Kentucky Geological Survey
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Generalized Geologic Map for Land-Use Planning: Hart County, Kentucky

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Acknowledgments

Geology adapted from Davidson (2002), Johnson (2002), Toth (2002a, b, 2006), Crawford (2004), Mullins (2004), Petersen (2004a, b), Smith (2004), and Thompson (2004a, b, c). Mapped sinkholes from Paylor and others (2004). Thanks to Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service, for pond construction illustration. Thanks to Richard Smath, Kentucky Geological Survey, for information on tar sands. Thanks to Richard Sergeant, Kentucky Geological Survey, for photo assistance. Thanks to Kim and Kent Anness, Kentucky Division of Geographic Information, for base-map data.

MAP AND CHART 151
Series XII, 2007

Hart County Courthouse at Munfordville

Hart County, an area of 416 square miles in the Pennyrile Region, was formed in 1819. Two plateau areas define the county. The lower is a slightly rolling limestone plain characterized by few surface streams and thousands of sinkholes. The higher plateau lies behind the Dripping Springs Escarpment about 200 feet above the sinkhole plain. The highest elevation, 1,156 feet, is on Frenchmans Knob, about 6 miles northnortheast of Munfordville. The lowest elevation, 421 feet, is at the Green River where it leaves the western edge of the county. From 2000 to 2005 the population grew 4.3 percent to 18,189. Photo by Dan Carey, Kentucky Geological Survey.

Sandstone: Unit 4

The Caseyville Formation conglomerate sandstone (unit 4) is exposed at this outcrop off Ky. 88 east of Cub Run. Photo by Dan Carey, Kentucky Geological Survey.

Radon

Radon gas can be a local problem, in some areas exceeding the U.S. Environmental Protection Agency's maximum recommended limit of 4 picocuries per liter. The limestones of unit 2 in particular may contain high levels of uranium or radium, parent materials for radon gas. Homes in these areas should be tested for radon, but the homeowner should keep in mind that the threat to health results from relatively high levels of exposure over long periods, and the remedy may simply be additional ventilation of the home.

Radon Risk If You've Never Smoked

Radon Level	If 1,000 people who never smoked were exposed to this level over a lifetime*...	The risk of cancer from radon exposure compares to**...	WHAT TO DO:
20 pCi/L	About 36 people could get lung cancer	35 times the risk of drowning	Fix your home
10 pCi/L	About 18 people could get lung cancer	20 times the risk of dying in a home fire	Fix your home
8 pCi/L	About 15 people could get lung cancer	4 times the risk of dying in a fall	Fix your home
4 pCi/L	About 7 people could get lung cancer	The risk of dying in a car crash	Fix your home
2 pCi/L	About 4 person could get lung cancer	The risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
0.4 pCi/L		(Average outdoor radon level)	

Note: If you are a former smoker, your risk may be higher.
* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).
** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

Transportation

Interstate 65, running from Mobile, Ala., to northern Indiana near Chicago, divides the county from north to south. It is known as "Auto Alley" because of the large number of auto plants and suppliers it passes. Photo by Dan Carey, Kentucky Geological Survey.

Tar Sands in Western Kentucky

Investigations by the Kentucky Geological Survey have confirmed that major tar-sand resources are present in western Kentucky (Noger, 1999). In-place resources are calculated to be in excess of 3 billion barrels. The principal formations that contain tar sand deposits (also referred to as asphaltic sandstones, heavy-oil deposits, or bitumenimpregnated sandstones) are the Kyrock, Bee Springs, Tar Springs, Hardinsburg, and Big Clifty Sandstones. Some of these may occur in Logan, Warren, Butler, Edmonson, Hart, Grayson, Breckinridge, and Hardin Counties. In Hart County, tar sands may be present in unit 3. Photo by Randy Bruner. For more information on tar sands, go to gsweb.uky.edu/Pubs Searching/PubsSimpleSearch.asp, keyword= tar sands.

Sandstone: Unit 3

The Big Clifty Sandstone Member (unit 3), seen in this outcrop near Ky. 1261, lies beneath most of western Hart County. Photo by Dan Carey, Kentucky Geological Survey.

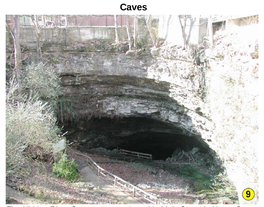
Magnolia Gas Field

The Magnolia Gas Field underground storage facility in northeastern Hart and southeastern Larue Counties, operated by Louisville Gas and Electric Company, contains over 10 Bcf of natural gas. Photo by Dan Carey, Kentucky Geological Survey.

