

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

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

Acknowledgments
Thanks to Noel Coplen, Graves County Health Department; Jerry McIntosh, U.S. Department of Agriculture-Natural Resources Conservation Service; Alan Melton, Kentucky-Tennessee Clay Company; and Dan and Roberta Bank, Purchase Area Aquaculture Cooperative for photo assistance.

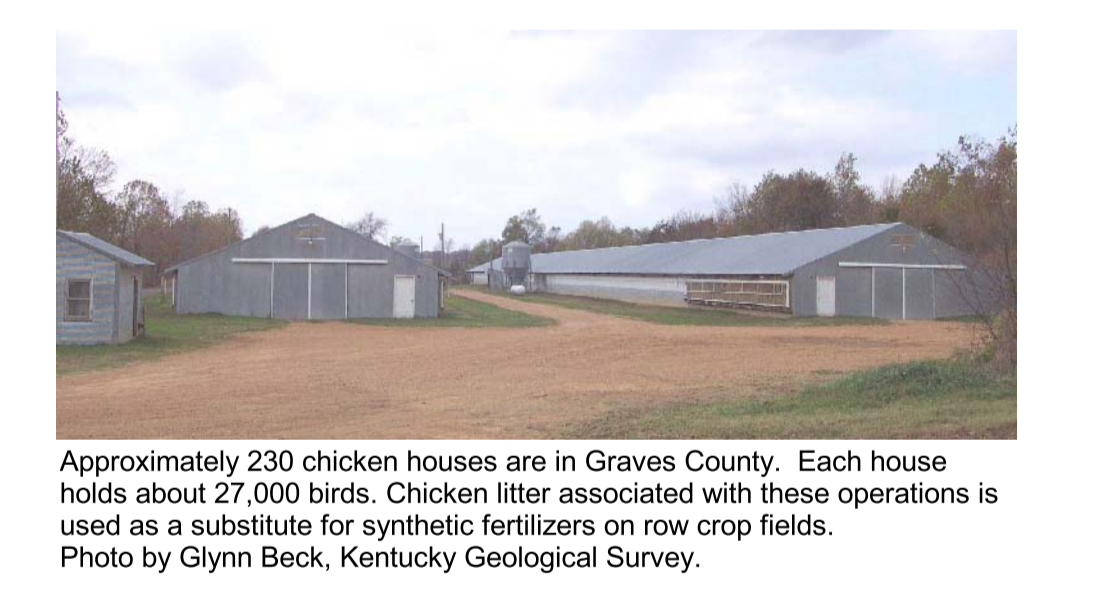
- EXPLANATION**
- School
 - Urban service boundary
 - Wetlands > 1 acre (NWIP, 2003)
 - Wildlife Management Area
 - Artificial fill
 - Water
 - Water Wells**
 - Domestic
 - Heat pump
 - Industrial
 - Irrigation
 - Livestock
 - Monitoring
 - Public
 - Unknown
 - Concealed fault
 - Fault
- 20-foot elevation contour interval



The Kentucky-Tennessee Clay Company has been mining ball clay in Graves County since 1887 and is currently one of three ball clay mining companies in the county. Ball clay has a high percentage of aluminum, which makes it suitable for the production of toilets, sinks, floor tile, bathtubs, and fine dinnerware. Photo by Glynn Beck, Kentucky Geological Survey.



