USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Kentucky Natural Resources and Environmental Protection Cabinet; Kentucky Agricultural Experiment Station; and United States Department of Agriculture, Forest Service

Soil Survey of Magoffin and Morgan Counties, Kentucky

How to Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

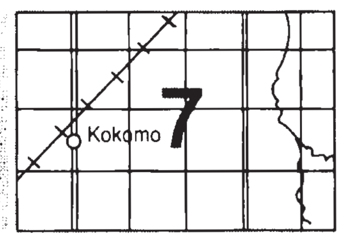
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

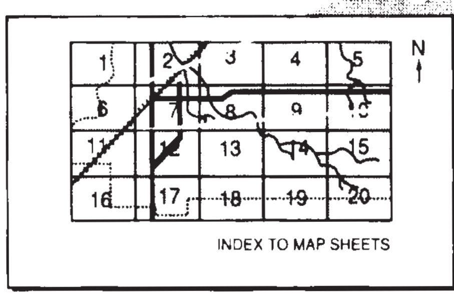
To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

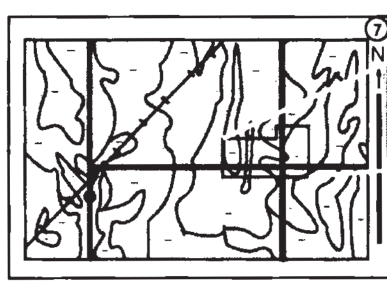
The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



MAP SHEET



INDEX TO MAP SHEETS



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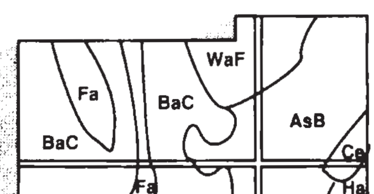

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1992. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service; the Kentucky Natural Resources and Environmental Protection Cabinet; the Kentucky Agricultural Experiment Station; and the United States Department of Agriculture, Forest Service. The survey is part of the technical assistance furnished to the Magoffin County Conservation District and the Morgan County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: A farmstead near Mize in Morgan County. It is in an area of the Shelocta-Gilpin-Allegheny-Grigsby general soil map unit.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

Contents

Issued 2002

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of Magoffin and Morgan Counties, Kentucky

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United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
the Kentucky Natural Resources and Environmental Protection Cabinet; the Kentucky Agricultural Experiment Station; and the United States Department of Agriculture, Forest Service

MAGOFFIN AND MORGAN COUNTIES are in the eastern part of Kentucky (fig. 1), along the western edge of the Mountains and Eastern Coal Fields physiographic region (University of Kentucky and USDA 1970). In 1990, the population of Magoffin County was about 13,000 and that of Morgan County was about 11,000 (U.S. Department of Commerce 1991). Salyersville is the county seat of Magoffin County, and West Liberty is the county seat of Morgan County. Magoffin County has a total area of about 198,093 acres, or about 309 square miles. Morgan County has a land area of about 244,199 acres, or about 382 square miles, and a water area of 1,343 acres. About 24,000 acres of Morgan County is included in The Daniel Boone National Forest.

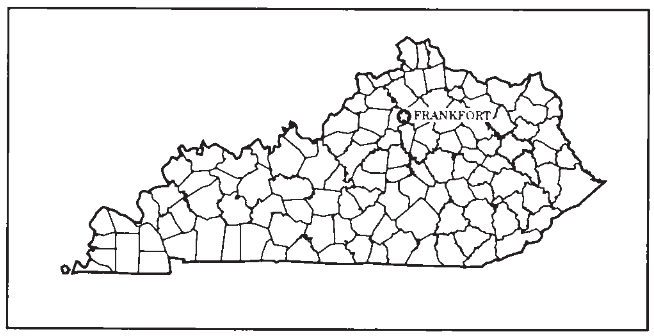


Figure 1.—Location of Magoffin and Morgan Counties in Kentucky.

Magoffin County is bounded on the west by Wolfe County, on the southwest by Breathitt County, on the south by Knott County, and on the east by Floyd and Johnson Counties. Morgan County is bounded on the southwest by Wolfe County, on the west by Menifee County, on the north by Rowan and Elliot Counties, and on the east by Lawrence and Johnson Counties.

This soil survey updates the "Reconnaissance Soil Survey of Fourteen Counties in Eastern Kentucky" published in 1965 and the Morgan County part of the "Soil Survey of Menifee and Rowan Counties and Northwestern Morgan County, Kentucky" published in 1974 (Avers and others 1974; McDonald and Blevins 1965). It provides more recent information and larger maps, which show the soils in greater detail than the maps in the 1965 soil survey but with slightly less detail than those in the 1974 soil survey.

General Nature of the Survey Area

This section gives general information about Magoffin and Morgan Counties. It describes history and settlement; topography and drainage; soil, vegetation, and other natural resources; climate; farming; and mining and transportation.

History and Settlement

Native peoples used the Licking River valley as a home, trade route, and hunting ground for thousands of years before European settlers came to Kentucky. Permanent settlements were built along the major rivers. A trail, known to settlers as the "warrior trail," ran roughly along what is now U.S. 460, from Paintsville to Salyersville, and linked the Big Sandy and Licking Rivers. Most of the native peoples encountered by early European explorers lived in towns and villages along the Ohio River. These peoples objected to the permanent settlement of Kentucky because the woodland areas provided them with excellent hunting, sources of flint, and trade routes from north to south.

Under provocation and facing annihilation, the native peoples resorted to sending raiding parties into Kentucky under direction of the English military. The loss of about 60 officers and men at the Battle of Blue Licks on August 19, 1782, sparked a number of reprisal raids into Ohio. Settlers under the command of George Rogers Clark burned the crops and villages of the Wyandottes in a large town near present day Chillicothe, Ohio. Finally, on August 20, 1794, General Anthony Wayne defeated the native combatants at Greenville on the Miami River. He also concluded a treaty of peace in 1795, which paved the way for unopposed settlement of Kentucky. As a result of the "peace of Greenville," the value of lands in the Licking River valley increased greatly (Allen 1872).

Dr. Thomas Walker's surveying party reached the present location of Salyersville on June 2, 1750, and noted the presence of native inhabitants camped at nearby "Elk Lick." The names of Elk Creek, Lickburg, and Lick Creek were taken from this account. An attempt at permanent settlement was made in 1794, but it failed. A settlement was finally established in about 1800 at Licking Station (1 mile downstream of what is now Salyersville on the Licking River, at a place now known as Ivy Point). The first postmaster of Licking Station, Benjamin F. Gardner, was commissioned on October 4, 1839. The settlement was well above the flood plain on a strath terrace, but rights for a town could not be obtained. An alternate site for a town seat was donated by William "Uncle Billy" Adams. A small village, which was known at that time as Adamsville, was on the site (Magoffin's First Century Committee 1960). Unfortunately, the future county seat, Salyersville, was built on the flood plain of the Licking River, and it has been subjected to periodic flooding to this day. The largest floods occurred in 1927 and 1939.

Magoffin County was established in 1859 from parts of Floyd, Johnson, and Morgan Counties. It was named for Governor Beriah Magoffin. Salyersville was named in honor of State Representative Samuel Salyers, who introduced the bill that established Magoffin County.

Magoffin County was the site of two battles during the Civil War. A skirmish at Ivy Point, near the first settlement in the county, was fought in 1863. A larger battle was fought near Royalton in 1864 (Colemen 1978).

Except for early hunters, Morgan County was officially first visited in 1787 by surveying parties of soldiers from the Revolutionary War. Daniel Williams, one of the early founders of Morgan County, came to Kentucky in 1775 with Daniel Boone.

Morgan County was established from parts of Floyd and Bath Counties. It was named for General Daniel Morgan, a veteran of the French and Indian War who, as a colonial officer, fought in the attack on Quebec during the Revolutionary War. Known as "the thunderbolt," Morgan later commanded the southern army in the defeat of Tarlton, a subordinate of British General Cornwallis at Cowpens, South Carolina. After the war, Morgan supported President George Washington during the Whiskey Rebellion. The county seat, West Liberty, was formerly known as Well's Mill but was renamed in 1823 when Morgan County was established. Most of West Liberty is built on a stream terrace and is not subject to flooding, except for the lowest streets near the Licking River. A Morgan County landmark, Cannel City, became a boomtown in about 1900 when the Hotel Delancey served as headquarters for coal, timber, and railroad industrialists; salesmen; and showmen.

Morgan County was the site of several skirmishes between Union and Confederate forces during the Civil War. Morgan County's second courthouse was destroyed by fire during that period. In 1861, General William Nelson's Union forces surprised Confederates commanded by Captain Andrew J. May, capturing some civilian Confederates and releasing many jailed Unionists. In 1862, both General George W. Morgans' Union forces and John Hunt Morgans' Confederate forces made raids through West Liberty. Later that year, the Confederate hold on the Big Sandy and Licking River valleys was broken by the Union forces at the Battle of Middle Creek in nearby Floyd County (Lee 1981).

Topography and Drainage

Magoffin and Morgan Counties generally are drained from south to northwest by the Licking River and its tributaries. A few tributaries of the Big Sandy River and the Red River drain the eastern and southwestern edges of the survey area.

Most of the soils in this survey area formed in colluvial, residual, or alluvial material weathered from sandstone, siltstone, or shale of the Pennsylvanian System. The landscape is mostly characterized by steep and very steep hillsides divided by long, narrow ridgetops and valleys. The hillsides feed perennial streams with abrasive sediment that slowly cuts through the rock, forming flood plains and stream terraces. Many old, high or strath terraces are separated from the valley floor by steep hillsides (fig. 2). These old terraces are remnants of an abandoned flood plain produced during a much earlier cycle of deposition and erosion.

The Licking River and its major tributaries empty into deep gorges formed in the northern and eastern parts of Morgan County. The soils in this deeply dissected area formed in bedrock residuum consisting of interbedded layers of sandstone, siltstone, shale, and limestone of the Pennsylvanian and Mississippian Systems.

