

Metcalfe County, an area of 291 square miles in the Mississippi Plateau Region, was formed in 1868. The highest point in the county, 1,182 feet, is on a ridge on Ky. 163 about 1/3 mile north of Ky. 90. The lowest elevation, 560 feet, is where the Little Barren River leaves the county. The 2006 population, 10,219, was 1.8 percent greater than that of 2000. Photo by Dan Carey, Kentucky Geological Survey.



Transportation to and from the 7-acre Edmonton-Metcalfe County Industrial Park is provided by the Louise B. Nunn Parkway (below). Photos by Dan Carey, Kentucky Geological Survey.

EXPLANATION

- School
- Water wells
 - Domestic
 - Monitoring
 - Spring
 - Oil well
 - Gas well
 - Secondary recovery well
- Severely eroded area
- Mine or quarry
- Rock outcrop
- Wet area
- Sinkhole
- Incorporated city boundary
- Public lands
- Source-water protection area, zone 1
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Watershed boundaries
- Quarry
- Mapped sinkhole
- 40-foot contour interval
- Photo location

Nearly 1 billion cubic feet from natural gas wells (above) and 3 million barrels from oil wells (below) have been produced in Metcalfe County. Photos by Dan Carey, Kentucky Geological Survey.

7.5-Minute Quadrangle Map Index

Metcalfe	Barren	Madison	Madison	Madison
Metcalfe	Barren	Madison	Madison	Madison
Metcalfe	Barren	Madison	Madison	Madison
Metcalfe	Barren	Madison	Madison	Madison
Metcalfe	Barren	Madison	Madison	Madison

Radon Ventilation

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 shales of unit 5 and 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 (U.S. Environmental Protection Agency, 2005)

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 people could get lung cancer	The risk of dying from poison	Consider fans 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	About 2 people could get lung cancer	(Average outdoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)

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.

Ventilation system removes radon from the basement area of this home on unit 5. Photo by Dan Carey, Kentucky Geological Survey.

