



Characteristics of Land Resources

The geology, soils and topography of Woodford County

The geology, soils and topography of an area are important to the community planning process for several reasons. Geological conditions determine the existence and extent of sinkholes, an important consideration in roadway, storm water and subdivision design. Soil classifications help to determine the potential of land areas for agricultural use, forage for cattle or horses, and human development at either the urban or rural scale. The type of soil present in a particular location can also be an accurate indicator of the presence of wetlands, as well as the suitability of the land for disposal of waste through septic tanks.

Topographic information, which describes the “lay of the land” or the vertical elevation of land (typically measured as the number of feet above or below mean sea level), can have a wide range of uses. The degree of slope can be used as a measure to establish thresholds for land uses, and the engineering practices that may be necessary to avoid unsafe building conditions. For example, a slope of 15% is probably too steep (without significantly altering the existing grade) to permit the safe operation of a public road.

Land elevation is also critical in determining the direction and velocity of storm water runoff. This is an important consideration for drainage of land as well as the management of storm water in urban and rural areas. Lands with very steep slopes generate greater velocity of storm water runoff and are, therefore, more problematic for human development regardless of its urban or rural scale.

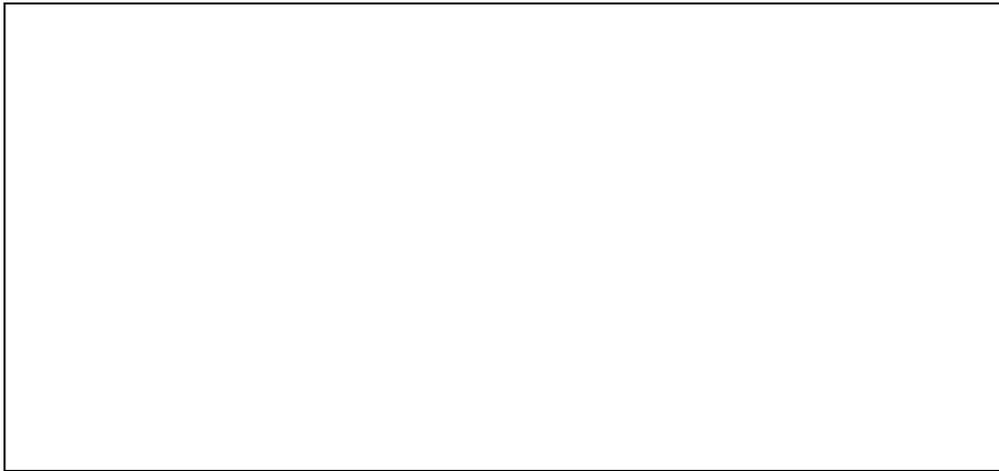
In Woodford County’s case, topography also is a primary ingredient in the usefulness of the land for agricultural purposes, and is an inherent factor in the quality of scenic vista’s. Topography is also a contributing factor to the value of land for the

purpose of producing high quality thoroughbred horses. Land with moderate changes in elevation produce higher quality horses as a result of the aerobic workout that horses gain by exercise through the rolling topography.

Geology of Woodford County

Woodford County is located in the Inner Bluegrass physiographic region. This region is underlain by limestone of the Cynthiana, Lexington, and High Bridge formations. The Cynthiana Formation, located primarily in the northwestern part of the County, is mainly limestone interblended with thin layers of calcareous shale. The High Bridge Formation, found primarily along the Kentucky River Gorge, is massive limestone, the oldest exposed rock in Kentucky. The rest of the County is underlain with the Lexington Formation and these areas are high in phosphate typical of the Maury and McAfee soil types.

While most of the County has gently rolling slopes, steep slopes have been formed in areas with less weather resistant rock formation. Limestone bluffs and gorges have occurred in areas where streams leading to the Kentucky River created deeply cut narrow valleys.