Soil, Vegetation, and Other Natural Resources

The major natural resources in the survey area are soil, water, timber, coal, oil, gas, and limestone. Supplies of surface water, which are adequate to meet present needs, are available from lakes and rivers. The

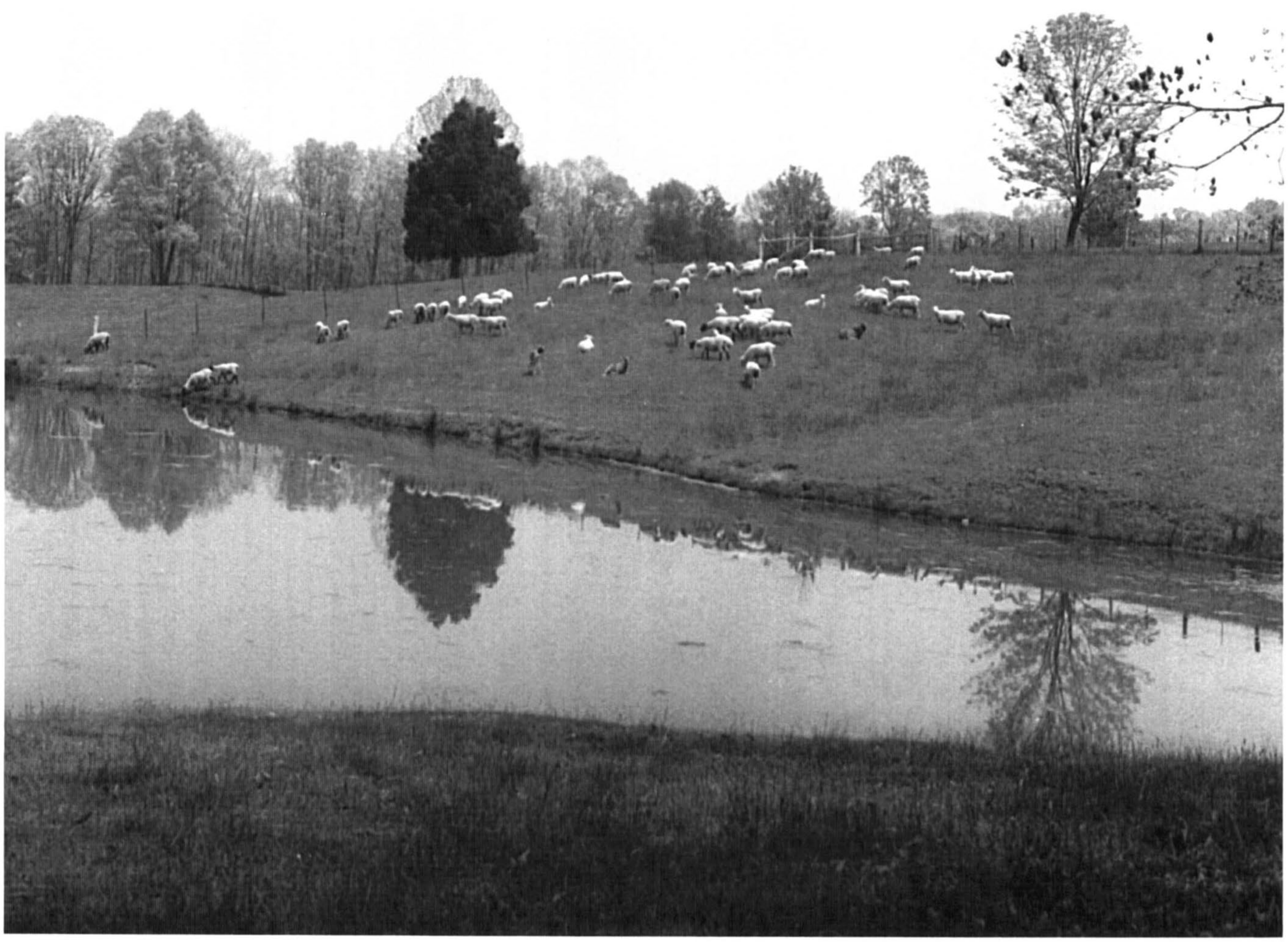


Figure 2.—Areas of Ezel-Gilpin complex, 6 to 15 percent slopes, on strath terraces provide good locations for grazing and for ponds.

supply of ground water is adequate in most rural areas.

Soil scientists have determined that there are about 34 major kinds of soils in the area. The soils range widely in texture, natural drainage, and other characteristics. Most of the steep and very steep hillsides are mantled by moderately deep, deep, and very deep loamy soils that contain varying amounts of clay, sand, and rock fragments. Most of the soils on flood plains are loamy or sandy, with only the soils on alluvial fans at the mouth of drainageways containing significant amounts of rock fragments. Soils on the banks of rivers and streams accumulate sand when they are flooded, and small levees eventually build up as the coarse sediment, mostly sand, falls out during overbank flow. Meanwhile, the finer textured sediment is carried toward the sides of the valley and settles out over time in standing backwater. This causes soils that formed near the valley walls to commonly be wet and gray because their distance from the ground-water draining channel and their silty texture affect drainage (Ferguson 1991). Some of the low stream terraces along the Licking River are also influenced by silty sediment, but they include areas of loamy soils. Generally, topsoil in the survey area is dark and ranges from a few inches to as much as 12 inches or more in thickness. In most of the survey area, the subsoil is pale and acid; however, in the northern part of Morgan County, where limestone rock outcrop is common or in cultivated fields that have been heavily limed, reaction ranges from moderately acid to neutral.

Secondary growth deciduous forest—mainly maple, beech, yellow-poplar, oak, and hickory—covers about 65 percent of the survey area. These species are mixed with buckeye and basswood on cool hillsides. Either oak or oak mixed with pine is common in areas of moderately deep soils on ridgetops. Some hemlock trees are in the deep ravines.

Most of the original forest on the flood plains and hillsides was cleared, almost to the ridgetops, by cutting the marketable and useable timber and burning the rest. The land was then cleared by digging up the roots and stumps and was used for corn, which received minimal applications of fertilizer. Once yields declined because of erosion and continuous cropping, the land was converted to pasture. These practices probably caused much of the flooding and rapid deposition of sediment in the Licking River channel. Fine fragments of charcoal are often found in the young soils near the river today and probably came from the burning of the original hardwood forest. Most of the hillsides have been reforested. Only the flood plains and stream terraces remain cleared.

Climate

Summers are hot in the valleys of Magoffin and Morgan Counties and slightly cooler at the higher elevations. Winters are moderately cold. Rains are fairly heavy and are well distributed throughout the year. Snow falls nearly every winter, but snow cover generally lasts only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at West Liberty, Kentucky, in the period 1951 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 33 degrees F and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at West Liberty on January 22, 1984, is -26 degrees. In summer, the average temperature is 73 degrees. The highest recorded temperature, which occurred on July 9, 1988, is 103 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 44.6 inches. Of this, about 24 inches or nearly 54 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of record was 4.86 inches at West Liberty on July 18, 1971. Thunderstorms occur on about 55 days each year. Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

The average seasonal snowfall is about 12 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 10 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 58 percent. Humidity is higher at night, and the average at dawn is about 79 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 8 miles per hour, in spring.

Farming

Agriculture is an important part of the economy in the survey area. In 1991, Morgan County had about 1,500 farms, making up about 40 percent of the land area, and was ranked 40th among the counties in Kentucky in burly tobacco production. About 25 percent of those farms were run by full-time operators. Magoffin County had about 450 farms, making up about 26 percent of the land area. About 20 percent of those farms were run by full-time operators (Kentucky Agricultural Statistics Service 1992).

The main crops in Magoffin and Morgan Counties are burly tobacco, corn, and hay. The livestock raised include cattle, calves, hogs, pigs, and a small number of sheep. Total cash receipts reported from farming in 1991 totaled about $11,642,000 in Morgan County and $4,529,000 in Magoffin County (Kentucky Agricultural Statistics Service 1992).

Farming has declined in importance in most of Magoffin County and in the steeper areas of Morgan County where hillsides that were once cleared for pasture and cultivated crops have since returned to woodland. During the 1950's, there were 708 commercial farms and 1,147 subsistence farms that reported agricultural production in Magoffin County (U.S. Department of Commerce 1951). The number of farms has been reduced by about 75 percent because subsistence agriculture is no longer a common lifestyle. Most of the remaining farms are small and include steep areas of woodland. Around Salyersville and some of the major communities along the Licking River, the soils on flood plains have been taken out of crop production and used for urban development. Fill material has been added to the soils on the flood plains in order to raise the structures above the flood level. This fill material, which consists of unconsolidated rock and soil, is mapped as Udorthents in this survey area.

Mining and Transportation

Numerous bituminous coal seams ranging from a few inches to several feet thick occur in the sedimentary rocks of the Pennsylvanian System (fig. 3). Coal has been commercially mined in the survey area since the late 19th century. Morgan County is a source of cannel coal, which was originally known as candle coal because it burns easily, has a silky luster, leaves little ash, and emits a bright flame (Colemen 1978). This coal was used extensively for residential and commercial heating until the late 1960's. Currently, most coal being mined is used for electric power generation. Underground mines with drift entrances, as well as surface mines, are used. In 1990, about 1,958,235 tons of coal was mined in Magoffin County and about 10,000 tons in Morgan County. Of the total tonnage mined in each county, about 60 percent was from surface mines in Magoffin County and about 90 percent from surface mines in Morgan County (Stanley 1990).

Several oil and gas fields are producing in the area. The oil and gas deposits are discovered mainly in the pre-Pennsylvanian bedrock underlying the coal fields. Limestone is quarried for road construction, concrete aggregate, and agricultural lime from exposures along the Licking River in Morgan County. Also, clay has been mined for production of sewer pipe, tile, and structural clay products (Hybert and Philley 1971; Pipringos, Bergman, and Trent 1968).

Highways, roads, and railroads in Magoffin and Morgan Counties generally follow the course of major streams. Major highways are The Bert T. Combs Mountain Parkway, U.S. Highway 205, U.S. Highway 460, and Kentucky Highway 7. A new section of U.S. Highway 205 has been constructed from West Liberty to Morehead, but it is not shown on the photobase used for this survey because the photograph was taken before construction began. A railroad in Magoffin County is used to transport coal out of the county. Passenger train service is available in Ashland, Kentucky. An airport, which is used by light aircraft, is in West Liberty.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind

