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

Bart Davidson
University of Kentucky, bdavidson@uky.edu

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

Stephen F. Greb
University of Kentucky, greb@uky.edu

Anthony Mount
University of Kentucky

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

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Bart Davidson, Daniel I. Carey, and Stephen F. Greb
Kentucky Geological Survey

Anthony Mount
University of Kentucky
Natural Resources Conservation Management

Acknowledgments
Geology adapted from Nelson (2002a-b), Thompson (2002), Tyra (2002), and Zhang (2002a-e). Sinkhole data from Paylor and others (2004). Karst illustration by Currens (2001). Thanks to Paul Howell, U.S. Department of Agriculture-Natural Resources Conservation Service, for pond construction illustration.

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 local area, visit our Land-Use Planning Internet Mapping Web Site at kgsmap.uky.edu/website/kyluplan/viewer.htm.

Population Growth

The population of Oldham County grew 11.8 percent from 2000 to 2004, making it the fourth fastest growing county in the state. Most of the land-use issues and concerns in the county stem from this rapid growth.

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 that are large enough for a person to enter.

Much of the bedrock in Oldham County is susceptible to karst development, especially in the east, where growth has been the greatest. In fact, many sinkholes shown on this map have been filled and covered during development.

Pond Construction

A new pond being constructed in a residential area. Pond construction in karstic geologic areas (caves, sinkholes, and springs) can often be problematic because of leaky soils and fractured bedrock. Photo by Stephen Greb, Kentucky Geological Survey.

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. (Illustration by Paul Howell, U.S. Department of Agriculture-Natural Resources Conservation Service.)

Groundwater

The alluvium along the Ohio River is the best source of groundwater in the county. Many properly constructed drilled wells will produce several hundred gallons per minute from the alluvium, with most wells able to produce enough for a domestic supply at depths of less than 100 feet. Water is hard or very hard, but otherwise of good quality. In the main sections of the larger creek valleys, in some of the Ohio River bottoms, and on broad ridges in a limited area south of the towns of Skylight and Crestwood, most drilled wells will produce enough water for a domestic supply at depths of less than 100 feet. Some wells located in the smaller creek valleys and in some broad ridges in western and central Oldham County will produce enough water for a domestic supply, except during dry weather. In the upland areas of the rest of Oldham County (approximately 50 percent of the county), most drilled wells will not produce enough water for a dependable domestic supply except along drainage lines; these may produce enough water except during dry weather. Groundwater in these areas is hard or very hard and may contain salt or hydrogen sulfide, especially at depths greater than 100 feet. For more about the groundwater resources of the county, see Carey and Stickney (2004).

Changing Land Uses

Waste Management

An abandoned landfill that has been reclaimed as grassland. Numerous monitoring wells are located on the landfill to check groundwater for contamination. A larger population requires more land for waste disposal and water treatment. Photo by Stephen Greb, Kentucky Geological Survey.

Abandoned Quarries

Limestone quarries in Oldham County provide aggregate for road construction and other uses. Ironically, population growth requires more aggregate, but few people like to live next to a quarry. This abandoned quarry has been converted to recreational use. Photo by Stephen Greb, Kentucky Geological Survey.

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.

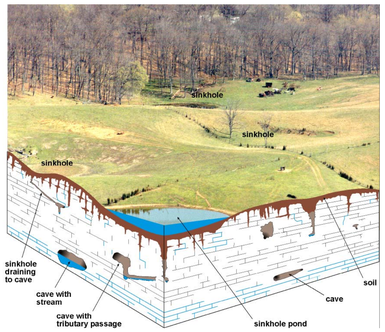
Extensive recreation -- Camp sites, picnic areas, parks, etc.

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.

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)

Mapped Geologic 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.

Topography

Power transmission lines at the northern tip of Oldham County in the rugged topography above the Ohio River. These lines transmit power across the river into Indiana. Power companies control the right-of-way for the lines, which must be considered for land-use planning in the area. The steep topography places limitations on road construction and residential, commercial, and industrial development in this area. Photo by Stephen Greb, Kentucky Geological Survey.

Kentucky State Reformatory

The Kentucky State Reformatory at LaGrange is a 43-acre medium-security facility constructed in 1936, and is the second largest prison in Kentucky. The reformatory has its own water supply and wastewater treatment facility. Photo by Stephen Greb, Kentucky Geological Survey.

