. Countywide, water contains noticeable amounts of iron. Salty water may be found less than 100 feet below the level of the principal valley bottoms. A few springs supply sufficient quantities of water for domestic use; however, yields are usually less than 5 gallons per minute. For more information on groundwater in the county, see Carey and Stickney (2005).

Little Sandy River

The Little Sandy River undercuts sandstone (unit 6) at this peaceful bend in Sandy Hook. Photo by Dan Carey, Kentucky Geological Survey.

Acknowledgments

Geology adapted from Ciszak and Lambert (2005), Murphy (2005a-c), Nelson and Petersen (2005a, b), Palmgreen (2005), Plauché (2005), Zhang and others (2005), and Smith and Petersen (2006a, b). Thanks to Kim and Kent Anness, Kentucky Division of Geographic Information, for base-map data.



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.

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.

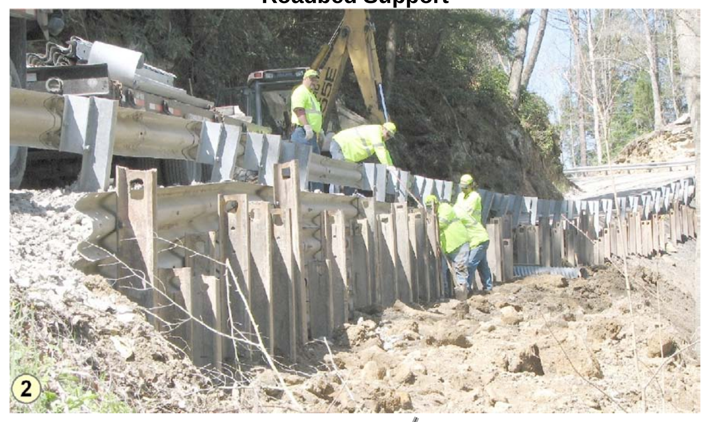
Sandstone (Unit 6)

Massive sandstone cliffs (right) such as this along Ky. 1620 are not uncommon in the county, nor is the need for roadbed support. Photo by Dan Carey, Kentucky Geological Survey.

Sandstone, Siltstone, Shale, Coal, and Underclay (Unit 3)

Rocks of unit 3 are exposed at this roadcut on Ky. 486. Percolating water flows down cracks in the siltstone and sandstone and then laterally when it encounters a layer of impermeable coal, shale, or underclay. Photo by Dan Carey, Kentucky Geological Survey.

Roadbed Support



Maintenance crew installs roadbed support along Ky. 649 near Little Caney Creek (right). Pavement failure of roads on cut slopes and near streams are common throughout the county, particularly when shale is present. Photo by Dan Carey, Kentucky Geological Survey.

Landslides

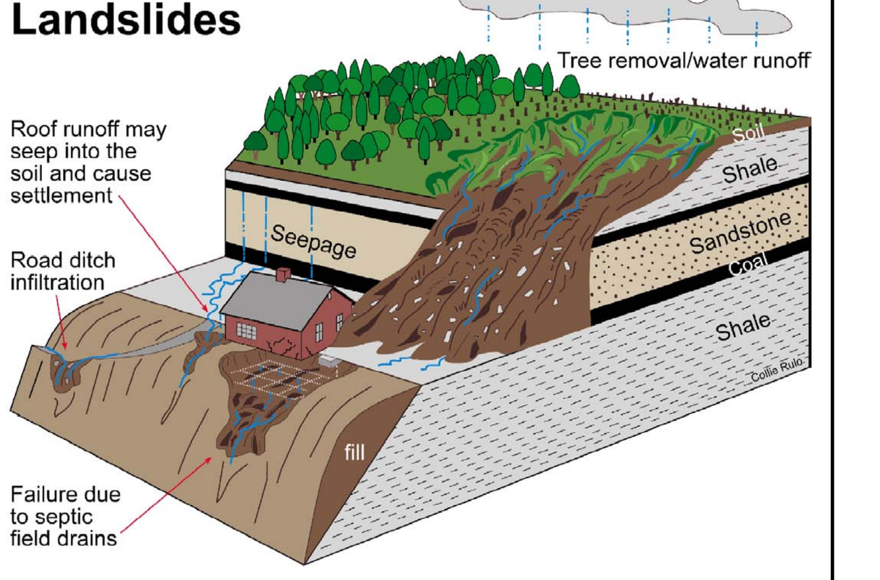
Hillside construction can cause earth movements if not properly planned. Photos by Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service.

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.

Water Can Cause Landslides



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)

EXPLANATION

- School
- Oil well
- Gas well
- Enhanced recovery well
- Water wells
  - Domestic
  - Monitoring
  - Public
  - Industrial
  - Agriculture
- County line
- Watershed boundary
- Geologic fault
- Concealed geologic fault
- Mined area
- Public lands
- Source-water protection area, zone 1
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Incorporated city boundaries

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.