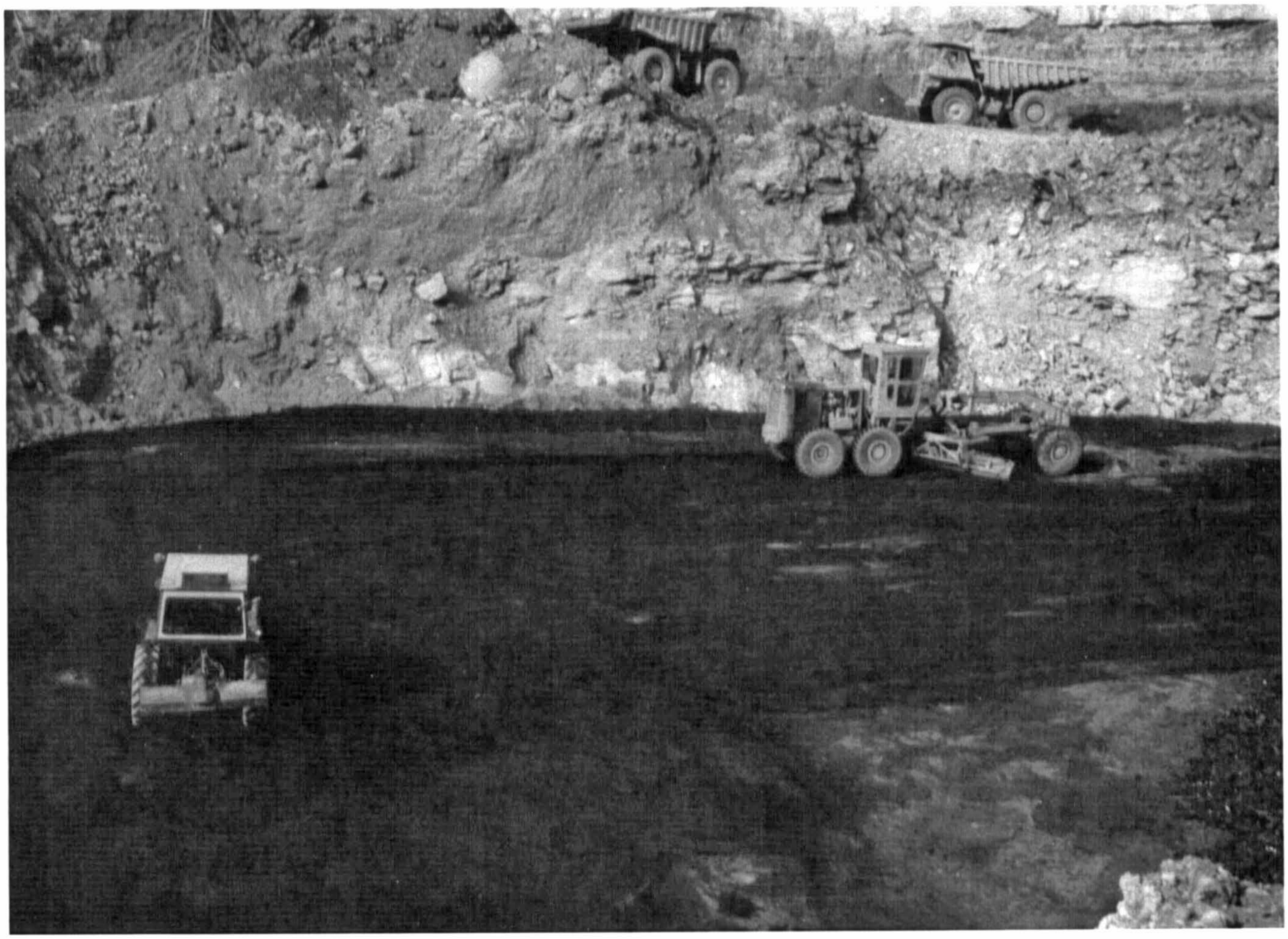


Figure 3.—An exposed coal seam awaits excavation in an area of Kaymine, Bethesda, and Fiveblock soils, 0 to 20 percent slopes, stony. The large trucks in the background are carrying away soil and rock overburden in a mining process known as mountaintop removal.

of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries (USDA 1993).

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research (USDA 1975).

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area may not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions of Magoffin County

1. Shelocta-Pope-Helechawa-Gilpin

Very deep, deep, and moderately deep, well drained and somewhat excessively drained, nearly level to very steep soils that have a loamy subsoil; on hillsides, flood plains, and ridgetops

This map unit consists of a narrow band of soils along the Licking River and its major tributaries in the northern and central parts of Magoffin County. The landscape is characterized by steep and very steep hillsides breaking to gently sloping to moderately steep terraces above a nearly level flood plain (fig. 4). The soils in this map unit generally are underlain by Pennsylvanian aged, stratified, level-bedded, acid bedrock of the lower and middle members of the Breathitt Formation. The rock formations are sandstone, siltstone, shale, coal, or a few thin layers of interbedded calcareous shale and limestone. The topography is dissected by numerous small drainageways that feed perennial streams, all of which eventually empty into the Licking River. Elevation ranges from about 800 feet on the valley floors to about 1,300 feet on the crest of ridgetops. Slopes range from 0 to 65 percent but are dominantly 0 to 20 percent on the flood plains and terraces and 20 to 65 percent on the ridgetops and hillsides.

Most of the terraces and flood plains in this map unit are cleared and used for cultivated crops, hay, or pasture. Pits or embankment ponds provide water for livestock. Many of the terraces are used as sites for residential, commercial, or industrial development. Fill has been added to some of the valley floors in order to provide additional level land for development and to raise building sites above the flood plain. The communities of Bloomington, Edna, Elsie, Lakeville, Royalton, and Sublett and the city of Salyersville are in areas of this map unit. The steep and very steep hillsides and ridgetops in this map unit generally are forested with secondary growth hardwoods, but some areas have remained cleared and are used for pasture.

This map unit makes up about 7 percent of Magoffin County. It is about 19 percent Shelocta and similar soils, 16 percent Pope and similar soils, 10 percent Helechawa and similar soils, and 6 percent Gilpin and similar soils. The remaining 49 percent is minor soils.

The deep, well drained Shelocta soils are on hillsides. Slopes range from 6 to 65 percent but are dominantly 30 to 65 percent. These soils formed in loamy colluvium derived from acid sandstone, siltstone, and shale. Typically, the surface layer is loam. The subsoil is loam, channery loam, channery silt loam, and silty clay loam. The substratum is very channery silty clay loam. Permeability is moderate.

The very deep, well drained Pope soils are on flood plains along the Licking River. Slopes range from 0 to 2 percent. These soils formed in stratified loamy and sandy alluvium washed from interbedded sandstone, siltstone, and shale. Typically, the surface layer is loam. The subsoil is sandy loam that has thin strata or bedding planes of sand throughout. Permeability is moderate or moderately rapid.

The very deep, somewhat excessively drained Helechawa soils are on hillsides. Slopes range from 30 to 65 percent. These soils formed in loamy colluvium derived mainly from sandstone. Typically, the

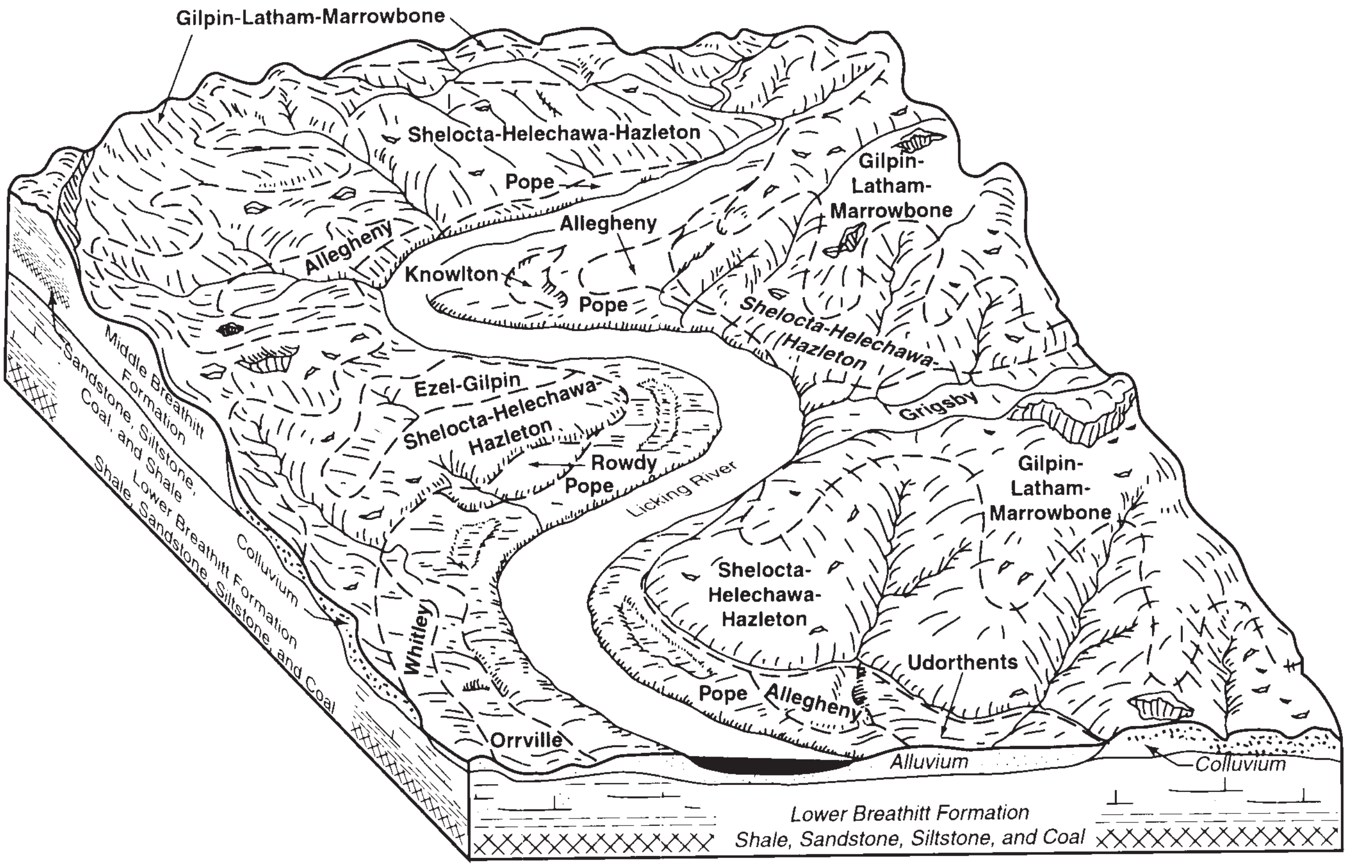


Figure 4.—Typical pattern of soils and their relationship to geology and topography in the Shelocta-Pope-Helechawa-Gilpin general soil map unit in Magoffin County.

surface layer is sandy loam. The subsoil is sandy loam and channery sandy loam. The substratum is extremely channery sandy loam. Permeability is moderately rapid.

The moderately deep, well drained Gilpin soils are on ridgetops and low nose slopes. Slopes range from 4 to 60 percent but are dominantly 20 to 60 percent. These soils formed in loamy residuum. They are underlain by sandstone, siltstone, or shale. Typically, the surface layer is channery silt loam. The subsoil is silt loam, channery silt loam, and very channery silt loam. Permeability is moderate.

Of minor extent in this map unit are Allegheny, Cotaco, Dekalb, Ezel, Fedscreek, Grigsby, Hazleton, Kimper, Knowlton, Latham, Marrowbone, Orrville, Riney, Rowdy, and Whitley soils and Udorthents. Allegheny and Cotaco soils are on stream terraces. Ezel and Riney soils are on strath terraces. Dekalb, Latham, and Marrowbone soils are on ridgetops. Fedscreek, Hazleton, and Kimper soils are on hillsides. Grigsby soils are on narrow, well drained flood plains. Knowlton soils are on low stream terraces, in abandoned river channels, and in sloughs. Orrville soils are in wet spots on flood plains. Rowdy soils are on low stream terraces and alluvial fans. Whitley soils are on low stream terraces. Udorthents are on flood plains in areas that have been filled with unconsolidated soils and rock.