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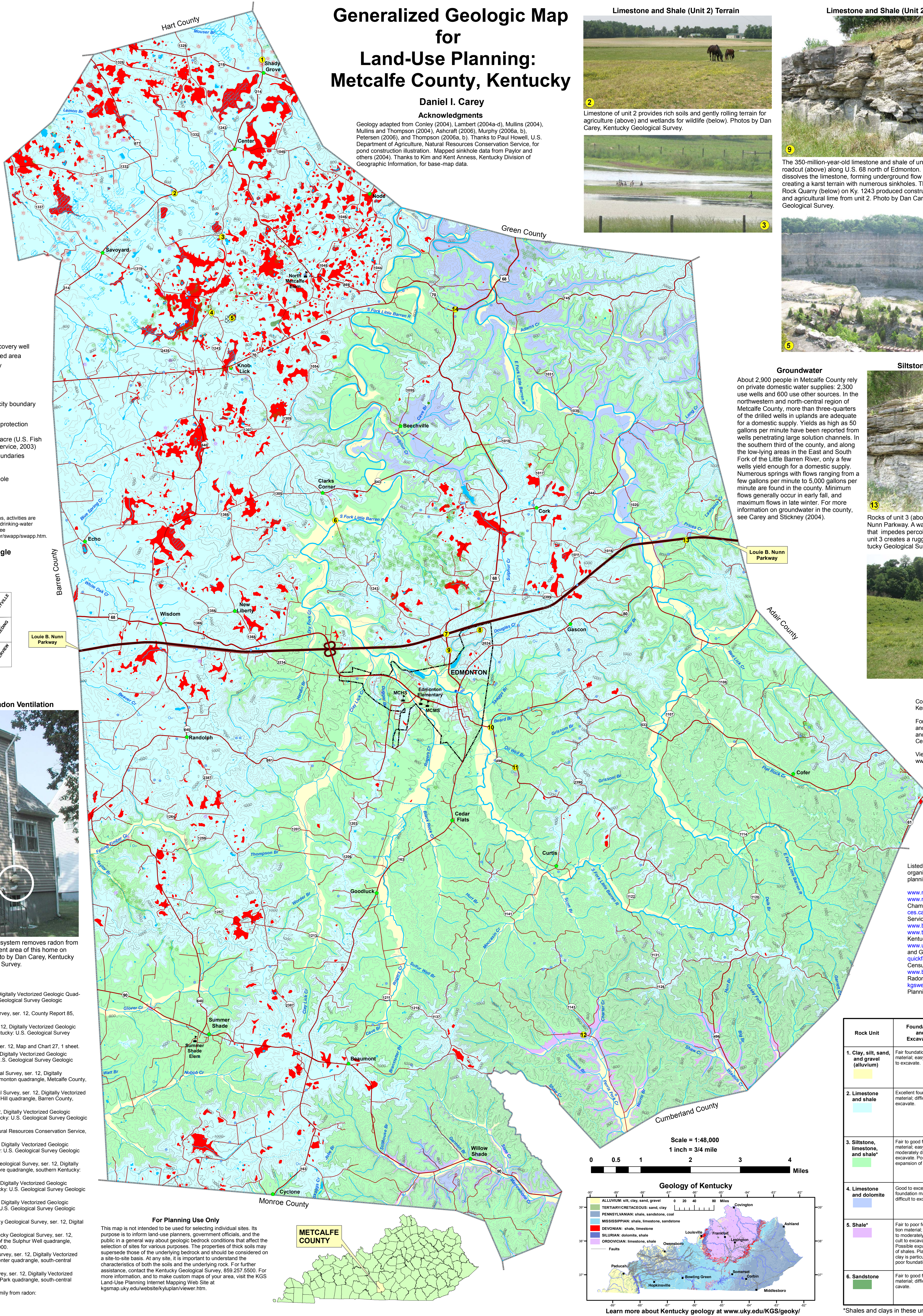
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Generalized Geologic Map for Land-Use Planning: Metcalfe County, Kentucky

Daniel I. Carey
Acknowledgments

Geology adapted from Conley (2004), Lambert (2004a-d), Mullins (2004), Mullins and Thompson (2004), Ashcraft (2006), Murphy (2006a, b), Petersen (2006), and Thompson (2006a, b). Thanks to Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service, for point construction illustration. Mapped sinkhole data from Taylor and others (2004). Thanks to Kim and Kent Anness, Kentucky Division of Geographic Information, for base-map data.