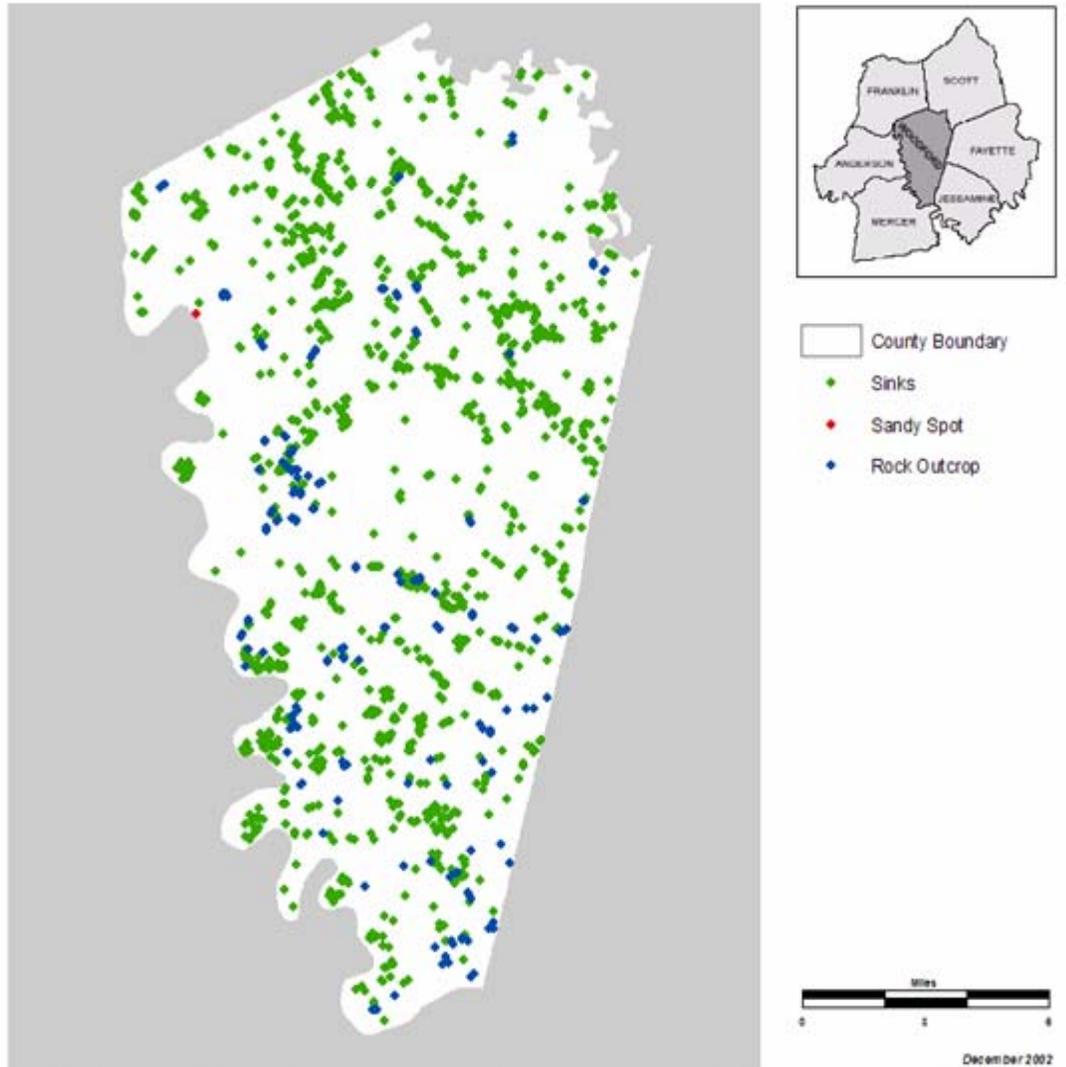
Looking northwest from Lawrencburg Road along the Kentucky River Gorge

The limestone that underlies Woodford County, and most of central Kentucky, is also prone to the formation of sinkholes. Sinkholes are one of the end results of the interaction of limestone and water. As storm water (or groundwater) seeps through a limestone formation it dissolves the stone, forming underground voids that may fill with groundwater or may become dry caves. However, as groundwater levels fluctuate or other conditions occur, the soil above these natural voids subsides into the void – creating a sinkhole.