Sinkholes

A landscape dimpled with sinkholes is typical of the karst plateau of unit 2, particularly south of the Green River. Photo by the U.S. Department of Agriculture, Farm Services Administration, National Agricultural Imagery Program, 2004.

Caves



The Hidden River Cave entrance alongside Main Street in Horse Cave was once billed as the "World's Largest Cave Entrance." Some of the longest caves in the world run through the limestones of Hart County. Part of Mammoth Cave National Park lies in the county. For more information, go to www.caves.org and www.cavern.org/hrc/cave.php. Photo by Dan Carey, Kentucky Geological Survey.

Agriculture

Limestones of unit 2 provide soils for a strong agricultural economy. Erosion-resistant sandstone-capped hills lie on the horizon. Photo by Dan Carey, Kentucky Geological Survey.

Limestone: Unit 2

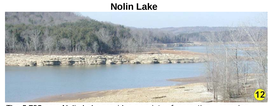
The Beaver Bend and Paoli Limestones (unit 2) are exposed in this roadcut on Ky. 728 east of Bonnieville. Photo by Dan Carey, Kentucky Geological Survey.

Green River

The Green River divides the county from east to west. The floodplain near Munfordville contains Stovall Park (below), an appropriate land use. Photo by Dan Carey, Kentucky Geological Survey.

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

Nolin Lake



The 5,795-acre Nolin Lake provides a variety of recreation—camping, boating, water sports, and fishing. Drawn-down winter pool reveals the Glen Dean Limestone of unit 2. Photo by Dan Carey, Kentucky Geological Survey.

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.

EXPLANATION

- School
- Gas well
- Oil well
- Enhanced recovery well

Water wells
- Domestic
- Monitoring
- Public
- Industrial
- Agricultural

- Sinkhole
- Rock outcrop
- Severely eroded area
- Wet area
- Spring
- County line
- Watershed boundary
- Railroad
- Geologic fault
- Concealed geologic fault
- Public lands
- Designated flood zone* (FEMA, 2005)
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Incorporated city boundaries
- Source-water protection area, zone 1
- Wildlife management area
- Mapped sinkhole
- Quarry

40-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/.

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.

Mineral Resources

Hart County Stone Quarry seen from above. Aerial photo by the U.S. Department of Agriculture, Farm Services Administration, National Agricultural Imagery Program, 2004.

Hart County Stone has produced crushed stone and agricultural lime from this quarry in unit 2 since 1940. Photo by Dan Carey, Kentucky Geological Survey.

Groundwater

In the limestone rich area of southwestern Hart County most drilled wells are adequate for a domestic supply; yields as high as 50 gallons per minute have been reported from wells penetrating large solution channels. Depths of adequate wells range up to 500 feet. In the southern half and parts of north-central Hart County, about three-fourths of the wells yield enough water for a domestic supply. In the remaining areas of the county only a few wells yield enough water for a domestic supply, except in the lowland areas bordering streams, where yields are sufficient from some wells. Springs with flows ranging from a few gallons per minute to 35,000 gallons per minute are found in the county. Minimum flows generally occur in early fall, maximum flows in late winter. The larger springs in the county have sufficient flows to be utilized for public or industrial water supplies. For more information on groundwater in the county, see Carey and Stickney (2005).

Pond Construction

Successful pond construction must prevent water from seeping through structured soils into limestone solution channels below. A compacted clay liner or artificial liner may prevent pond failure. Getting the basin filled with water as soon as possible after construction prevents drying and cracking, and possible leakage, of the clayey soil liner. Ponds constructed in dry weather are more apt to leak than ponds constructed in wet weather. A geotechnical engineer or geologist should be consulted regarding the requirements of a specific site. Other leakage prevention measures include synthetic liners, bentonite, and asphaltic emulsions. The U.S. Department of Agriculture–Natural Resources Conservation Service can provide guidance on the application of these liners to new construction, and for treatment of existing leaking ponds.