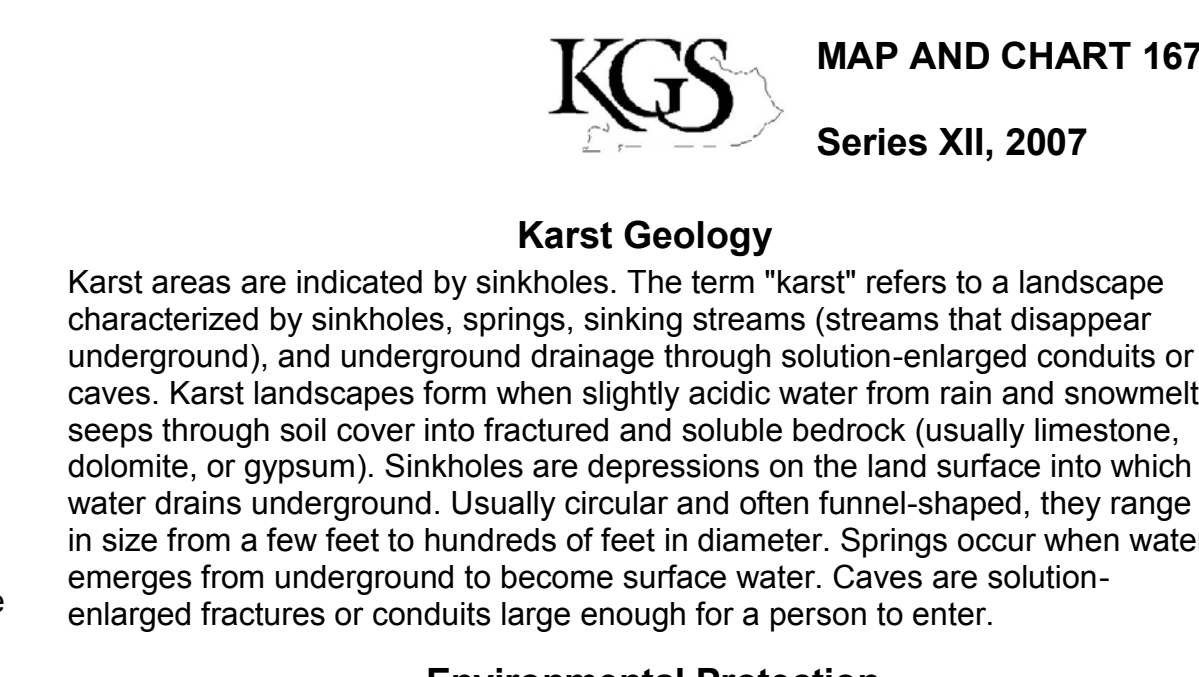
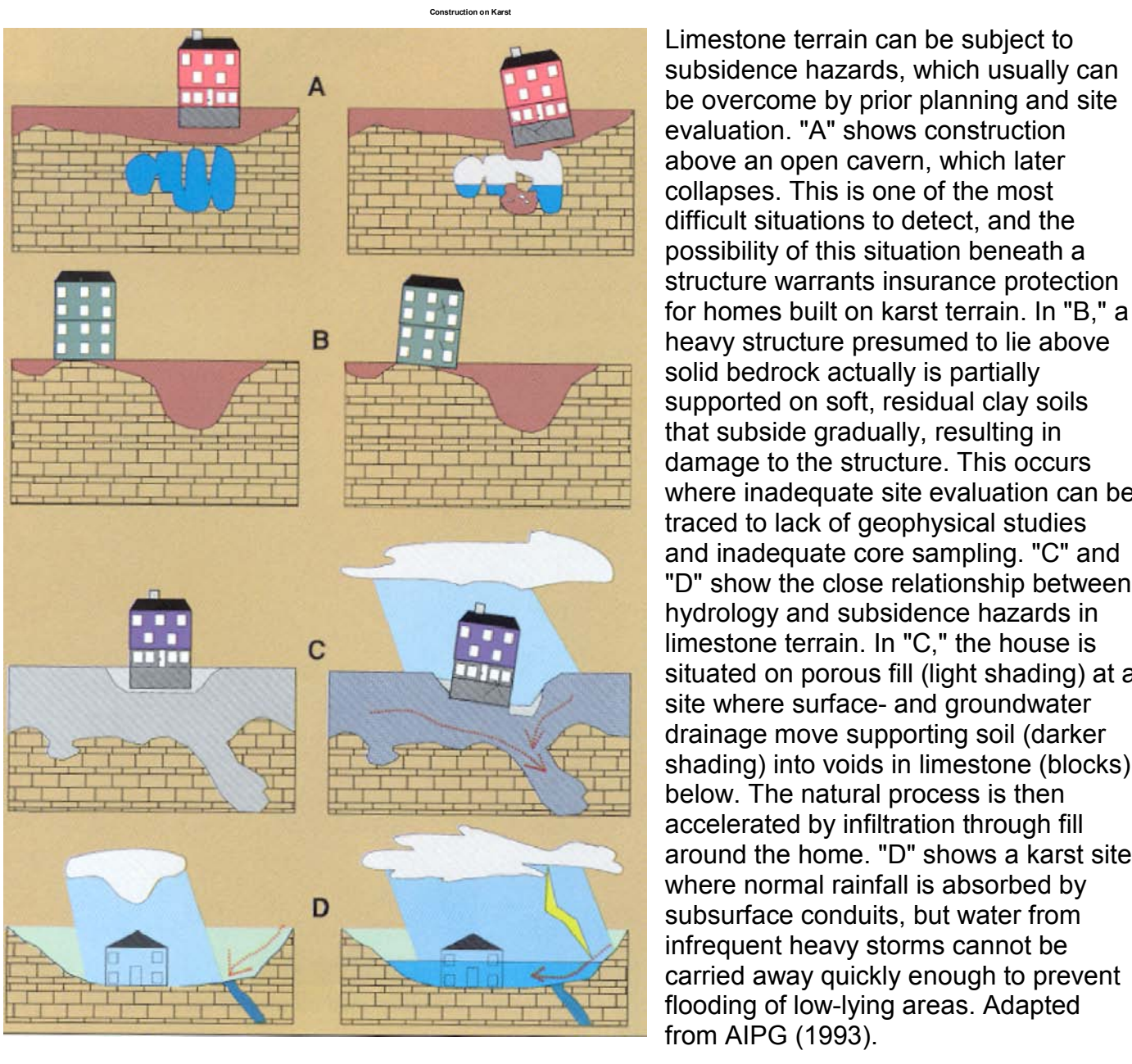


