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https://doi.org/10.13023/kgs.mc79.12
MAP AND CHART 79
Series XII, 2004

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

E. Glynn Beck, David A. Williams, and Daniel I. Carey

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 Court, Henderson, KY 42420, phone 270.827.3414 or 270.827.3404. 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/kyluplan/viewer.htm.

Agriculture is a major part of the Hickman County economy. There are 156,871 acres in Hickman County, and 84,800 of them were planted in either corn or soybeans in 2002 (Kentucky Agriculture Statistics, 2002-2003). Photo courtesy of Jerry McIntosh, USDA Natural Resources Conservation Service.

Acknowledgments

Bedrock mapping adapted from Martin (2000a-d), Melton and Martin (2003), Murphy (2003), and Solis (2003a-c). Thanks to Darian Irvan, Hickman County Agriculture and Natural Resource agent; Mike Wilson, Hickman County 4-H Youth Development agent; and Charlie McIntire, Hickman County District Conservationist, for photo assistance.

Landslides and slumps are associated with tall bluffs during strong earthquakes. The bluff pictured above is located just south of Columbus-Belmont State Park on Ky. 58. The bluff is capped by approximately 30 feet of loess (windblown) material. Photo by Glynn Beck, Kentucky Geological Survey.

Geologic Hazards

The most prominent geologic hazard for Hickman County is flooding. Areas underlain by alluvium, unit 1 on the map, are subject to regular flooding. Urban development often increases flooding, and therefore potential flooding should always be considered in urban development plans. Areas of steep-walled drainage are conducive to flash flooding, especially in developed areas. Flood prone maps are usually available from the Federal Emergency Management Agency and the United States Geological Survey. Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, www.water.ky.gov/floods/.

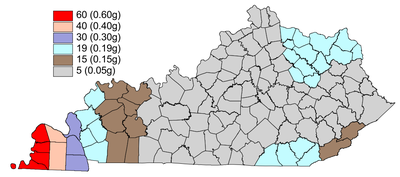
None of the faults in Hickman County are considered to be active; the proximity of the New Madrid Seismic Zone, however, calls for precautions to be taken for earthquake damage mitigation. The presence of thick alluvium, which normally has a high water table, should also be treated with special concern, 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 soil a high shrink/swell capacity, affecting structural foundations and roads.

Steep slopes, especially along streams, are present 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 development site on a hillside.

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 and soil to keep the holes from enlarging and to divert drainage from the area.

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, the 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 pertaining to earthquake hazards visit the Kentucky Geological Survey Web site at www.uky.edu/KGS/geologichazards/geologichazards.html.

A typical way to control gully erosion, which is very common in Hickman County, is to construct a grassed waterway with a rock chute outlet. Funding for this structure is provided by the CRP CP-21 program through the USDA Conservation Reserve Program. Photo by Glynn Beck, Kentucky Geological Survey.

Groundwater

Abundant groundwater is available for domestic, irrigation, and industrial uses in Hickman County, from depths of a few feet down to 750 feet. Generally, depth to groundwater is less than 100 feet, except in the uplands and in the western part of the county, where water is found in the 100- to 250-foot range. Yields in some of the deeper wells (250-750 feet) are greater than 1,000 gallons per minute, which is sufficient for a community or industrial supply. Groundwater from the deeper zones sometimes contains naturally occurring iron in objectionable amounts. In some formations with slightly acidic groundwater, a chemical reaction between the groundwater, steel well casing, and pump equipment will produce a high iron content in the water. In general, the chemical quality of the water is good. Water from alluvium is generally hard to very hard. Water from the sand or gravel, non-alluvium aquifers is considered soft and slightly acidic, with low dissolved solids. For more information on groundwater in the county, see Carey and Stickney (2001).

Approximately 140 chicken houses are in Hickman County. Each house holds about 27,000 birds. Chicken litter associated with these operations is used as a substitute for synthetic fertilizers on row crop fields. Photo by Glynn Beck, Kentucky Geological Survey.

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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 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.

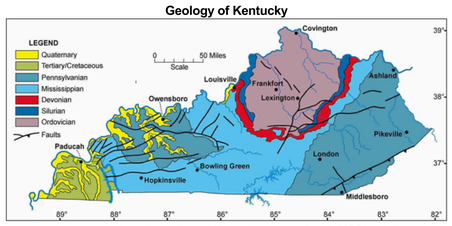
Reservoir embankments--The rocks are rated on limitations for embankment material.

Underground utilities--Included in this group are sanitary sewers, storm sewers, water mains, and other pipes that require fairly deep trenches.

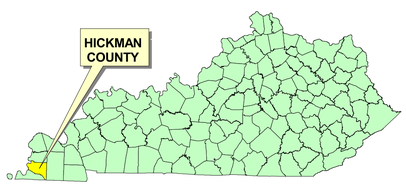
Planning Guidance by Rock Unit Type

Rock Unit	Foundation and Excavation	Septic Tank Disposal System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Alluvium	Fair to good foundation material. Easily excavated.	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).
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. Gravel	Fair to good foundation material. Moderately difficult excavation.	Slight to moderate limitations. Variable thickness and permeability.	Severe to moderate limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Severe limitations. Leaky reservoir material.	Severe limitations. Leaky reservoir material.	Slight to moderate limitations. Variable materials.
4. Sand, clay, and silt	Fair to good foundation material.	Slight to moderate limitations. Variable materials; low-permeability zones possible.	Slight limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight to moderate limitations. Permeable materials possible.	Slight to moderate limitations. Permeable materials possible.	No limitations.
5. Clay and sand	Moderate limitations. Possibility of expanding clay minerals.	Severe limitations. Impermeable material.	Severe limitations; high moisture content.	Moderate limitations. Expanding clay minerals may be present.	Minor limitations. Expanding clay minerals may be present. Mmay be slippery when wet.	Minor limitations. Expanding clay minerals may be present. Drainage required.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.

Geology of Kentucky



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



EXPLANATION

- School
- Urban services boundary
- Watershed divide
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003).
- Water
- Wildlife management area
- Artificial fill
- Concealed faults

Water Wells
- Domestic
- Heat pump
- Industrial
- Irrigation
- Livestock
- Monitoring
- Public
- Unknown

10-foot contour interval

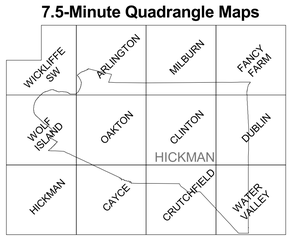
A typical cypress swamp located in the Obion Creek drainage. Most of Obion Creek drains the Loess Plains Ecoregion (Woods and others, 2002). Photo by Glynn Beck, Kentucky Geological Survey.

Additional Planning Resources

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

ces.ca.uky.edu/hickman/—University of Kentucky Cooperative Extension Service
www.purchaseadd.org/—Purchase Area Development District
www.thinkkentucky.com/edis/cmnty/cw082/—Detailed county statistics
www.uky.edu/KentuckyAtlas/21105.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21105.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information, Kentucky Geological Survey

7.5-Minute Quadrangle Maps



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Scale 1:48,000

1 inch equals 3/4 mile

2 0 2 4 Miles

3 0 3 6 Kilometers