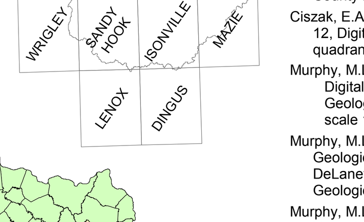
Shale, Siltstone, Sandstone, Thin Coal, and Underclay (Unit 2)

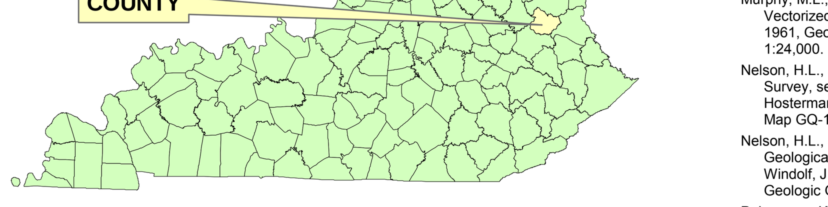
Thick, erodible shale beds separated by sandstone (unit 2) are exposed at this Ky. 70 roadcut. Unit 2 contains more shale than unit 3, and its terrain (below) is in general less rugged. Photos by Dan Carey, Kentucky Geological Survey.

Timber

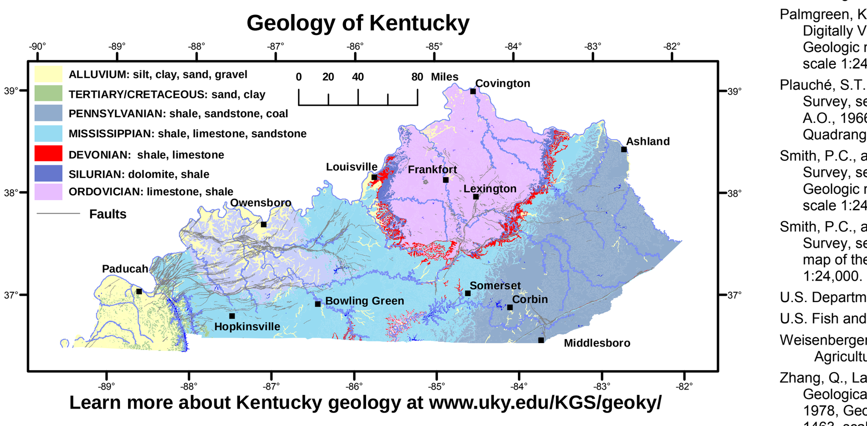
The timber on units 2 and 3 contributes to the local economy. Photo by Dan Carey, Kentucky Geological Survey.

7.5-Minute Quadrangle Map Index





Geology of Kentucky



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

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 (Weisenberger and others, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Pervious material. Seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).	Fair stability. Fair compaction characteristics. Piping hazard. Refer to soil report (Weisenberger and others, 1965).	Slight limitations, in general, except for seasonal high water table. Subject to flooding. Refer to soil report (Weisenberger and others, 1965).
2. Shale*, siltstone, sandstone, thin coal, 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.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
3. Sandstone, siltstone, shale*, coal, underclay	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays. Possibility of underground coal-mine voids.	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.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
4. Siltstone, sandstone, shale*, limestone	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales.	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.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
5. Limestone and shale (limited to valley bottoms and sides)	Excellent foundation material; difficult to excavate.	Severe limitations. Locally fast drainage through fractures. Danger of water contamination.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Drainage required.	Slight to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Drainage required.	Slight limitations. Local drainage problems from seeps or springs.	Slight to moderate limitations, depending on topography. Rock excavation; locally, upper few feet may be rippable. Sinks possible. Local drainage problems.	Slight to severe limitations. Rock excavation may be required.	Slight to moderate limitations, depending on activity and topography. Slight limitations for forest or nature preserve.	Severe limitations. Leaky reservoir rock. Locally, conditions may be favorable.	Severe limitations. Leaky rock.	Severe limitations. Rock excavation.
6. Sandstone	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.	Moderate to severe limitations, depending on activity and topography.	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.

*Shales and clays in these units may shrink during dry periods and swell during wet periods and cause cracking of foundations. On hillsides, especially where seeps and springs are present, they can also be susceptible to landslides.

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.

Additional Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with land-use planning issues in Elliott County:
ces.ca.uky.edu/Elliott/ University of Kentucky Cooperative Extension Service
www.fivco.org/ FIVCO Area Development District
www.thinkkentucky.com/edis/cmnty/cw/cw111/ Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21063.html Kentucky Atlas and Gazetteer, Elliott County
quickfacts.census.gov/qfd/states/21/21063.html U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm Planning information from the Kentucky Geological Survey

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