Limestone and Shale (Unit 2) Terrain

Limestone of unit 2 provides rich soils and gently rolling terrain for agriculture (above) and wetlands for wildlife (below). Photos by Dan Carey, Kentucky Geological Survey.

Limestone and Shale (Unit 2)

The 350-million-year-old limestone and shale of unit 2 is seen at this roadcut (above) along U.S. 68 north of Edmonton. Percolating water dissolves the limestone, forming underground flow channels and creating a karst terrain with numerous sinkholes. The Montgomery Rock Quarry (below) on Ky. 1243 produces construction aggregate and agricultural lime from unit 2. Photo by Dan Carey, Kentucky Geological Survey.



Groundwater

About 2,900 people in Metcalfe County rely on private domestic water supplies: 2,300 use wells and 600 use other sources. In the northwestern and north-central region of Metcalfe County, more than three-quarters of the drilled wells in uplands are adequate for a domestic supply. Yields as high as 50 gallons per minute have been reported from wells penetrating large solution channels. In the southern third of the county, and along the low-lying areas in the East and South Fork of the Little Barren River, only a few wells yield enough for a domestic supply. Numerous springs with flows ranging from a few gallons per minute to 5,000 gallons per minute are found in the county. Minimum flows generally occur in early fall, and maximum flows in late winter. For more information on groundwater in the county, see Carey and Stockney (2004).

Siltstone, Limestone, and Shale (Unit 3)

Rocks of unit 3 (above) are exposed in this roadcut near the Louise B. Nunn Parkway. A water-loving sycamore feeds from the shale layer that impedes percolating water. The erosion-resistant siltstone in unit 3 creates a rugged terrain (below). Photos by Dan Carey, Kentucky Geological Survey.

Limestone and Dolomite (Unit 4)

Slabs of limestone (unit 4) are exposed near the intersection of Ky. 70 and U.S. 68. Photo by Dan Carey, Kentucky Geological Survey.

Shale (Unit 5)

The Chattanooga Shale (unit 5) makes a poor foundation. Photo by Dan Carey, Kentucky Geological Survey.

Pond Construction

Anti-Leakage Strategy
Deny water access to permeable materials and/or materials to an impermeable condition.

Top of Dam
Structured Clay Soil
Limestone Bedrock with Plumbing
Perm - Imperm Boundary

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 asphalt 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 three units horizontal to one 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.