The Ohio River Floodplain

The Ohio River forms the northern boundary of Oldham County. Land use along the river includes recreation, farming, and residential areas. Development along the river is subject to floodplain construction requirements. Photo by Anthony Mount, University of Kentucky.

Yards in the upscale subdivision in the background are being threatened by erosion from the Ohio River. Stone riprap groins have been added to slow the process. Photo by Stephen Greb, Kentucky Geological Survey.

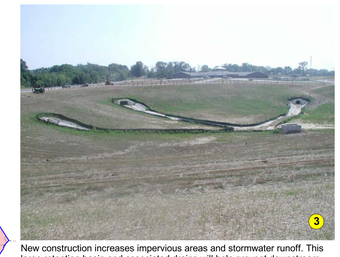
Population Growth and Changing Land Use

Limestone parent material provides quality soil for pastures. Horse farms along U.S. 42 are rapidly being converted to residential areas. Row crops and grazing land are still found in western Oldham County. Photo by Anthony Mount, University of Kentucky.

New subdivision construction near the Ohio River along Ky. 322 is indicative of the tremendous population growth in Oldham County. Farmland and pasture land is rapidly succumbing to residential development. Photo by Stephen Greb, Kentucky Geological Survey.

A growing population requires additional infrastructure, services, and schools. Geology plays an important role in the placement, construction, and design of new facilities. Photo by Stephen Greb, Kentucky Geological Survey.

Stormwater Management and Sediment Control



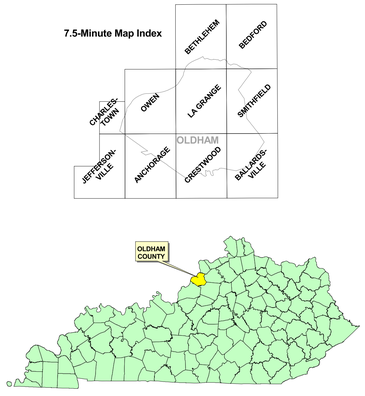
New construction increases impervious areas and stormwater runoff. This large retention basin and associated drains will help prevent downstream flooding. Photo by Stephen Greb, Kentucky Geological Survey.

Soils exposed during construction are subject to high rates of erosion. The retention basin and pond in the background will trap sediment and prevent downstream water-quality degradation. Development is especially prominent along the main east-west connectors to Jefferson County to the west. Photo by Stephen Greb, Kentucky Geological Survey.

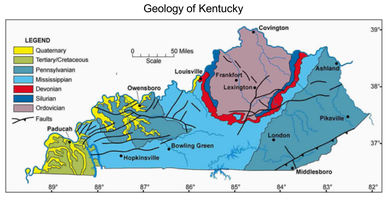
Bedrock

This roadcut along Ky. 524 near the river shows limestone and shale units typical of unit 3. Photo by Anthony Mount, University of Kentucky.