The soils on the nearly level and gently sloping flood plains and those on the gently sloping to moderately steep terraces are suited to all of the cultivated crops commonly grown in the area. They are also suited to specialty crops, such as vegetables, Christmas trees, and nursery plants. The main limitations are the slope, the hazard of erosion, and wetness in low areas. The soils on the flood plains along the Licking River are subject to frequent flooding, but they are not commonly flooded during the growing season.

Although most of the less sloping areas in this map unit have been cleared, these soils are suited to woodland. Productivity is high on flood plains and terraces and moderate or high on hillsides. Eastern hemlock, American beech, white oak, northern red oak, red maple, sugar maple, and yellow-poplar are native trees. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

Most of this map unit is generally not suited to building site development because of the slope, unless major grading and reshaping are done. The soils on terraces that are not wet or in low areas are suited to building site development. The main limitation on sites for dwellings without basements is the slope. The depth to bedrock may be a limitation on sites for dwellings with basements on strath terraces. The main limitation on sites for septic tank absorption fields is the slope. The restricted permeability is an additional limitation affecting absorption fields in some areas.

2. Kimper-Shelocta-Fedscreek-Gilpin

Very deep, deep, and moderately deep, well drained, moderately steep to very steep soils that have a loamy subsoil; on hillsides and ridgetops

This map unit consists of an extensive area in the southern part of Magoffin County in the watersheds of Big Half Mountain Creek, Howard Branch, Long Creek, Puncheon Camp Creek, Salt Lick Branch, Sycamore Creek, and Trace Branch and the headwaters of Licking River. The landscape is characterized by steep and very steep hillsides; narrow, crested ridgetops; and deep, narrow, nearly level to sloping valleys that are long and winding (fig. 5). The soils in this map unit are underlain by Pennsylvanian aged, stratified, level-bedded, acid to slightly calcareous bedrock of the middle and upper members of the Breathitt Formation. The rock formations are sandstone, siltstone, shale, coal, and thin beds of calcareous siltstone and limestone. Rock outcrop in the shape of ledges, bluffs, rubble, and chimney rock is common on the crest of ridgetops, on nose slopes, and in some drainageways. The topography is dissected by a dendritic drainage pattern made up of numerous small drainageways, many intermittent streams, and a few perennial streams that empty into the Licking River. Elevations range from about 900 feet on the valley floors to about 1,400 feet on the crest of ridgetops. In most areas slopes range from 20 to about 80 percent.

Most of this map unit is forested with secondary growth hardwoods and scattered plantations of pine. Cultivated crops and hay are grown in areas on valley floors and in the sloping and moderately steep areas on some ridgetops and footslopes. Some hillsides and recently reclaimed surface mines are used for pasture. Embankment ponds, drilled wells, and spring developments provide most of the water for livestock. Except for a few small communities, such as Carver, Duco, Fredville, Foraker, Galdia, Gapville, Gunlock, Tiptop, and Waldo, development in this map unit consists of scattered farmsteads along drainageways. It is restricted by the narrow valleys and the steep and very steep hillsides and ridgetops. Important structures in the county include farm buildings, roads, coal tipples, schools, and facilities used by gas, power, water, and communication companies.

This map unit makes up about 37 percent of Magoffin County. It is about 13 percent Kimper and similar soils, 13 percent Shelocta and similar soils, 9 percent Fedscreek and similar soils, and 8 percent Gilpin and similar soils. The remaining 57 percent is minor soils.

The very deep, well drained Kimper soils are on hillsides that have cool aspects. Slopes range from 30 to 80 percent. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. Typically, the surface layer is fine sandy loam. The upper part of the subsoil is fine sandy loam and channery fine sandy loam, and the lower part is channery loam, fine sandy loam, and channery sandy loam. Permeability is moderate or moderately rapid in the subsoil.

The deep, well drained Shelocta soils are on hillsides that mostly have warm aspects. Slopes range from 6 to 65 percent but are dominantly 30 to 65 percent. These soils formed in loamy colluvium derived from acid sandstone, siltstone, and shale. Typically, the surface layer is loam. The subsoil is loam, channery loam, channery silt loam, and silty clay loam. The substratum is very channery silty clay loam. Permeability is moderate.

The very deep, well drained Fedscreek soils are on hillsides that have cool aspects. Slopes range from 30 to 65 percent. These soils formed in loamy colluvium derived mainly from sandstone. Typically, the surface layer is channery loam. The upper part of the subsoil is sandy loam, channery sandy loam, and very channery sandy loam, and the lower part is very stony sandy loam. Permeability is moderately rapid in the subsoil.

The moderately deep, well drained Gilpin soils are on ridgetops. Slopes range from 12 to 60 percent but are dominantly 20 to 60 percent. These soils formed in loamy residuum. Typically, the surface layer is channery silt loam. The subsoil is silt loam, channery

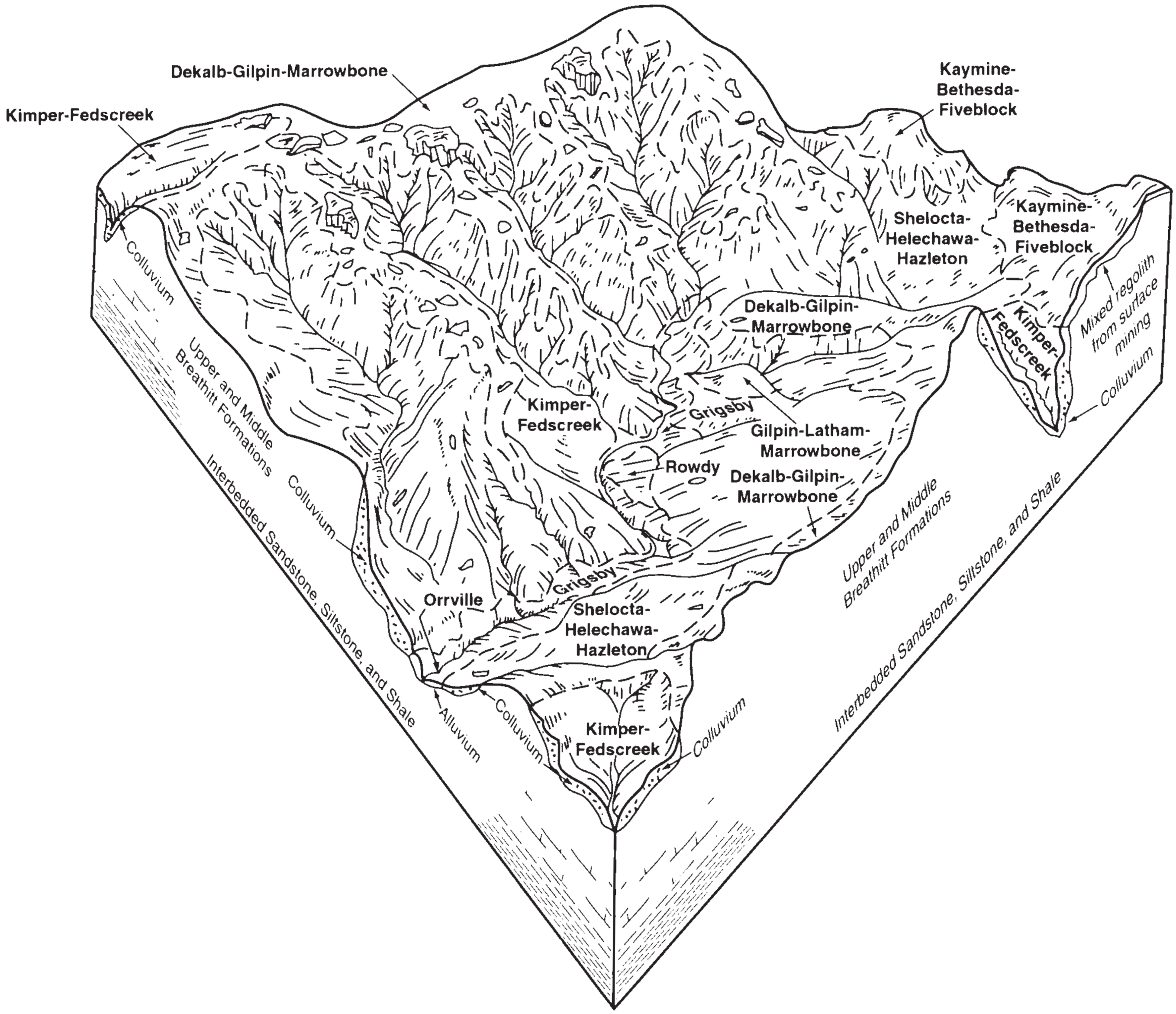


Figure 5.—Typical pattern of soils and their relationship to geology and topography in the Kimper-Shelocta-Fedscreek-Gilpin general soil map unit in Magoffin County.

silt loam, and very channery silt loam. Permeability is moderate.

Of minor extent in this map unit are Bethesda, Fiveblock, Dekalb, Grigsby, Hazleton, Helechawa, Kaymine, Latham, Marrowbone, Orrville, and Rowdy soils. Bethesda, Fiveblock, and Kaymine soils are in areas that have been strip-mined for coal. Grigsby soils are on well drained flood plains. Hazleton and Helechawa soils are on hillsides that have warm aspects. Dekalb, Latham, and Marrowbone soils are on ridgetops. Orrville soils are in wet spots on flood plains. Rowdy soils are on low stream terraces and alluvial fans.

The soils in this map unit are generally not suited to cultivated crops because of the rugged terrain and the steep slopes. Only the minor soils in the map unit that are on stream terraces, footslopes, or flood plains are suited to cultivated crops, hay, and pasture.

These soils are suited to woodland. Productivity is moderate on ridgetops and moderate or high on hillsides. Common trees on ridgetops are Virginia pine, pitch pine, scarlet oak, chestnut oak, and mockernut hickory. Eastern hemlock, American beech, white oak, chestnut oak, sugar maple, and yellow-poplar are on hillsides. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

Most of this map unit is generally not suited to building site development because of the slope, which makes major grading and reshaping necessary before construction; however, the soils on stream terraces and footslopes can be developed for urban uses with careful site preparation. The main limitation on sites for dwellings without basements is the slope. The depth to bedrock is a limitation on sites for dwellings with basements on strath terraces and footslopes. The main limitations on sites for septic tank absorption fields are the depth to bedrock and the slope. The slow permeability is an additional limitation affecting absorption fields in some areas.