Without extensive geotechnical analysis it is difficult to determine where sinkholes will occur. At best, it can be inferred that areas of Woodford County with existing

Figure 1.2

Woodford Resources: Land, Water & Air Geologic Formations and Known Sinkholes



2003 COMPREHENSIVE PLAN UPDATE
VERSAILLES MIDWAY WOODFORD COUNTY

CONTEXT
A State-Wide Geologic Context
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sinkholes are more prone to such activity than areas without. Figure 1.1 depicts areas with sinkhole concentrations based on data generated by the United States Geological Survey.

The significant number of known sinkholes shown on Figure 1.1 can only be interpreted to mean that much of Woodford County is susceptible to additional formations. The largest concentration of known activity appears to be in the northern portion of the County above the line formed by US 33 and US 60. Lands south of this line, which are characterized by more steeply sloped areas, also is prone to sinkhole activity, particularly along stream corridors. This suggests that surface water movement most influences the water and limestone relationship in the southern portion of the County. However, in the northern portion of the County that relationship is most likely to be more susceptible to groundwater conditions.

Should the relationship between water action and limestone formation suggested above, for the southern part of the County, prove to be accurate it suggests that storm water management associated with human uses of the land should be closely monitored. Increased storm water flow in the stream valleys could have the effect of accelerating sinkhole formation activity – to the possible harm of affected property owners

Soils

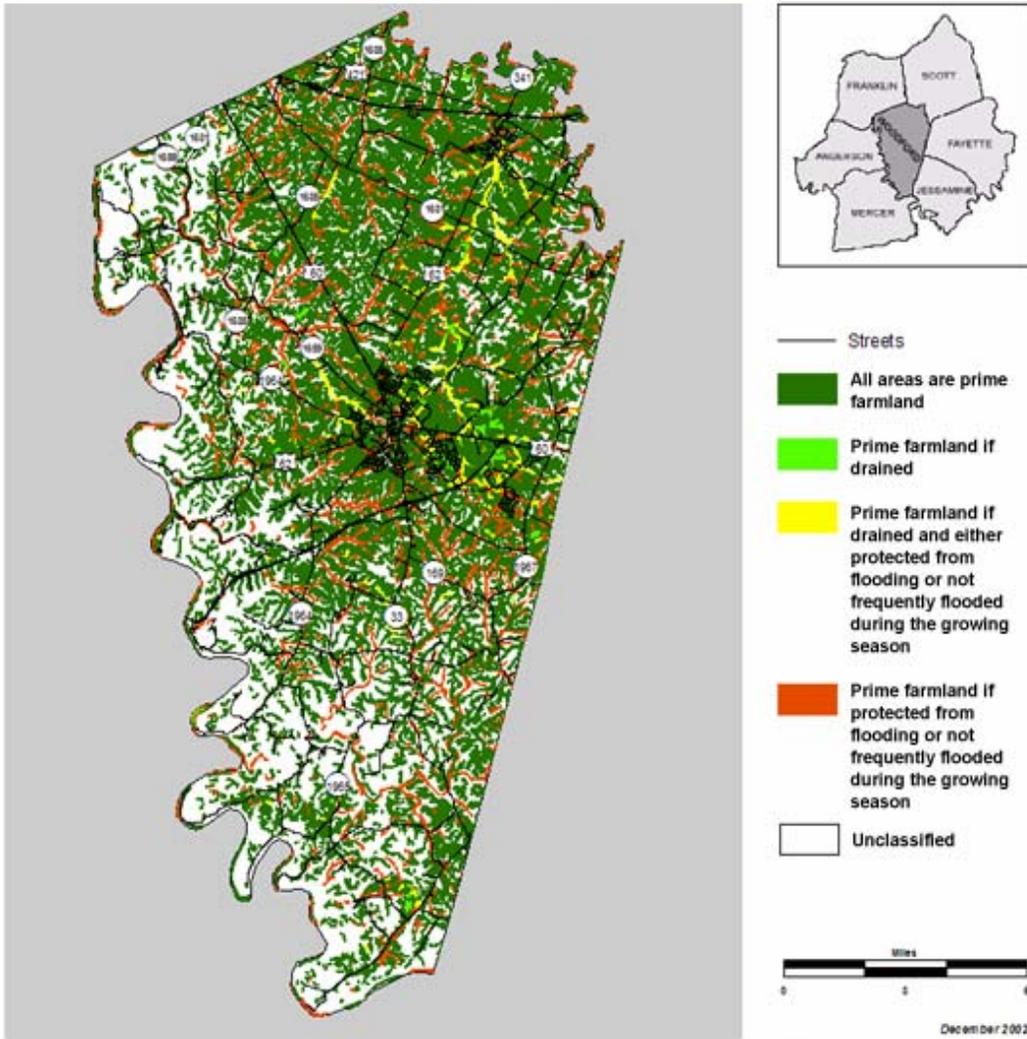
Generalized soil classifications and prime farmlands are depicted on Figure 1.2. Soil data has been developed from a Soil Survey of Woodford County undertaken by the National Resource Conservation Service. Soil types have been grouped into three primary associations with similar characteristics. The prime farmland data is created from a composite of factors, including soils, topography, drainage and floodplain. There are four categories of prime farmland ranging from areas with no constraints to areas with potential flooding constraints.

