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

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Clay County Administration Building at Manchester

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Clay County, an area of 471 square miles, was formed in the Eastern Kentucky Coal Field in 1807. Most of the county lies within the Daniel Boone National Forest. Elevations in the county range from a low of 690 feet where the South Fork of the Kentucky River leaves the county, to 2,235 feet atop a mountain near the junction of Clay, Bell, and Knox Counties. The 2004 population of 24,254 was 1.2 percent less than the population in 2000. About 65 percent of the residents are served by public water; 16 percent are served by public sewer. Photo by Dan Carey, Kentucky Geological Survey.

Goose Creek

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Goose Creek and other streams in the county offer many scenes of peaceful beauty. Photo by Dan Carey, Kentucky Geological Survey.

Goose Creek at Manchester

2

Goose Creek flows past the Rawlings-Stinson Park in Manchester. Using flood-plains for parks and recreation reduces the cost of flood damages. 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, and to make custom maps of your area, visit the KGS Land-Use Planning Internet Mapping Web site at kgsmap.uky.edu/website/kyluplan/viewer.htm.

Sandstone and Shale

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Construction at the interface of sandstone overlying shale presents possible rockfall problems as the shale erodes beneath. Photo by Dan Carey, Kentucky Geological Survey.

Landslides

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Road construction near stream banks and on hillsides can contribute to slope failure if not properly planned. Photos by Dan Carey, Kentucky Geological Survey.

Early History

An early settler, James Collins, built a log cabin around 1798 at the headwaters of Goose Creek. Salt reserves and fertile grasslands attracted settlers to the area as they attracted large game animals, making a bountiful hunting ground for prehistoric Native Americans and possibly the Cherokee during the early historic era. During the 19th century Clay County was the leading producer of salt in the state. So vital was salt to frontier life and trade that Daniel Boone offered a plan to reroute the Wilderness Road to pass the Goose Creek salt works near Manchester. Boone did not get the contract, and the area was left without suitable roadways for the next century. In 1811 the Kentucky River was made navigable to the confluence of Goose Creek and Redbird River (named for a Cherokee chief who, according to legend, was thrown into the river after being slain for his furs). A canal system proposed during the 1820's and 1830's to link the Ohio River to the Atlantic Ocean at Charleston and Savannah was to pass by the Goose Creek salt works to expand its market. Salt production peaked at more than 200,000 bushels per year between 1835 and 1845. (From Lee, 1993.)

EXPLANATION

- School
- Gas well
- Oil well

Water wells

- Commercial or industrial
- Domestic
- Monitoring
- Public
- Spring
- Alluvial fan
- Wet area
- Railroad
- County line
- Watershed boundary
- Geologic fault
- Mined area**
- Daniel Boone National Forest
- Designated flood zone* (FEMA, 2005)
- Source-water protection area, zone 1
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Wildlife management area boundary
- Incorporated city boundaries
- 100-foot contour interval
- 4 Photo location

*Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, www.water.ky.gov/floods/.
**Mined area data, surface and underground, from the Kentucky Mine Mapping Information System, minemaps.ky.gov/.

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/swappl/swapp.htm.

What Are The Factors That Cause Landslides?

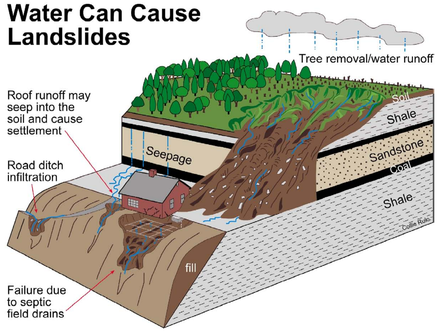
1. Many factors contribute to landslides. The most common factors contributing to landslides in eastern Kentucky are listed below.
2. Steep slopes: Steep slopes should be avoided when choosing a building site.
3. Water: Slope stability decreases as water moves into the soil. Springs, seeps, roof runoff, gutter down spouts, septic systems, and site grading that cause ponding or runoff are sources of water that often contribute to landslides.
4. Changing the natural slope by creating a level area where none previously exists.
5. Poor site selection for roads and driveways.
6. Improper placement of fill material.
7. 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?