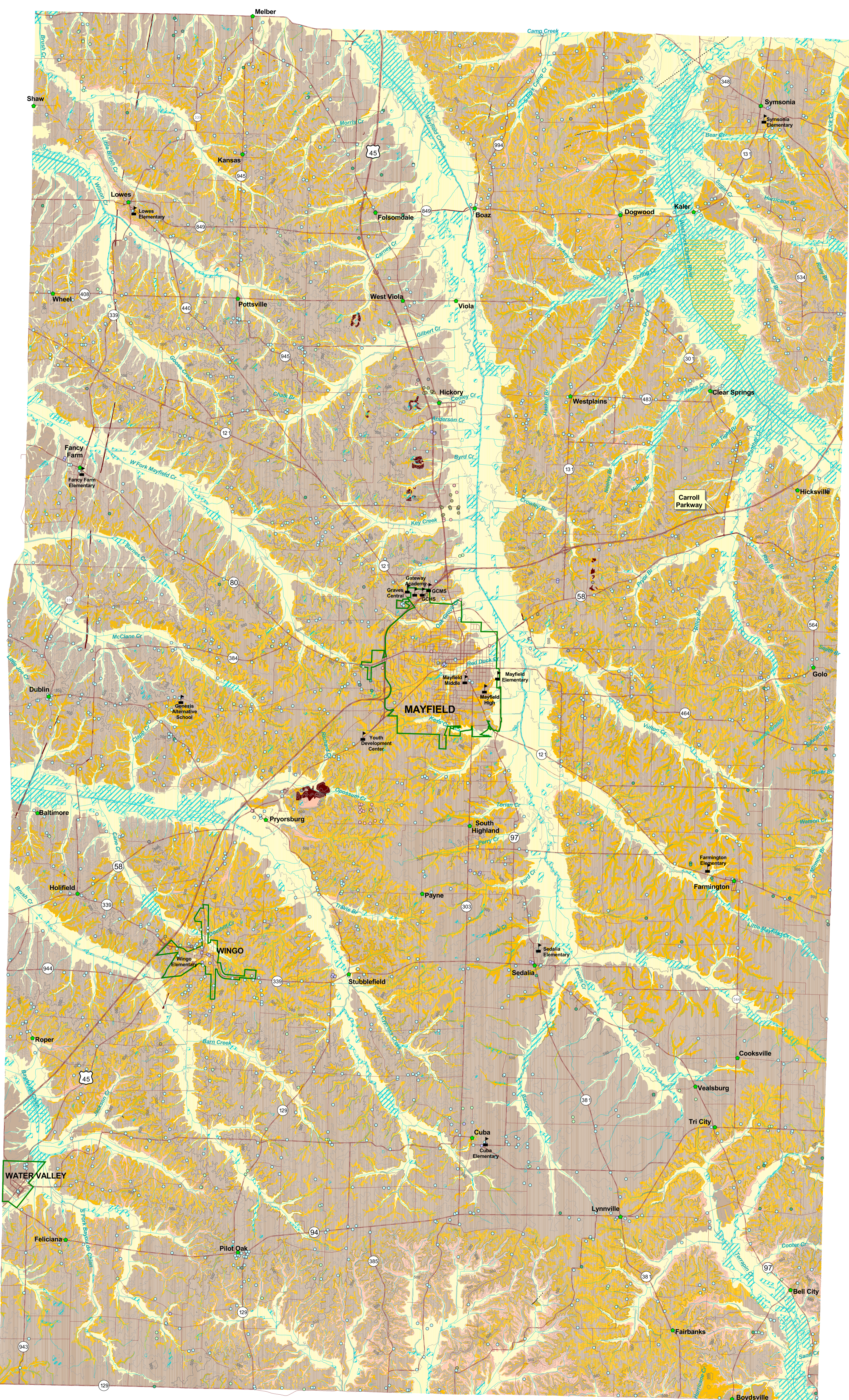
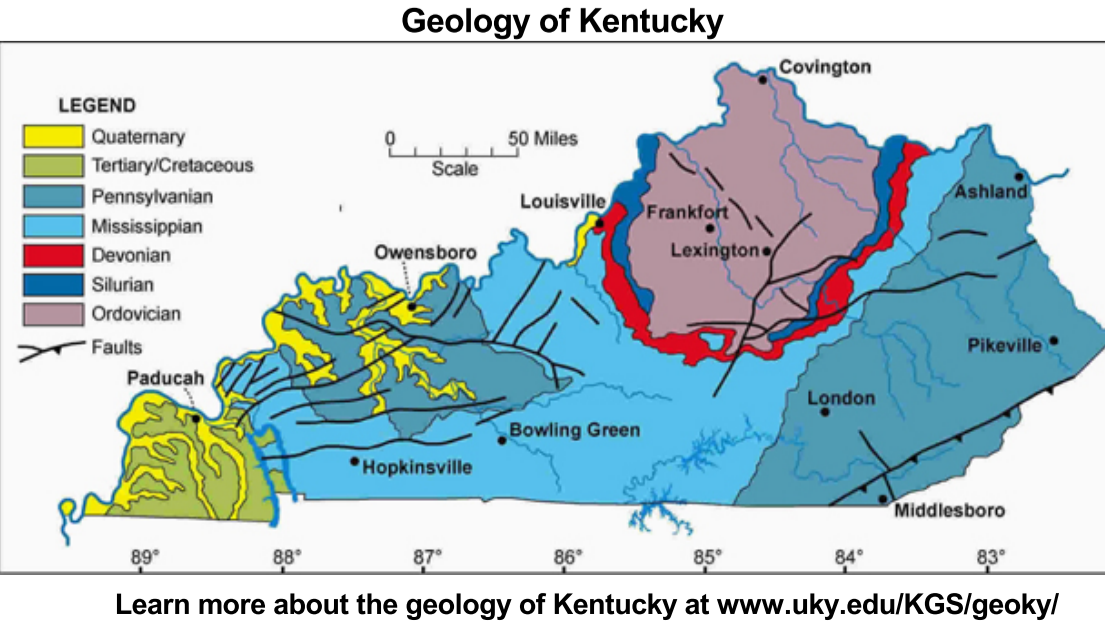
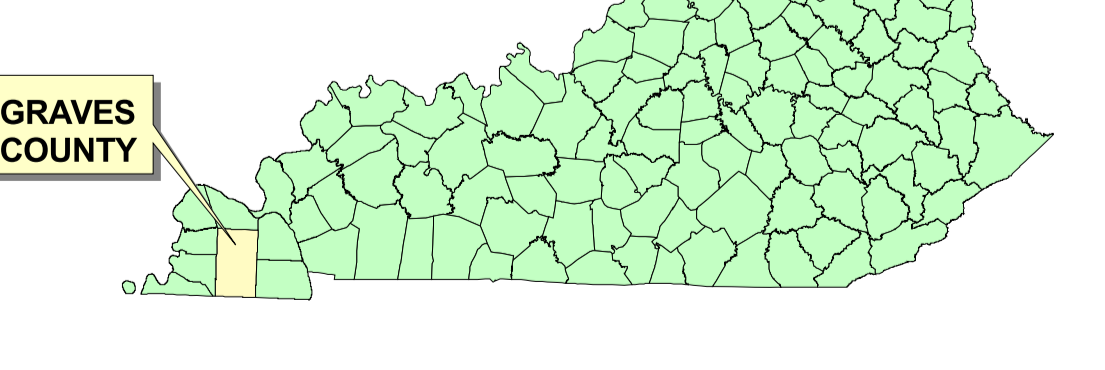
Currently, 61 catfish ponds are in Graves County. After harvesting, the fish are trucked to the processing plant, located at the Purchase Area Aquaculture Cooperative. The processing plant is currently running at 30 percent capacity. To get the plant to 50 percent capacity, 1,000 more acres of ponds are needed. Photo courtesy of Roberta Bank, Purchase Area Aquaculture Cooperative.