The **Maury-McAfee** Association, making up about 40 percent of Woodford County's soils, is found in the northern half of the County. This association consists of broad gently sloping ridges and somewhat steeper slopes along drainage ways and around sinkholes. Irregular topography, including sinkholes, are common in this soil unit. Most of this acreage is used for cultivated crops, hay and pasture. Historically, the chief crops have been burley tobacco and Kentucky bluegrass for pasture and hay. This unit has high potential for cultivated crops, some specialty crops, woodland, and intensive recreation facilities except in areas of steeper slopes. In some areas, more intensive uses would be limited by depth to bedrock and flood hazard.

This area encompassed by this association also contains a significant portion of the prime farmland in Woodford County. It is interesting to note the location of Midway and Versailles in relation to the major pockets of prime farmland – both communities were located in close proximity to these pockets.

Figure 1.3

Woodford Resources: Land, Water & Air Soil Capability for Agricultural Use



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The most predominant soil association in Woodford County, the **McAfee-Maury-Fairmont unit**, makes up about 50 percent of County land area. This soil type is found primarily in the southern and western parts of Woodford County. The areas that include this soil unit consist of rolling uplands and moderately steep slopes along the major drainage ways; and, karst topography (rock outcroppings and sinkholes) is also common. Most of the acreage in this association is used for cultivated crops, hay and pasture.

The soils in this unit have medium potential for cultivated farm crops, specialty crops, woodlands and recreation facilities. On steeper cultivated slopes, the hazard of erosion is severe. Crop production and facilities for intensive recreation are limited in many places because of the slope and depth to rock.

The **Fairmount-Rock Outcrop** unit, comprising approximately ten percent of the County's soils, is found along the southern and western boundary of the County bordering the Kentucky River. The landscape in this soil unit consists of long, very steep slopes, massive limestone outcrops, or palisades. Slope varies from fairly level to strongly sloping and this feature combined with periodic flooding impact the soils development potential. Most of the acreage in this association is in low-grade hardwoods, red cedar, and brush. Some of the acreage has been cleared for hay, pasture, tobacco, and corn.

Soils in this map unit generally have low potential for cultivated or specialty crops, woodlands, urban or intensive recreation uses due to erosion hazard, depth to bedrock, the rock outcrop, steep slopes, and flooding hazard areas. There is very little prime farmland within the area encompassed by this soil association.