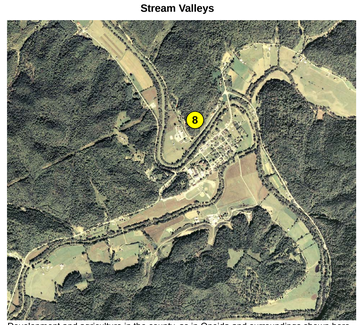
1. Seek professional assistance prior to construction.
2. Proper site selection. Some sloping areas are naturally prone to landslides. Inspect the site for springs, seeps, and other wet areas that might indicate water problems. Take note of unusual cracks or bulges at the soil surface. These are typical 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 earthmoving 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 ground water. Trees and other permanent vegetative covers should be established as rapidly as possible and maintained to reduce soil erosion and landslide potential.
5. Proper 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



Stream Valleys



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Development and agriculture in the county, as in Oneida and surroundings shown here, are confined almost exclusively to the broad stream valleys underlain by units 1, 2, and 3. Aerial photo (2004) by the U.S. Department of Agriculture, Farm Services Administration, National Agricultural Imagery Program.

Oneida Baptist Institute

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Oneida Baptist Institute, a boarding school for grades 6-12, provides a model of self-sufficiency by growing much of their own meat and vegetables. Photo by Bart Davidson, Kentucky Geological Survey.

Bert T. Combs Lake

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Bert T. Combs Lake lies within the Beech Creek Wildlife Management Area. The lake provides recreational fishing and serves as a water source for Manchester Water Works. Photo by Bart Davidson, Kentucky Geological Survey.

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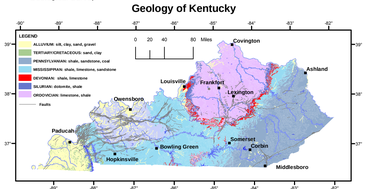
The water treatment plant lies downstream from the earthen dam at Bert T. Combs Lake. The Manchester Recreational Center is farther down the valley. Photo by Bart Davidson, Kentucky Geological Survey.

Additional Planning Resources

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

http://www.claycountykentucky.org Clay County Web page
ces.ca.uky.edu/clay/ University of Kentucky Cooperative Extension Service
www.cvadd.org/ Cumberland Valley Area Development District
www.thinkkentucky.com/edis/cmnty/cw039/ Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21051.html Kentucky Atlas and Gazetteer, Clay County
quickfacts.census.gov/qfd/states/21/21051.html U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm Planning information from the Kentucky Geological Survey

Geology of Kentucky



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

7.5- Minute Quadrangle Map Index

Groundwater

Most wells drilled in valley bottoms are adequate for a domestic supply. Fewer than half the wells drilled on hillsides are adequate for a domestic supply, and wells on hilltops and ridges yield smaller quantities of water. In the western half of the county, wells penetrating 500 feet or more of sandstone may yield enough water for a small municipal or industrial supply. Water obtained from most wells in this area is soft or moderately hard and contains noticeable amounts of iron. Salty water may be found in wells drilled less than 100 feet below the level of the principal valley bottoms. A few springs supply sufficient quantities of water for domestic use; they usually produce less than 5 gallons per minute. For more information on groundwater in the county, see Carey and Stickney (2005).

Acknowledgments

Geology adapted from Miller and others (2006), Mullins (2003), Mullins and Murphy (2003), Morris and others (2005a, b), Nelson and others (2006a–e), and Sparks and others (2005a–c). 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.

Scale = 1:63,360 — 1 inch equals 1 mile

0 1 2 4 6 8 Miles

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 (unconsolidated)	Fair foundation material; easy to excavate. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Pervious material. Seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).	Fair stability. Fair compaction characteristics. Piping hazard. Refer to soil report (McDonald and Blevins, 1965).	Slight limitations, in general, except for seasonal high water table. Subject to flooding. Refer to soil report (McDonald and Blevins, 1965).
2. Shale, siltstone, and coal (sparse sandstone)	Fair to good foundation material; difficult excavation. 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. 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. Shale, siltstone (channel sandstone and sparse coal)	Fair to good foundation material; difficult excavation. 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. Sandstone, siltstone, shale (sparse coal)	Fair to good foundation material; difficult excavation. 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.
5. Sandstone, siltstone, and coal	Fair to good foundation material; difficult excavation. 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. 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.
6. Sandstone (sparse shale and sparse coal)	Excellent foundation material; difficult to excavate.	Severe limitations. Thin soils.	Severe to moderate limitations. Rock excavation may be required. Steep slopes.	Severe to moderate limitations. Rock excavation may be required. Steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes and narrow ridges.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. 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. Thin soils.

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.

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