Approximately 230 chicken houses are in Graves 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.

7.5-Minute Quadrangles

LOWLICK MELBER	KANSAS	SYMONIA	ELVA
FANCY FARM	HICKORY	WEST PLAINS	OAK LEVEL
DUBLIN	MAYFIELD	FARMINGTON	WINDY HOLLOW
WATER VALLEY	CUBA	LYNNVILLE	LYNN GEOLOGIC



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 270.827.5404. 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/web/site/kyplan/viewer.htm.



The well-drained soils in Graves County are conducive to the use of septic tanks with lateral lines. The unconsolidated sediment makes for easy excavation. In areas where the soils are not well-drained, unconventional methods to handle waste may be needed. Photo by Glynn Beck, Kentucky Geological Survey.

Groundwater
Abundant quantities of groundwater are available for domestic, irrigation, and industrial uses in Graves County from depths of a few feet to below 700 feet; most wells are set at the 100 foot range. Yields in some of the deeper wells (250 to 1,500 feet) are greater than 1,000 gallons per minute, which is sufficient for a community or industrial supply. A few wells obtain shallow, perched water from gravel or alluvial deposits. These zones often will not yield an adequate domestic supply during dry periods in late summer and fall.

Water quality generally is good, except in areas where downward percolation of surface water and fluids from domestic sewage-disposal systems, and other sources of domestic or industrial pollution, have contaminated the aquifer. Water from alluvium is generally hard to very hard with moderate to high levels of dissolved solids. Water from the sand or gravel, nonalluvium aquifers is considered soft and slightly acidic, with low dissolved solids content. In a few wells, harmful amounts of nitrate have been detected. 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 acidic groundwater and steel well casing and pump equipment will produce a high iron content in the water. For more information on groundwater resources in the county, see Carey and Slickney (2001).