3. Shelocta-Helechawa-Hazleton-Gilpin

Very deep, deep, and moderately deep, sloping to very steep, well drained and somewhat excessively drained soils that have a loamy subsoil; on hillsides and ridgetops

This map unit consists of an extensive area in the northern and central parts of Magoffin County in the watersheds of Burning Fork, Grape Creek, Johnson Creek, Lick Creek, Mash Fork, Middle Fork, Raccoon Creek, State Road Fork, and the Left Fork of White Oak Creek. The landscape is characterized by steep and very steep hillsides and sharply crested ridgetops dissected by nearly level to sloping valley floors that are long and winding (fig. 6). The soils in this map unit are underlain by Pennsylvanian aged, stratified, acid to slightly calcareous bedrock of the lower and middle members of the Breathitt Formation. The rock formations are interbedded sandstone, siltstone, shale, and coal. The topography is dissected by a dendritic pattern of many small drainageways, intermittent streams, and a few perennial streams emptying into the Licking and Big Sandy Rivers. Elevations range from about 800 feet on the valley floors to about 1,200 feet on the crest of ridgetops. In most areas slopes range from 6 to about 65 percent.

Most of this map unit is forested with secondary growth hardwoods and a few scattered plantations of pine. Cultivated crops and hay are grown on the valley floors and footslopes. Some areas on the moderately steep to very steep hillsides are used as pasture. Small embankment ponds, drilled wells, and spring developments provide water for livestock. The small communities of Bradley, Falcon, Foraker, Hendricks, Ivyton, Lickburg, Maggard, Seitz, and Wheelersburg are in areas of this map unit. Most of the development in the unit consists of farmsteads and homesites along drainageways. Development is restricted by the narrow valleys, steep and very steep hillsides, and narrow ridgetops. The important structures in the county include farm buildings, roads, schools, and facilities used by gas, power, water, and communication companies. Lines for gas, power, water, and communication run through the county.

This map unit makes up about 56 percent of Magoffin County. It is about 26 percent Shelocta and similar soils, 14 percent Helechawa and similar soils, 9 percent Hazleton and similar soils, and 8 percent Gilpin and similar soils. The remaining 43 percent is minor soils.

The deep, well drained Shelocta soils are on hillsides. Slopes range from 6 to 65 percent but are dominantly 30 to 65 percent. These soils formed in loamy colluvium derived from acid sandstone, siltstone, and shale. Typically, the surface layer is loam. The subsoil is loam, channery loam, channery silt loam, and silty clay loam. The substratum is very channery silty clay loam. Permeability is moderate.

The very deep, somewhat excessively drained Helechawa soils are on hillsides. Slopes range from 30 to 65 percent. These soils formed in loamy colluvium derived mainly from sandstone. Typically, the surface layer is sandy loam. The subsoil is sandy loam and channery sandy loam. The substratum is extremely channery sandy loam. Permeability is moderately rapid.

The deep, well drained Hazleton soils are on hillsides. Slopes range from 30 to 65 percent. These soils formed in colluvium derived mainly from sandstone. Typically, the surface layer is loam. The subsoil is loam, channery loam, very channery loam, and extremely channery loam. The substratum is extremely channery loam. Permeability is moderately rapid.

The moderately deep, well drained Gilpin soils generally are on ridgetops but are also on a few low nose slopes along the major streams. Slopes range from 6 to 60 percent but are dominantly 20 to 60 percent. These soils formed in loamy material weathered from sandstone, siltstone, and shale. Typically, the surface layer is channery silt loam. The subsoil is silt loam, channery silt loam, and very channery silt loam. Permeability is moderate.

Of minor extent in this map unit are Barbourville, Bethesda, Fedscreek, Fiveblock, Grigsby, Kaymine,

Figure 6.—A typical landscape in the Shelocta-Helechawa-Hazleton-Gilpin general soil map unit in Magoffin County. The hillside in the background is in an area of the Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony, detailed soil map unit. Note the catsteps, cattle trails, and invading woodland on the slopes above the homesite. The narrow flood plain in the foreground is in an area of the Grigsby sandy loam, 0 to 4 percent slopes, occasionally flooded, detailed soil map unit, which is a minor but intensively used component of this general soil map unit.

Kimper, Latham, Marrowbone, Orrville, Pope, Rowdy, and Whitley soils. Barbourville soils are on alluvial fans at the mouth of drainageways. Bethesda, Fiveblock, and Kaymine soils are in surface-mined areas. Fedscreek and Kimper soils are on hillsides that have cool aspects. Latham and Marrowbone soils are on ridgetops. Grigsby and Pope soils are on well drained flood plains. Orrville soils are in wet spots on flood plains. Rowdy and Whitley soils are on well drained, low stream terraces.

Most of this map unit is generally not suited to cultivated crops because of the rugged terrain and the steep slopes. Only the minor soils in the map unit that are on stream terraces, flood plains, or footslopes are suited to cultivated crops, hay, and pasture.

These soils are suited to woodland. Productivity is moderate on ridgetops and moderate or high on hillsides. Common trees on ridgetops are Virginia pine, pitch pine, scarlet oak, chestnut oak, and mockernut hickory. Eastern hemlock, American beech, white oak, chestnut oak, northern red oak, red maple, sugar maple, and yellow-poplar are on hillsides. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

Most of this map unit is not suited to building site development because of the slope, and it cannot be developed without major grading and reshaping. With careful site preparation, however, soils on stream terraces, low nose slopes, and footslopes are suited to building site development. The main limitation on sites for dwellings without basements is the slope. The depth to bedrock is a limitation on sites for dwellings with basements on strath terraces and low nose slopes. The main limitations on sites for septic tank absorption fields are the depth to bedrock and the slope. The slow permeability is an additional limitation affecting absorption fields in some areas.

Soil Descriptions of Morgan County

1. Shelocta-Helechawa-Gilpin-Hazleton

Very deep, deep, and moderately deep, well drained and somewhat excessively drained, sloping to very steep soils that have a loamy subsoil; on hillsides and ridgetops

This map unit consists of an extensive area in the eastern and southern parts of Morgan County. The landscape is characterized by long, winding ridgetops that are narrow and steep; steep and very steep hillsides; and narrow and winding valleys (fig. 7). The soils in this map unit are underlain by Pennsylvanian aged, stratified, level-bedded, acid bedrock of the lower and middle members of the Breathitt Formation. The rock formations are sandstone, siltstone, shale, and coal. Elevations range from about 800 feet on the valley floors to about 1,200 feet on the crest of ridgetops. In most areas slopes range from 6 to about 55 percent.

Most of this map unit is forested with hardwoods and scattered plantations of pine. Cultivated crops and hay are grown in areas on valley floors and in the moderately steep areas on narrow ridgetops. The topography is typically dissected by a dendritic drainage pattern made up of many intermittent streams and a few perennial streams. Embankment ponds are common in the narrow drainageways. Except for a few small communities, such as Caney, Cannel City, Dingus, Elamton, Moon, Redwine, and Relief, development in most areas of the map unit consists of scattered farmsteads and homesites along drainageways. It is restricted by the narrow valleys, steep and very steep hillsides, and ridgetops. The important structures in the county include farm buildings, schools, and roads. Lines for gas, power, water, and communication run through the county.

This map unit makes up about 37 percent of Morgan County. It is about 28 percent Shelocta and similar soils, 14 percent Helechawa and similar soils, 12 percent Gilpin and similar soils, and 8 percent Hazleton and similar soils. The remaining 38 percent is minor soils.

The deep, well drained Shelocta soils are on hillsides and footslopes. Slopes range from 6 to 65 percent but are dominantly 30 to 65 percent. These soils formed in loamy colluvium derived from acid sandstone, siltstone, and shale. Typically, the surface layer is loam. The subsoil is loam, channery loam, channery silt loam, and silty clay loam. The substratum is very channery silty clay loam. Permeability is moderate.

The very deep, somewhat excessively drained Helechawa soils are on hillsides. Slopes range from 30 to 65 percent. These soils formed in loamy colluvium derived mainly from sandstone. Typically, the surface layer is sandy loam. The subsoil is sandy loam and channery sandy loam. The substratum is extremely channery sandy loam. Permeability is moderately rapid.

The moderately deep, well drained Gilpin soils are on ridgetops and a few nose slopes. Slopes range from 6 to 60 percent but are dominantly 25 to 60 percent. These soils formed in loamy residuum and are underlain by sandstone, siltstone, and shale. Typically, the surface layer is channery silt loam. The subsoil is silt loam, channery silt loam, and very channery silt loam. Permeability is moderate.

The deep, well drained Hazleton soils are on hillsides. Slopes range from 30 to 65 percent. These soils formed in colluvium derived mainly from sandstone. Typically, the surface layer is loam. The subsoil is loam, channery loam, very channery loam, and extremely channery loam. The substratum is extremely channery loam. Permeability is moderately rapid or rapid.