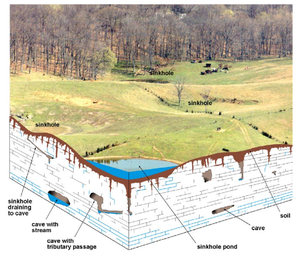
Dams should be constructed of compacted clayey soils at slopes flatter than 3 units horizontal to 1 unit vertical. Ponds with dam heights exceeding 25 feet, or pond volumes exceeding 50 acre-feet, require permits. Contact the Kentucky Division of Water, 14 Reilly Rd., Frankfort, KY 40601, telephone: 502.564.3410. Illustration by Paul Howell, U.S. Department of Agriculture–Natural Resources Conservation Service.

Man-made "structure" will improve fish habitat in this new pond on unit 2. Photo by Richard Sergeant, Kentucky Geological Survey.

Karst Geology

The term "karst" refers to a landscape characterized by sinkholes, springs, sinking streams (streams that disappear underground), and underground drainage through solution-enlarged conduits or caves. Karst landscapes form when slightly acidic water from rain and snowmelt seeps through soil cover into fractured and soluble bedrock (usually limestone, dolomite, or gypsum). Sinkholes are depressions on the land surface into which water drains underground. Usually circular and often funnel-shaped, they range in size from a few feet to hundreds of feet in diameter. Springs occur when water emerges from underground to become surface water. Caves are solution-enlarged fractures or conduits large enough for a person to enter.

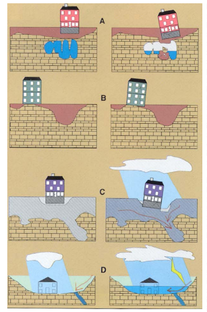
Environmental Protection



- Never use sinkholes as dumps. All waste, but especially pesticides, paints, household chemicals, automobile batteries, and used motor oil, should be taken to an appropriate recycling center or landfill.
- Make sure runoff from parking lots, streets, and other urban areas is routed through a detention basin and sediment trap to filter it before it flows into a sinkhole.
- Make sure your home septic system is working properly and that it's not discharging sewage into a crevice or sinkhole.
- Keep cattle and other livestock out of sinkholes and sinking streams. There are other methods of providing water to livestock.
- See to it that sinkholes near or in crop fields are bordered with trees, shrubs, or grass buffer strips. This will filter runoff flowing into sinkholes and also keep tilled areas away from sinkholes.
- Construct waste-holding lagoons in karst areas carefully, to prevent the bottom of the lagoon from collapsing, which would result in a catastrophic emptying of waste into the groundwater.
- If required, develop a groundwater protection plan (410KAR5:037) or an agricultural water-quality plan (KRS224.71) for your land use.

(From Currens, 2001)

Construction on Karst



Limestone terrain can be subject to subsidence hazards, which usually can be overcome by prior planning and site evaluation. "A" shows construction above an open cavern, which later collapses. This is one of the most difficult situations to detect, and the possibility of this situation becomes a structure warrants insurance protection for homes built on karst terrain. In "B," a heavy structure presumed to lie above solid bedrock actually is partially supported on soft, residual clay soils that subside gradually, resulting in damage to the structure. This occurs where inadequate site evaluation can be traced to lack of geophysical studies and inadequate core sampling. "C" and "D" show the close relationship between hydrology and subsidence hazards in limestone terrain. In "C," the house is situated on porous fill (light shading) at a site where surface- and groundwater drainage move supporting soil (darker shading) into voids in limestone (blocks) below. The natural process is then accelerated by infiltration through fill around the home. "D" shows a karst site where normal rainfall is absorbed by subsurface conduits, but water from infrequent heavy storms cannot be carried away quickly enough to prevent flooding of low-lying areas. Adapted from AIPG (1993).

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Additional Resources

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

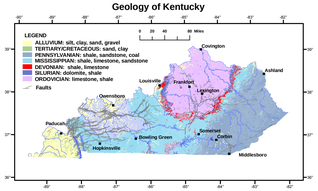
www.hartcounty.com/ Hart County
www.hartcountyky.org/ Hart County Chamber of Commerce
www.horsecavekentucky.com Horse Cave
http://www.cavern.org/hrc/geology.php Hidden River Cave
www.hart.k12.ky.us/ Hart County Schools
ces.ca.uky.edu/hart/ University of Kentucky Cooperative Extension Service
www.bradd.org/ Barren River Area Development District
www.thinkkentucky.com/edis/cmrty/cwl/cw040/ Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21099.html Kentucky Atlas and Gazetteer, Hart County
quickfacts.census.gov/qfd/states/21/21099.html U.S. census data
kgsweb.uky.edu/download/kgsplanning.htm Planning information from the Kentucky Geological Survey

7.5-Minute Quadrangle Map Index

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, 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.