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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).
View the KGS World Wide Web site at: www.uky.edu/kgs

Additional Resources

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

www.metcalfechamber.com/ Metcalfe County Chamber of Commerce
www.uky.edu/metcalfe/ UK Cooperative Extension Service
www.bradd.org/ Barren River Area Development District
www.uky.edu/kgs/waterlibrary/gwbas/Metcalfe/Metcalfe.htm [accessed 3/20/07]
www.uky.edu/KentuckyAtlas21169.html Kentucky Atlas and Gazetteer
quickfacts.census.gov/qd/states/21/21169.html U.S. Census data
www.uky.edu/extension/ResidentialRadonQandA.htm Radon in the home
kgsweb.uky.edu/download/miscellaneous/marknykupan.htm Planning information from the Kentucky Geological Survey

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

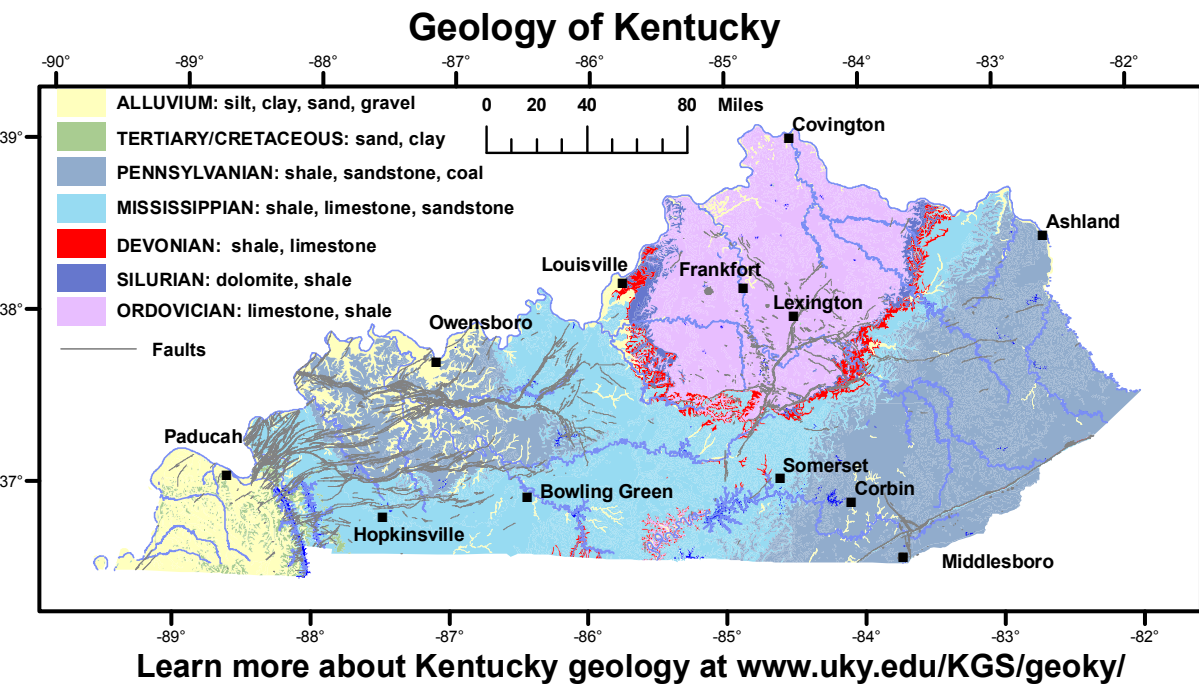
Slight—A slight limitation is one that commonly requires some corrective measure but can be overcome without a great deal of difficulty or expense.
Moderate—A moderate limitation is one that can normally be overcome but the difficulty and expense are great enough that completing the project is commonly 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 requirements 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 foundations 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.