Of minor extent in this map unit are Allegheny,

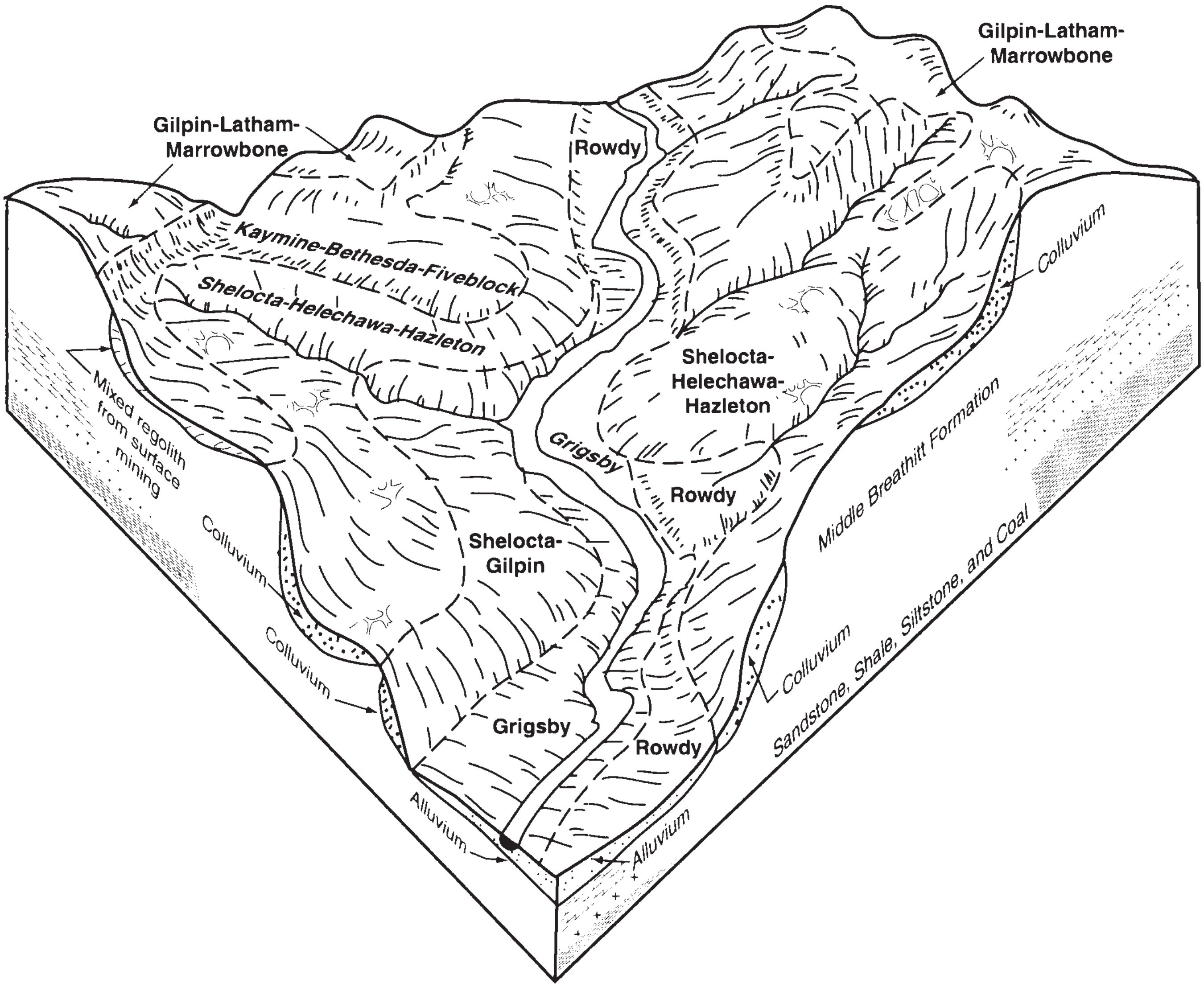


Figure 7.—Typical pattern of soils and their relationship to geology and topography in the Shelocta-Helechawa-Gilpin-Hazleton general soil map unit in Morgan County.

Barbourville, Bethesda, Fiveblock, Grigsby, Kaymine, Latham, Marrowbone, Orrville, Pope, and Rowdy soils. Allegheny soils are on well drained stream terraces. Barbourville soils are on alluvial fans at the mouth of drainageways. Bethesda, Fiveblock, and Kaymine soils are in areas that have been strip-mined for coal. Grigsby and Pope soils are on well drained flood plains. Latham and Marrowbone soils are on ridgetops. Orrville soils are in wet spots on flood plains. Rowdy soils are on well drained, low stream terraces.

Most of this map unit is not suited to cultivated crops because of the rugged terrain and the steep slopes. Only the minor soils on nearly level to sloping stream terraces and flood plains and in sloping and moderately steep areas of ridgetops and footslopes are suited to cultivated crops, hay, and pasture.

These soils are suited to woodland. Productivity is moderate on low ridges and moderate or high on side slopes. Common trees on ridges are Virginia pine, pitch pine, scarlet oak, chestnut oak, and hickory. Eastern hemlock, American beech, white oak, chestnut oak, sugar maple, and yellow-poplar are on side slopes. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

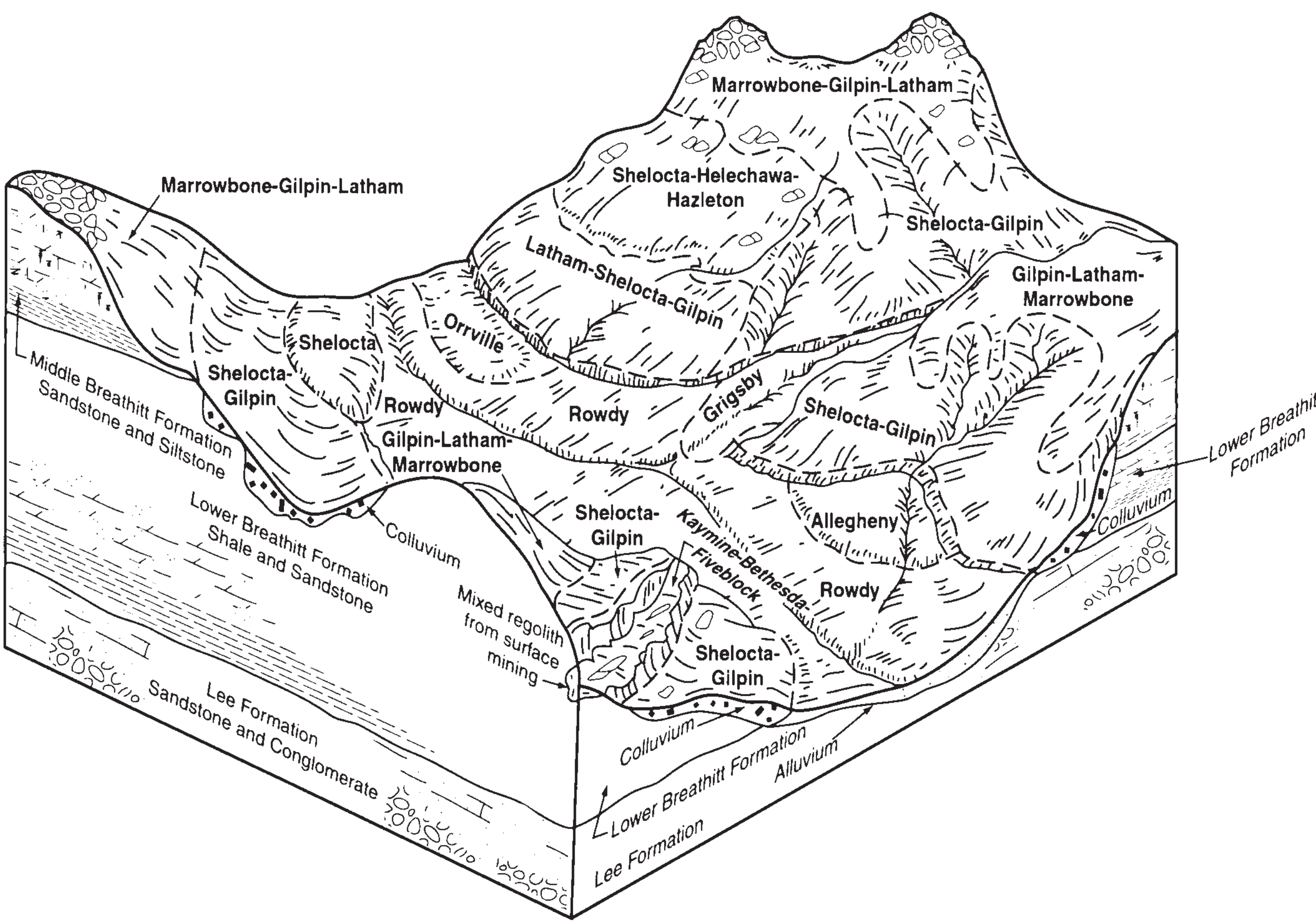
Most of this map unit is not suited to building site development because of the slope, and it cannot be developed without major grading and careful site preparation. The main limitation on sites for dwellings without basements is the slope. The depth to bedrock is a limitation on sites for dwellings with basements on ridgetops and the upper side slopes. The main limitations on sites for septic tank absorption fields are the depth to bedrock and the slope. The slow permeability is an additional limitation affecting absorption fields in some areas.

2. Shelocta-Gilpin-Latham-Marrowbone

Deep and moderately deep, well drained and moderately well drained, gently sloping to very steep soils that have a loamy or clayey subsoil; on hillsides and ridgetops

This map unit is in the central and southwestern parts of Morgan County. The landscape is characterized by long, narrow ridgetops that are moderately steep or steep; hillsides that are steep or very steep; and long, narrow valleys (fig. 8). The soils in this map unit are underlain by stratified, level-bedded, acid bedrock of the lower and middle Pennsylvanian members of the Breathitt Formation. The rock formations are shale, sandstone, siltstone, and coal. Elevations range from about 1,160 feet on the valley floors to about 1,600 feet on the crest of ridgetops. In most areas slopes range from 6 to about 60 percent.

Most of this map unit is forested with secondary growth hardwoods and scattered plantations of pine. Cultivated crops and hay are grown in areas on valley floors, footslopes, and ridgetops. Embankment ponds provide water for livestock. The topography is dissected by a dendritic drainage pattern of many intermittent streams and a few perennial streams. Except for a few small communities, such as Adele, Malone, Maytown, Salem, White Oak, and Yocum, most of the development in the map unit consists of scattered farmsteads and homesites along



drainageways. Development is restricted by the narrow valleys, steep and very steep hillsides, and narrow ridgetops. The important structures in the county include farm buildings, schools, and roads. Lines for gas, power, water, and communication run through Morgan County.

This map unit makes up about 31 percent of Morgan County. It is about 34 percent Shelocta and similar soils, 25 percent Gilpin and similar soils, 6 percent Latham and similar soils, and 6 percent Marrowbone and similar soils. The remaining 29 percent is minor soils.

The deep, well drained Shelocta soils are on hillsides and on a few footslopes. Slopes range from 6 to 65 percent but are dominantly 25 to 60 percent. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam and silty clay loam. The substratum is silt loam. Permeability is moderate.

The moderately deep, well drained Gilpin soils are on ridgetops, hillsides, and a few nose slopes. Slopes range from 4 to 60 percent but are dominantly 15 to 60 percent. These soils formed in loamy residuum and are underlain by sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam, channery silty clay loam, and channery silt loam. The substratum is extremely channery silt loam. Permeability is moderate.

The moderately deep, moderately well drained Latham soils are on ridgetops. Slopes range from 4 to 30 percent. These soils formed in clayey residuum and are underlain by interbedded siltstone and shale. Typically, the surface layer is silt loam. The subsoil is silt loam, silty clay loam, and silty clay. Permeability is slow.

The moderately deep, well drained Marrowbone soils are on ridgetops. Slopes range from 15 to 30 percent. These soils formed in loamy material weathered from sandstone. Typically, the surface layer is loam. The subsoil is channery fine sandy loam. Permeability is moderately rapid.

Of minor extent in this map unit are Allegheny, Bethesda, Cotaco, Ezel, Fiveblock, Grigsby, Hazleton, Helechawa, Kaymine, Knowlton, Marrowbone, Morehead, Orrville, Rigley, and Rowdy soils. Allegheny, Cotaco, and Morehead soils are on stream terraces. Bethesda, Fiveblock, and Kaymine soils are in areas that have been strip-mined for coal. Ezel soils are on strath terraces. Grigsby soils are on flood plains. Hazleton and Helechawa soils are on hillsides that have warm aspects. Knowlton and Rowdy soils are on low stream terraces, in sloughs, and in abandoned river channels. Marrowbone soils are on ridgetops. Orrville soils are in wet spots on flood plains. Rigley soils are on footslopes and benches below areas of sandstone rock outcrop.