Soil associations and subsurface geology (depth to bedrock for example) are also key elements in determining the suitability of geographic areas for waste disposal via septic tank systems. Although Woodford County discourages the use of septic tank systems, preferring centralized public collection and disposal systems, a brief overview of this factor may be useful in the review and evaluation of future conservation or rural residential subdivision proposals.

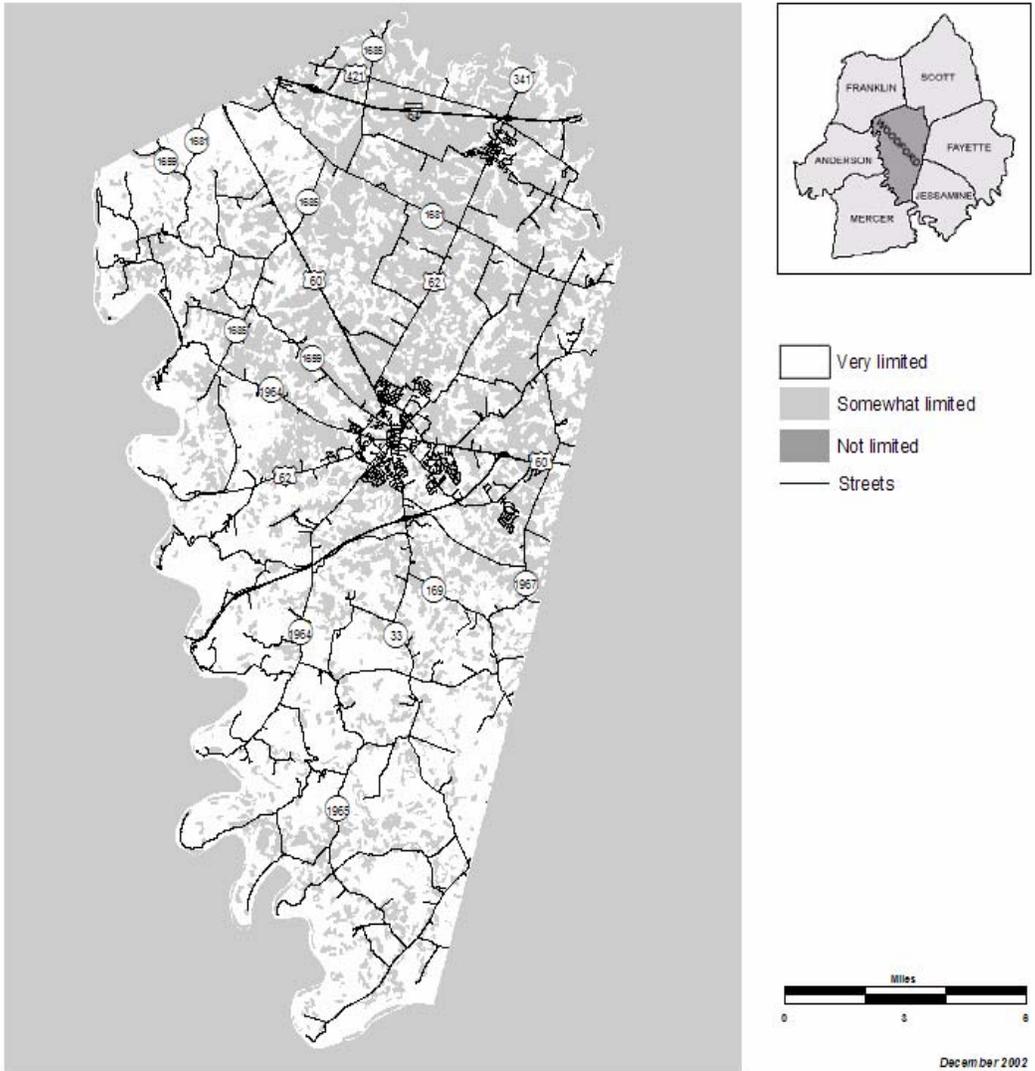
The suitability of a specific site for waste disposal is determined in large part by three factors, soil texture and structure, the depth to bedrock, and the size of the site.