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	Fair foundation material; easy to excavate.	Severe limitations. Failed septic systems can contaminate groundwater. Refer to soil report (Mitchell, 1993).	Water in alluvium may be in direct contact with basements. Refer to soil report (Mitchell, 1993). Drainage required.	Slight limitations. Refer to soil report (Mitchell, 1993).	Slight to moderate limitations. Refer to soil report (Mitchell, 1993).	Slight to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Sinks common. Drainage required.	Refer to soil report (Mitchell, 1993).	Refer to soil report (Mitchell, 1993).	Refer to soil report (Mitchell, 1993).	Not recommended. Refer to soil report (Mitchell, 1993).	Not recommended. Refer to soil report (Mitchell, 1993).
2. Limestone and shale	Good to excellent foundation material; difficult to moderately difficult to excavate.	Severe limitations. Impermeable rock. Locally fast drainage through fractures and sinks. Danger of groundwater contamination.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Sinks common. Drainage required.	Slight to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Sinks possible. Drainage required.	Slight limitations. Local drainage problems from seeps or springs. Sinks possible.	Slight to moderate limitations, depending on topography. Rock excavation; locally, upper few feet may be rippable. Sinks possible. Local drainage problems.	Slight to moderate limitations, depending on activity and topography.	Slight to moderate limitations, depending on activity and topography.	Severe limitations. Leaky reservoir rock; locally, conditions may be favorable.	Severe limitations. Leaky reservoir rock; locally, conditions may be favorable.	Severe limitations. Rock excavation.
3. Sandstone, siltstone, and shale	Fair to good foundation material; difficult to excavate.	Severe limitations. Thin soils. Impermeable rock.	Severe to moderate limitations. Difficult to excavate; locally, upper few feet may be rippable.	Severe to moderate limitations. Difficult to excavate; locally, upper few feet may be rippable.	Severe to moderate limitations. Difficult to excavate; locally, upper few feet may be rippable.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations, depending on activity and topography.	Slight to moderate limitations, depending on activity and topography.	Moderate limitations. Reservoir may leak where rocks are fractured.	Moderate limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
4. Conglomerate, sandstone, siltstone, and shale*	Fair to good foundation material; difficult to excavate.	Severe limitations. Thin soils.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable.	Moderate limitations. Rock excavation.	Severe limitations. Rock excavation.	Severe limitations.	Slight to moderate limitations, depending on activity and topography.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
5. Shale and sandstone	Fair to good foundation material; difficult to excavate. Slumps when wet. Shales may shrink and swell. Avoid steep slopes.	Severe limitations.	Severe to moderate limitations. Rock excavation may be required. Slumps when wet. Possible drainage problems. Avoid steep slopes.	Moderate to severe limitations. Rock excavation may be required. Slumps when wet.Drainage problems. Possible steep slopes.	Moderate to severe limitations. Slumps when wet. Drainage required.	Moderate to severe limitations. Slumps when wet. Drainage required.	Severe limitations.	Slight to moderate limitations, depending on activity.	Moderate to slight limitations. Reservoir may leak where rocks are fractured.	Moderate to severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.
6. Siltstone and limestone	Excellent foundation material; difficult to excavate.	Severe limitations. Risk of water pollution.	Severe to moderate limitations. Rock excavation.	Severe to moderate limitations. Rock excavation.	Moderate limitations. Rock excavation.	Severe to moderate limitations. Rock excavation.	Moderate limitations.	Moderate limitations.	Severe limitations. Leaky reservoir rock; locally, conditions may be favorable.	Severe limitations.	Severe limitations. Rock excavation.
7. Gravel	Fair foundation material; easy to excavate.	Slight to severe limitations, depending on soil cover.	Slight to moderate limitations, depending on slope.	Slight limitations.	Slight limitations, depending on slope.	Slight limitations, depending on slope.	Slight to moderate limitations, depending on activity.	Slight limitations.	Pervious material; not recommended.	Severe limitations. Pervious material and unstable steep slopes.	Slight limitations.

*When this unit overlies unit 2, plastic clays may be present at the interface.

LAND-USE PLANNING TABLE DEFINITIONS

FOUNDATION AND EXCAVATION

The terms "earth" and "rock" excavation are used in the engineering sense; earthcan 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 compleling 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 thi 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 cavems, 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.