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.

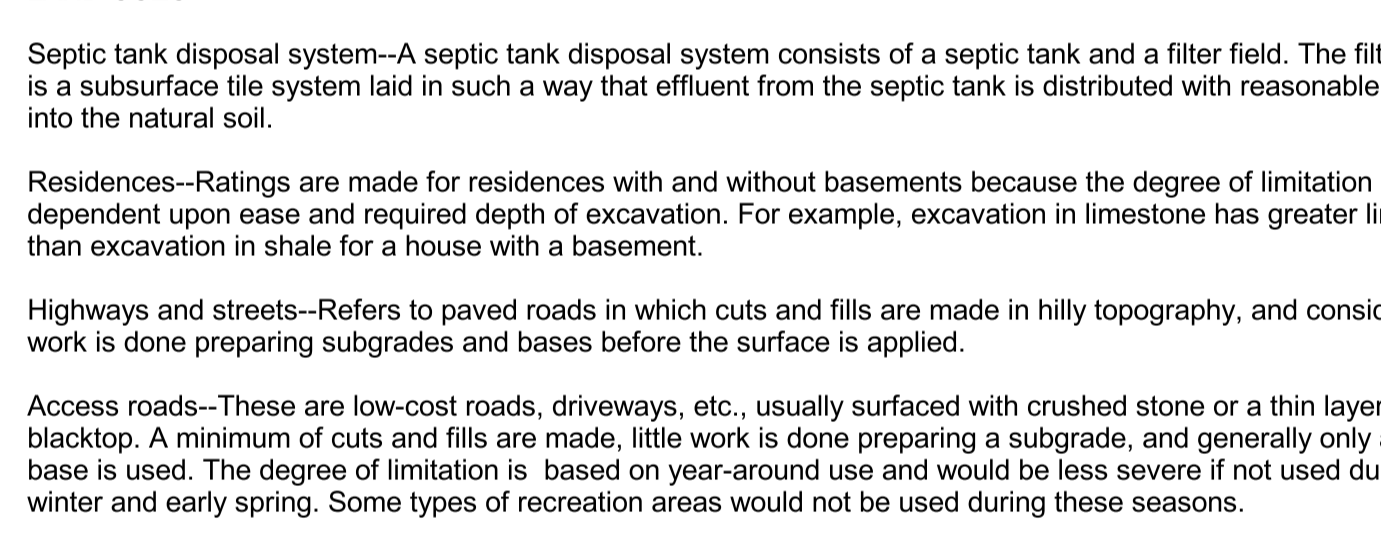
LAND USES
Septic tank disposal system—A septic tank disposal system consists of a septic tank and a filter field. The filter field is a subsurface tile system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.
Residences—Ratings are 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.

Geologic Hazards
The most prominent geologic hazard for Graves 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 Graves 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 careful thought 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.



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.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.	Contact local USDA soil scientist.
2. Loess	Fair to good foundation material. Easily excavated.	Slight to moderate limitations. Variable thickness and permeability.	Severe limitations.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Gravel	Fair to good foundation material. Easily excavated.	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 material.
4. Sand, clay, and silt	Fair to good foundation material.	Slight to moderate limitations. Variable thickness and permeability.	Slight limitations. Possibility of shallow groundwater table.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight to moderate limitations. Possibility of permeable material.	Slight to moderate limitations. Possibility of permeable material.	No limitations.
5. Clay and sand	Moderate limitations. Possibility of expanding clay minerals.	Severe limitations. Impervious material.	Severe limitations. High moisture content.	Moderate limitations. Expanding clay minerals may be present.	Minor limitations. Expanding clay minerals may be present, may be slippery when wet.	Minor limitations. Expanding clay minerals may be present. Drainage required.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.

References Cited

Carey, D.I., and Slickney, J.F., 2001. Groundwater resources of Graves County, Kentucky. Kentucky Geological Survey, Open-File Report OF-01-42, 19 p.

Duncan, R.S., 2003. Spatial database of the Hickory quadrangle, Graves County, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-457. Adapted from Blade, L.V., 1965. Geologic map of the Hickory quadrangle, Graves County, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-457, scale 1:24,000.

Duncan, R.S., and Martin, S.L., 2003. Spatial database of the Elva quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-230. Adapted from Olive, W.W., 1963. Geology of the Elva quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-230, scale 1:24,000.