Soil texture and structure determine how quickly or slowly water will move through the medium (drain). Depth to bedrock will be a partial indicator of the capacity of a site to dissipate a given volume of wastewater. If the depth, as measured from the surface soil is very shallow, the site may have insufficient area in which a drain field can properly function. Finally, size of site is also an indicator of whether there is sufficient area for disposal purposes.

The area of Woodford County that falls within the prime farmland classification (no constraints or conditions) generally represents the area that would be most suitable

Figure 1.4

Woodford Resources: Land, Water & Air Soil Capability for Waste Disposal by Septic Tank



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for use of septic tank disposal systems. This is borne out by the information depicted in Figure 1.3, which confirms that a large percentage of septic tanks systems permitted and continuing to function are located within prime agricultural lands in the northern portion of the County.

It is unfortunate however, that the depth of bedrock for much of this area is also fairly shallow and susceptible to sinkhole formation. This means that existing septic tank systems, while capable of proper functioning within a given site, may likely have a cumulative negative impact to the groundwater system. Data maintained by the Woodford County Health Department indicates that approximately 10 septic tank systems are reported to fail each year.

The gently rolling topography of northern Woodford County, shallow soil profile to bedrock and septic tank operations is also problematic because this combination of factors can result in wastes transmitted to the surface through springs created by a perched groundwater table. The potential health threat from this scenario could be severe for humans, horses and cattle.