7.5-Minute Map Index



Geology of Kentucky



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

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Scale = 1:48,000

1 inch equals 3/4 mile

1 0 1 2 Miles

Planning Guidance by Rock Unit Type

Rock Unit	Karst Potential Rating	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. Silt, sand, and gravel	None, but on-site karst investigation recommended where less than 25 feet thick over soluble rock.	Fair foundation material. Easy to excavate.	Moderate to severe limitations. Failed septic systems can contaminate groundwater. Refer to soil report (Whitaker, 1977).	Moderate to severe limitations. Check area to determine if flood prone. Basements can be wet. Refer to soil report (Whitaker, 1977).	Slight to moderate limitations. Refer to soil report (Whitaker, 1977).	Slight to moderate limitations. Refer to soil report (Whitaker, 1977).	Slight to moderate limitations. Avoid construction in floodplain. Refer to soil report (Whitaker, 1977).	If not flood prone, slight limitations based on type of structure. Refer to soil report (Whitaker, 1977).	If not flood prone, slight limitations based on type of structure. Refer to soil report (Whitaker, 1977).	Severe limitations. Leaky reservoir material. Refer to soil report (Whitaker, 1977).	Severe limitations. Leaky reservoir material. Refer to soil report (Whitaker, 1977).	Moderate to severe limitations. High groundwater table possible. Refer to soil report (Whitaker, 1977).
2. Limestone	High.	Good to excellent foundation material. Difficult excavation.	Severe limitations. Impermeable rock. Locally fast drainage through fractures and sinks. Danger of groundwater contamination.	Severe to moderate limitations. Rock excavation may be required.	Severe limitations; rock excavation. Steep slopes.	Moderate limitations. Rock excavation. Possible steep slopes. Slight limitations with suitable topography.	Slight to severe limitations, depending on topography. Rock excavation. Sinks common. Local drainage problems. Groundwater contamination possible.	Severe to moderate limitations; rock excavation may be required.	Slight to moderate limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Reservoir may leak where rocks are fractured. Sinks possible.	Moderate to severe limitations. Possible rock excavation.
3. Limestone, dolomite, and shale	High.	Fair to good foundation material. Difficult to excavate.	Moderate to severe limitations. Impermeable rock. Locally fast drainage through fractures and sinks to water table, with possible contamination.	Moderate to severe limitations. Rock excavation may be required.	Moderate limitations. Rock excavation possible. Local drainage problems, especially on shale. Sinks common and caves possible.	Moderate limitations. Rock excavation likely. Local drainage problems. Sinks common.	Slight to severe limitations, depending on topography. Rock excavation. Sinks common. Local drainage problems. Groundwater contamination possible.	Slight to moderate limitations, depending on activity and topography. Possible steep wooded slopes.	Slight to moderate limitations, depending on activity and topography. Possible steep wooded slopes.	Moderate to severe limitations. Reservoir may leak where rocks are fractured. Sinks possible.	Moderate to severe limitations. Reservoir may leak where rocks are fractured. Sinks possible.	Moderate to severe limitations. Possible rock excavation.
4. Limestone and shale	High to medium.	Fair to good foundation material. Moderately difficult to excavate. Possible expansion of shales.	Severe limitations. Impermeable rock, thin soils.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes. Possible expansion of shales.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes. Possible expansion of shales.	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes. Possible expansion of shales.	Severe slopes.	Slight limitations.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Reservoir may leak where rocks are fractured.	Moderate limitations. Highly variable amount of rock and earth excavation.
5. Dolomite	Medium.	Excellent foundation material. Difficult excavation.	Severe limitations. Impermeable rock. Locally fast drainage through fractures and sinks. Danger of groundwater contamination.	Severe limitations. Rock excavation may be required.	Severe limitations. Rock excavation. Possible steep slopes.	Moderate to severe limitations. Rock excavation. Possible steep slopes and narrow ravines.	Slight to moderate limitations, depending on topography. Rock excavation. Sinks common. Local drainage problems.	Slight to moderate limitations, depending on activity and topography. Possible steep wooded slopes.	Slight to moderate 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. Sinks possible.	Slight to moderate limitations. Reservoir may leak where rocks are fractured. Sinks possible.	Severe limitations. Rock excavation.
6. Shale*	Low.	Poor foundation material; easy to moderately difficult to excavate. Low strength and stability. May contain plastic clays.	Severe limitations. Thin soils and low permeability.	Severe limitations. Low strength, slumping, and seepage problems.	Severe limitations. Low strength, slumping, and seepage problems.	Severe limitations. Low strength, slumping, and seepage problems.	Severe limitations. Low strength, slumping, and seepage problems.	Moderate to severe limitations. Depending on activity.	Slight to severe limitations. Depending on activity.	No limitations. Impermeable rock.	Severe limitations. Poor strength and stability.	Moderate limitations. Highly variable amount of rock and earth excavation.

*These clay shales and soils may swell when wet and shrink when dry.

Additional Resources

ces.ca.uky.edu/oldham/--UK Cooperative Extension Service (agriculture agents)
www.kineticnet.net/kycrd/eagle.html--Kentucky Resource Conservation and Development
www.kipda.org/--Kentuckiana Regional Planning and Development Agency
www.thinkkentucky.com/edis/cmnty/cmntyindex.htm--Detailed county statistics
www.uky.edu/KentuckyAtlas/21185.html--Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21185.html--U.S. Census data

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