Hettinger, C.P., 2003a. Spatial database of the Cuba quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-322. Adapted from Blade, L.V., 1964. Geology of the Cuba quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-322, scale 1:24,000.

Hettinger, C.P., 2003b. Spatial database of the Kirskey quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-246. Adapted from Wilshire, H.G., 1963. Geology of the Kirskey quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-246, scale 1:24,000.

Martin, S.L., 2003a. Spatial database of the Fancy Farm quadrangle, western Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-1491. Adapted from Finch, W.L., and Lee, K.Y., 1978. Geologic map of the Fancy Farm quadrangle, western Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-1491, scale 1:24,000.

Martin, S.L., 2003b. Spatial database of the Lynn Grove quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-268. Adapted from Olive, W.W., 1963. Geology of the Lynn Grove quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-268, scale 1:24,000.

Martin, S.L., 2003c. Spatial database of the Oak Level quadrangle, western Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-744. Adapted from Olive, W.W., and Davis, R.W., 1968. Geologic map of the Oak Level quadrangle, western Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-744, scale 1:24,000.

Martin, S.L., 2003d. Spatial database of the Symsonia quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-326. Adapted from Finch, W.L., 1964. Geology of the Symsonia quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-326, scale 1:24,000.

Melton, C.E., and Martin, S.L., 2003. Spatial database of the Water Valley quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-269. Adapted from Finch, W.L., 1963. Geology of the Water Valley quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-269, scale 1:24,000.

Murphy, M.L., 2003a. Spatial database of the Dublin quadrangle, Graves and Hickman Counties, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-972. Adapted from Sims, J.D., 1972. Geologic map of the Dublin quadrangle, Graves and Hickman Counties, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-972, scale 1:24,000.

Murphy, M.L., 2003b. Spatial database of the Farmington quadrangle, Graves County, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-530. Adapted from Finch, W.L., and Minard, J.P., 1966. Geologic map of the Farmington quadrangle, Graves County, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-530, scale 1:24,000.

Murphy, M.L., 2003c. Spatial database of the Mayfield quadrangle, Graves County, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-372. Adapted from Finch, W.L., 1965. Geology of the Mayfield quadrangle, Graves County, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-372, scale 1:24,000.

Murphy, M.L., and Martin, S.L., 2003. Spatial database of the West Plains quadrangle, Graves County, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-587. Adapted from Swanson, R.W., and Wilshire, H.G., 1967. Geologic map of the West Plains quadrangle, Graves County, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-587, scale 1:24,000.

Solis, M.P., 2003a. Spatial database of the Lovelockville quadrangle, western Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-763. Adapted from Finch, W.L., 1968. Geologic map of the Lovelockville quadrangle, western Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-763, scale 1:24,000.

Solis, M.P., 2003b. Spatial database of the Lynnville quadrangle, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-414. Adapted from Lambert, T.W., 1965. Geology of the Lynnville quadrangle, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-414, scale 1:24,000.

Solis, M.P., 2003c. Spatial database of the Metter quadrangle, Graves and McCracken Counties, Kentucky. Kentucky Geological Survey, ser. 12, Digitally Vectorized Geologic Quadrangle Data DVGQ-860. Adapted from Swanson, R.W., 1970. Geologic map of the Metter quadrangle, Graves and McCracken Counties, Kentucky. U.S. Geological Survey Geologic Quadrangle Map GQ-860, scale 1:24,000.

Street, R., Wang, Z., Hank, L., and Allen, D., 1998. Source zones, recurrence rates, and time histories for earthquakes affecting Kentucky. Kentucky Transportation Center, University of Kentucky, KTC-98-4.

Woods, A.L., Smernik, J.M., Martin, W.H., Pond, G.J., Andrews, W.M., Call, S.M., Cornstock, J.A., and Taylor, D.D., 2002. Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, scale 1:1,000,000.

Copyright 2004 by the University of Kentucky, 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 Graves County:

ces.ca.uky.edu/graves/—University of Kentucky Cooperative Extension Service
www.purchaseadd.org/—Purchase Area Development District
www.thinkkentucky.com/edis/omny/ov0101/—Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas21063.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qft/states/21/21063.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information, Kentucky Geological Survey

Public Information Center
859.257.3898 or
877.778.7827 (toll free)

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

Scale 1:63,360
1 inch = 1 mile

0 4 8 Miles