The soils on steep and very steep hillsides and ridgetops are not suited to cultivated crops because of the rugged terrain and the hazard of erosion. Only the soils on valley floors and low stream terraces are suited to cultivated crops, hay, and pasture.

These soils are suited to woodland. Productivity is moderate on ridgetops and moderate or high on the middle and lower side slopes. Common trees on the ridgetops are Virginia pine, pitch pine, scarlet oak, chestnut oak, and mockernut hickory. Eastern hemlock, American beech, white oak, chestnut oak, sugar maple, and yellow-poplar are on the middle and lower side slopes. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

These soils are not suited to building site development in many areas. Because of the slope, most areas cannot be developed without major grading and careful site preparation. The slope is the main limitation on sites for dwellings without basements. The depth to bedrock is a limitation on sites for dwellings with basements in areas of the Gilpin and Latham soils. The main limitations on sites for septic tank absorption fields are the depth to bedrock and the slope. The slow permeability is an additional limitation affecting absorption fields in some areas.

3. Shelocta-Gilpin-Allegheny-Grigsby

Very deep, deep, and moderately deep, well drained, nearly level to very steep soils that have a loamy subsoil; on hillsides, ridgetops, stream terraces, and flood plains

This map unit is in the central part of Morgan County along the Licking River and in the watersheds of Elk Fork, Grassy Creek, and Caney Creek. The landscape is characterized by steep and very steep hillsides breaking onto narrow stream terraces and footslopes that descend to a wide flood plain (fig. 9). The soils in this map unit are underlain by Pennsylvanian aged, stratified, level-bedded, acid sandstone, siltstone, and shale of the lower and middle members of the Breathitt Formation. The topography is dissected by numerous small

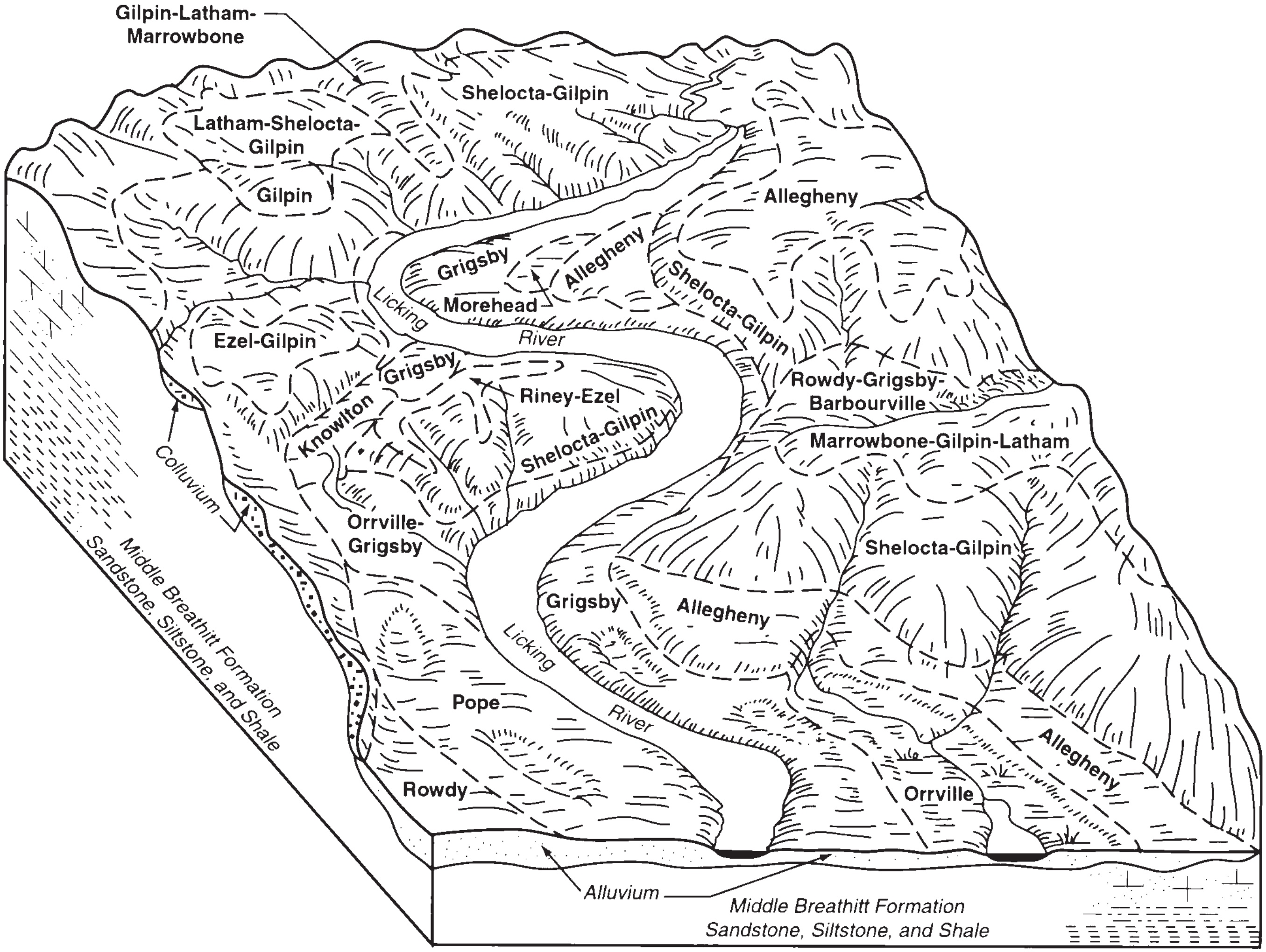


Figure 9.—Typical pattern of soils and their relationship to geology and topography in the Shelocta-Gilpin-Allegheny-Grigsby general soil map unit in Morgan County.

drainageways that feed perennial streams, all of which eventually empty into the Licking River. Elevation ranges from about 760 to 1,000 feet. Slopes range from 0 to 60 percent but are dominantly 0 to 25 percent on terraces, footslopes, and flood plains and 25 to 60 percent on hillsides.

Most of the terraces, footslopes, and flood plains in this map unit have been cleared and are used for cultivated crops, hay, or pasture. Embankment or pit ponds provide most of the water for livestock. Some areas on terraces are used as sites for residential, commercial, or industrial development. The communities of Cottle, Index, Lenox, Liberty Road, Licking River, Mize, and Woods Bend and the city of West Liberty are in areas of this map unit. The steep and very steep hillsides generally are forested with secondary growth hardwoods, but a few areas remain cleared and are used for pasture.

This map unit makes up about 8 percent of Morgan County. It is about 19 percent Shelocta and similar soils, 16 percent Gilpin and similar soils, 8 percent Allegheny and similar soils, and 8 percent Grigsby and similar soils. The remaining 49 percent is minor soils.

The deep, well drained Shelocta soils are on hillsides and footslopes. Slopes range from 6 to 65 percent but are dominantly 25 to 60 percent. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam and silty clay loam. The substratum is silt loam. Permeability is moderate.

The moderately deep, well drained Gilpin soils are on hillsides, ridgetops, and a few low nose slopes, some of which are associated with strath terraces. Slopes range from 6 to 60 percent but are dominantly 20 to 60 percent. These soils formed in loamy colluvium or residuum and are underlain by sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam, channery silty clay loam, and channery silt loam. The substratum is extremely channery silt loam. Permeability is moderate.

The very deep, well drained Allegheny soils are on stream terraces. Slopes range from 2 to 15 percent. These soils formed in loamy alluvium washed from sandstone, siltstone, and shale. Typically, the surface layer and subsoil are loam. The substratum is channery sandy loam. Permeability is moderate.

The very deep, well drained Grigsby soils are on flood plains of major streams. Slopes range from 0 to 4 percent. These soils formed in loamy alluvium derived from sandstone, siltstone, and shale. Typically, the surface layer, subsoil, and substratum are sandy loam. Permeability is moderately rapid.

Of minor extent in this map unit are Barbourville, Cotaco, Ezel, Hazleton, Helechawa, Knowlton, Latham, Marrowbone, Morehead, Orrville, Pope, Rigley, Riney, Rowdy, and Whitley soils. Barbourville soils are on alluvial fans at the mouth of drainageways. Cotaco, Morehead, Rowdy, and Whitley soils are on low stream terraces. Cotaco soils are also on some strath terraces. Ezel and Riney soils are on strath terraces above the Licking River. Hazleton and Helechawa soils are on hillsides. Knowlton soils are on low stream terraces, in sloughs, and in abandoned river channels. Latham and Marrowbone soils are on ridgetops. Orrville soils are in wet spots on flood plains. Pope soils are on flood plains along the Licking River. Rigley soils are on footslopes and benches below areas of sandstone rock outcrop.

The soils on nearly level or gently sloping flood plains and those on gently sloping to moderately steep stream terraces are suited to all of the cultivated crops commonly grown in the survey area. They are also suited to specialty crops, such as vegetables and nursery plants. The soils in steep and very steep areas are suited to woodland. The main limitations to farming are the slope, the hazard of erosion, and, in some areas, the wetness.

Although most of the nearly level to moderately steep areas in this map unit have been cleared, these soils are suited to woodland. Productivity is high on flood plains and stream terraces and moderate or high on steep and very steep side slopes. Eastern hemlock, American beech, white oak, northern red oak, sugar maple, and yellow-poplar are on steep and very steep side slopes. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

Most of the soils on stream terraces in this map unit are suited to building site development. Because of excessive slopes, however, some areas cannot be developed without major grading. These areas are not suited to building site development. The main limitation on sites for dwellings without basements is the slope. The depth to bedrock may be a limitation on sites for dwellings with basements. The main limitation on sites for septic tank absorption fields is the slope. The slow permeability is an additional limitation affecting absorption fields in some areas.

4. Gilpin-Shelocta-Latham

Deep and moderately deep, well drained and moderately well drained, gently sloping to very steep soils that have a clayey or loamy subsoil; on ridgetops and hillsides

This map unit consists of two areas in the northern and western parts of Morgan County. The landscape is characterized by moderately steep and steep hillsides that have rounded or crested ridgetops and are directly above areas of sandstone rock outcrop or narrow valleys (fig. 10). The soils are underlain by Pennsylvanian aged, stratified, level-bedded, acid sandstone, siltstone, and shale of the lower member of the Breathitt Formation and of the Lee Formation. In most areas slopes range from 12 to 60 percent. Elevations generally range from about 900 to 1,200 feet. Those along the valley floors commonly range from 900 to about 1,000 feet.