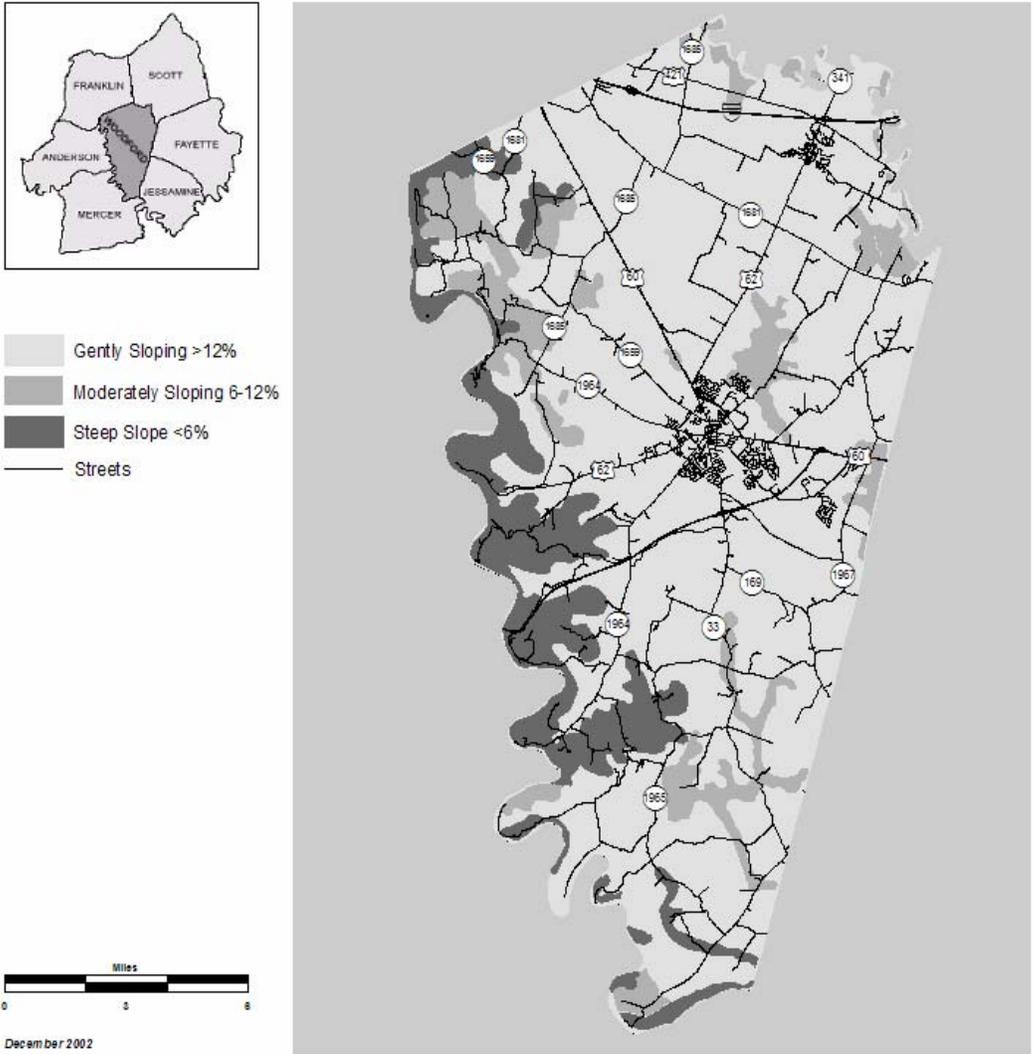
Topography

The topography of Woodford County can vary significantly depending on location – from the steeply sloped areas adjoining the Kentucky River to the gently rolling landscapes of the northern part of the County. For analysis purposes, topographic features have been grouped into three classifications: areas with slopes less than 6 percent; areas with slopes between 6 and 12 percent, and areas with slopes greater than 12 percent. These categories represent benchmarks relative to the use of land for human use at either urban or rural scales. These topographic categories are depicted on Figure 1.5



Figure 1.5

Woodford Resources: Land, Water & Air Topographic Contours/Slopes



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Generally, the greater the slope the more constrained the land is for development and agriculture. Why? Development or agricultural practices on steeply sloped areas require special engineering for foundations and structures as well as altered agricultural production practices that are not economically feasible for most types of crops. In addition, more difficult to address erosion control and storm water management in areas of steep slopes. The velocity of storm water runoff in areas of steep slopes simply overwhelms the capabilities of most types of silt fences and detention facilities.

The analysis of the data presented in Figure 1.5 indicates what other components of this review have also revealed, the western most areas of the County are significantly constrained. In this case the constraint is the presence of slopes greater than 12 percent. The southern portion of the County does not have severe changes in topography, but still exhibits some areas of steep slopes. Lands north of Versailles are characterized as gently rolling and there are few areas constrained in any way by topographic features.

Natural Vegetation, Woodlands and Wildlife Habitat

This aspect of land resources in Woodford County has not been previously addressed in the Comprehensive Plan, yet it is an integral part of the natural environment that residents and visitors can enjoy.

Woodford's natural environment ceased to be "natural" some time ago. Farming and other land altering practices have permanently changed the Woodford landscape. What remains today is still very valuable in terms of wildlife habitat and scenic vista's.

Figure 1.6 contains an aerial photograph of Woodford County. It is evident from this photograph that Woodford's former natural environment still predominates in the western part of the County adjacent to the Kentucky River. However, in the northern and southern parts of the County, extensive former woodlands have been transformed through agricultural operations. Significant stretches of woodland still remain, particularly in the Pisgah area and lands around Nonesuch.

Figure 1.6
Aerial Photograph of Woodford County depicting Woodlands and Vegetation

To be inserted in final draft.

Summary

The karst geology of Woodford County, which contributes significantly to the high quality of the soil and scenic topography of the land, is also the reason for the incidence of so many sinkholes. Water is the element that binds all of these characteristics together – providing the medium for the dissolution of the calcium carbonates that make up the limestone deposits, and in term the limestone provides storage and avenues of movement for water from area to area. A land management strategy designed to minimize the sinkhole potential on human operations and structures should also manage the relationship of water and geology in terms of storm water surface flow, groundwater recharge and pollutant loadings.