LAND-USE PLANNING TABLE DEFINITIONS

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.	Severe limitations. Failed septic systems can contaminate groundwater. Refer to soil report (Latham and Barton, 1967).	Water in alluvium may be in direct contact with basements. Refer to soil report (Latham and Barton, 1967).	Slight limitations. Refer to soil report (Latham and Barton, 1967).	Slight to moderate limitations. Rock excavation locally; upper few feet may be ripable. Steep slopes possible. Drainage required.	Slight to moderate limitations. Avoid construction in flood-plain. Refer to soil report (Latham and Barton, 1967).	Refer to soil report (Latham and Barton, 1967).	Refer to soil report (Latham and Barton, 1967).	Refer to soil report (Latham and Barton, 1967).	Not recommended. Refer to soil report (Latham and Barton, 1967).	Not recommended. Refer to soil report (Latham and Barton, 1967).
2. Limestone and shale	Excellent foundation material; difficult to excavate.	Severe limitations. Impermeable rock. Locally fast drainage through fractures and sink. Danger of groundwater contamination.	Severe to moderate limitations. Rock excavation locally; upper few feet may be ripable. Sink common. Drainage required.	Slight to moderate limitations. Rock excavation locally; upper few feet may be ripable. Sink possible. Drainage required.	Slight limitations. Local drainage problems from seeps or springs. Steep slopes possible.	Slight to moderate limitations, depending on topography. Rock excavation locally; upper few feet may be ripable. Sink common. Local drainage problems.	Slight to moderate limitations, depending on topography.	Slight to moderate limitations, depending on topography.	Severe limitations. Leaky reservoir rock; locally conditions may be favorable. Sinks possible.	Severe limitations. Leaky rock. Locally, conditions may be favorable.	Severe limitations. Rock excavation.
3. Siltstone, limestone, and shale	Fair to good foundation material; easy to excavate. Possible expansion of shales.	Severe limitations. Low permeability.	Moderate to severe limitations. Rock excavation locally; upper few feet may be ripable. Possible expansion of shales.	Severe limitations. Rock excavation locally; upper few feet may be ripable. Possible expansion of shales.	Moderate limitations. Rock excavation locally; upper few feet may be ripable. Steep slopes possible.	Severe limitations. Rock excavation locally; upper few feet may be ripable. Steep slopes possible.	Severe limitations. Steep slopes.	Slight to moderate limitations, depending on topography.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Steep slopes.	Moderate limitations. Highly variable amount of rock and earth excavation.
4. Limestone and dolomite	Good to excellent foundation material; difficult to excavate.	Severe limitations. Impermeable rock. Danger of groundwater contamination.	Severe limitations. Rock excavation may be required.	Severe limitations. Rock excavation possible. Steep slopes possible.	Severe to moderate limitations. Rock excavation locally; upper few feet may be ripable. Steep slopes possible.	Slight to moderate limitations, depending on topography. Rock excavation locally; upper few feet may be ripable. Steep slopes possible.	Slight to moderate limitations, depending on topography.	Slight to moderate limitations, depending on topography.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation.
5. Shale	Fair to poor foundation material; easy to excavate. Possible expansion of shales. Plastic pipe particularly poor foundation material.	Severe limitations. Low permeability.	Severe limitations. Low strength. Local slumping and seepage problems. Possible expansion of shales. Plastic pipe particularly poor foundation material.	Moderate to severe limitations, depending on topography. Strength, slumping, and seepage problems.	Moderate to severe limitations, depending on topography. Strength, slumping, and seepage problems.	Moderate to severe limitations, depending on topography. Strength, slumping, and seepage problems.	Severe to slight limitations, depending on topography. Strength, slumping, and seepage problems.	Moderate to slight limitations, depending on topography.	Severe limitations. Reservoir may leak where rocks are fractured. Most ponds and seeps are seepage problems.	Severe limitations. Poor strength and stability.	Moderate limitations. Poor strength, weakness.
6. Sandstone	Fair to good foundation material; difficult to excavate.	Severe limitations. Impermeable rock.	Severe to moderate limitations. Difficult excavation locally; upper few feet may be ripable.	Severe to moderate limitations. Difficult excavation locally; upper few feet may be ripable.	Moderate limitations. Difficult excavation locally; upper few feet may be ripable.	Moderate to severe limitations. Rock excavation locally; upper few feet may be ripable. Steep slopes possible.	Slight to moderate limitations, depending on topography.	Slight to moderate limitations, depending on topography.	Moderate limitations. Reservoir may leak where rocks are fractured.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Highly variable amount of rock and earth 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.