Most of the moderately steep and steep hillsides and many of the more rounded ridgetops have been cleared and are used for pasture and hay. Cultivated crops and hay are grown in gently sloping to moderately steep areas of ridgetops, on sloping narrow benches, and on low stream terraces and flood plains. The remaining moderately steep to very steep side slopes and ridgetops are forested with secondary growth hardwoods and scattered plantations of pine. A dendritic drainage pattern of intermittent streams and a few perennial streams is typical of this map unit. Embankment ponds are common in the narrow drainageways. The communities of Arnett, Blairs Mills, Blaze, Ebon, Ezel, Kellacey, Wrigley, and Zag are in areas of the map unit. Most of the development in the unit consists of scattered farmsteads on rolling ridgetops and in long, narrow valleys. The major structures are farm buildings, highways, and schools. Lines for gas, power, water, and communication run through the county.

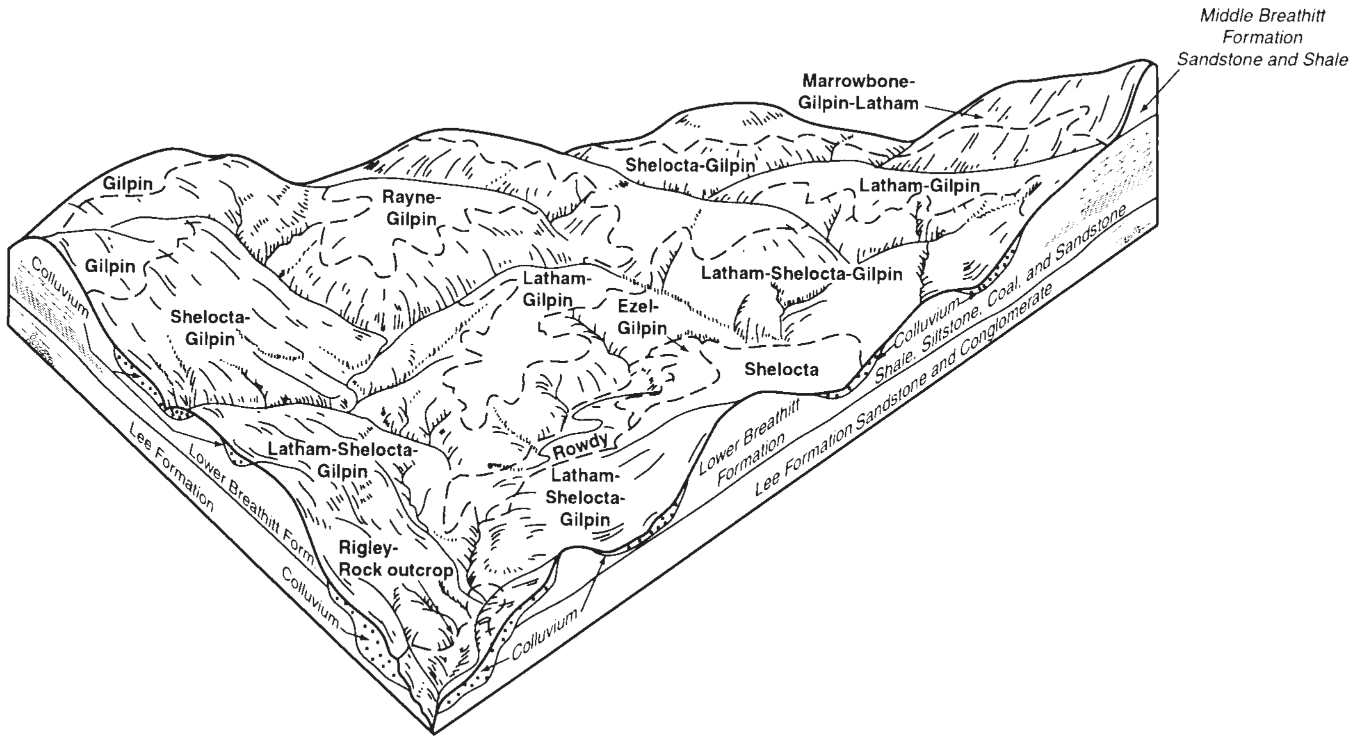


Figure 10.—Typical pattern of soils and their relationship to geology and topography in the Gilpin-Shelocta-Latham general soil map unit in Morgan County.

This map unit makes up about 16 percent of Morgan County. It is about 28 percent Gilpin soils, 24 percent Shelocta soils, and 23 percent Latham soils. The remaining 25 percent is minor soils.

The moderately deep, well drained Gilpin soils are on ridgetops, hillsides, and nose slopes, some of which are associated with strath terraces. Slopes range from 4 to 60 percent but are dominantly 15 to 30 percent. These soils formed in loamy colluvium or residuum and are underlain by sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam, channery silty clay loam, and channery silt loam. The substratum is extremely channery silt loam. Permeability is moderate.

The deep, well drained Shelocta soils are on hillsides and footslopes, mainly above areas of sandstone rock outcrop. Slopes range from 6 to 60 percent but are dominantly 15 to 30 percent. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam and silty clay loam. Permeability is moderate.

The moderately deep, moderately well drained Latham soils are on ridgetops and hillsides. Slopes range from 4 to 30 percent. These soils formed in clayey residuum and are underlain by interbedded siltstone and shale. Typically, the surface layer is silt loam. The subsoil is silt loam, silty clay loam, and silty clay. Permeability is slow.

Of minor extent in this map unit are Alticrest, Ezel, Grigsby, Lily, Marrowbone, Orrville, Ramsey, Rayne, Rowdy, and Rigley soils and rock outcrop. Alticrest soils are on shoulder slopes, side slopes, and benches above areas of sandstone rock outcrop. Ezel soils are on strath terraces. Grigsby soils are on well drained flood plains. Lily and Marrowbone soils are on narrow ridgetops. Orrville soils are in wet spots on flood plains. Ramsey soils are on nose slopes and narrow benches on ridgetops and hillsides. Rayne soils are on relatively broad ridgetops. Rigley soils are on footslopes and benches below areas of sandstone rock outcrop. Rowdy soils are on low stream terraces and alluvial fans.

Many areas of these soils are not suited to cultivated crops because of the hilly terrain and the steep slopes. Only the soils on valley floors and the sloping and moderately steep soils on ridgetops are suited to cultivated crops and hay. The moderately steep and steep hillsides are suited to pasture, but overgrazing is a management concern.

These soils are suited to woodland. Productivity is moderate on low ridges and moderate or high on side slopes. Common trees on the ridgetops are Virginia pine, pitch pine, scarlet oak, chestnut oak, and hickory. Eastern hemlock, American beech, white oak, chestnut oak, sugar maple, and yellow-poplar are on the middle and lower side slopes. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Protection of the habitat from fire, establishment of wildlife food plots, and development of water supplies are necessary.

Many areas of these soils are not suited to building site development, but the limitations can be overcome if care is taken when the site is selected and graded and when utilities are installed. The main limitation on sites for dwellings without basements is the slope. The depth to bedrock is a limitation on sites for dwellings with basements on nose slopes, ridgetops, and the upper side slopes. The main limitations on sites for septic tank absorption fields are the depth to bedrock and the slope. The slow permeability is an additional limitation affecting absorption fields in some areas.

5. Rigley-Shelocta-Gilpin-Rock Outcrop

Rock outcrop and very deep, deep, and moderately deep, well drained, sloping to very steep soils that have a loamy subsoil; on hillsides, ridgetops, and escarpments

This map unit consists of three irregularly shaped areas in the northern part of Morgan County, along the Licking River and in the watersheds of Blackwater Creek, Yocum Creek, and Devils Fork. The landscape is deeply dissected and characterized by steep footslopes separated from ridgetops by sandstone rock outcrop in the form of cliffs and narrow ledges (fig. 11). The soils are underlain by Pennsylvanian aged, stratified, level-bedded, acid sandstone, siltstone, and shale of the lower member of the Breathitt Formation and the Lee Formation. Elevations range from about 750 feet along the Licking River to about 1,050 feet on the narrow ridgetops. In most areas slopes range from 6 to 75 percent.

Most areas of this map unit are used as woodland. A few areas along the narrow flood plains have been cleared and are used for farming.

This map unit makes up about 5 percent of Morgan County. It is about 34 percent Rigley and similar soils, 12 percent Shelocta and similar soils, 11 percent Gilpin and similar soils, and 8 percent sandstone rock outcrop. The remaining 35 percent is minor soils.

The very deep, well drained Rigley soils are on footslopes and benches below areas of sandstone rock outcrop. Slopes range from 25 to 60 percent. These soils formed in colluvium derived mainly from sandstone rock outcrop. The colluvium has been deposited over a narrow, lower tongue of the Breathitt Formation that consists of interbedded siltstone and shale. Typically, the surface layer is sandy loam. The subsoil is sandy loam, channery sandy loam, and very channery sandy loam. Permeability is moderately rapid.

The deep, well drained Shelocta soils are on hillsides and a few footslopes above areas of sandstone rock outcrop. Slopes range from 6 to 60 percent but are dominantly 15 to 60 percent. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam and silty clay loam. Permeability is moderate.

The moderately deep, well drained Gilpin soils are on ridgetops and hillsides above areas of sandstone rock outcrop. They are also associated with strath terraces. Slopes range from 4 to 60 percent but are dominantly 15 to 60 percent. These soils formed in loamy colluvium or residuum and are underlain by sandstone, siltstone, and shale. Typically, the surface layer is silt loam. The subsoil is silt loam, channery silty clay loam, and channery silt loam. Permeability is moderate.

The Rock outcrop consists of sandstone escarpments and rubble ranging from about 10 to 50 feet in height. The escarpments are nearly continuous and form as many as three narrow benches. The Rock outcrop supports little or no vegetation, although some hardy species of dwarfed trees and undergrowth grow on top of the rubble piles and escarpments by sending roots into nearby soils.

Of minor extent in this map unit are Alticrest, Bledsoe, Donahue, Grigsby, Latham, Lily, Marrowbone, Ramsey, Rayne, and Rowdy soils. Alticrest soils are on benches, side slopes, and nose slopes above areas of sandstone rock outcrop. Bledsoe soils are in coves, on benches, and on footslopes below areas of sandstone rock outcrop. Donahue soils are on nose slopes, benches, and the upper side slopes associated with limestone rock outcrop. Grigsby soils are on flood plains. Lily soils are on ridgetops weathered from soft sandstone. Latham and Marrowbone soils are on narrow ridgetops. Rayne soils are on relatively wide ridgetops. Ramsey soils are on nose slopes and narrow benches on ridgetops and hillsides. Rowdy soils are on low stream terraces and alluvial fans.

This map unit is not suited to farming because of the steep and very steep slopes and the Rock outcrop. Only some areas of the included minor soils on the nearly level flood plains and the gently sloping to

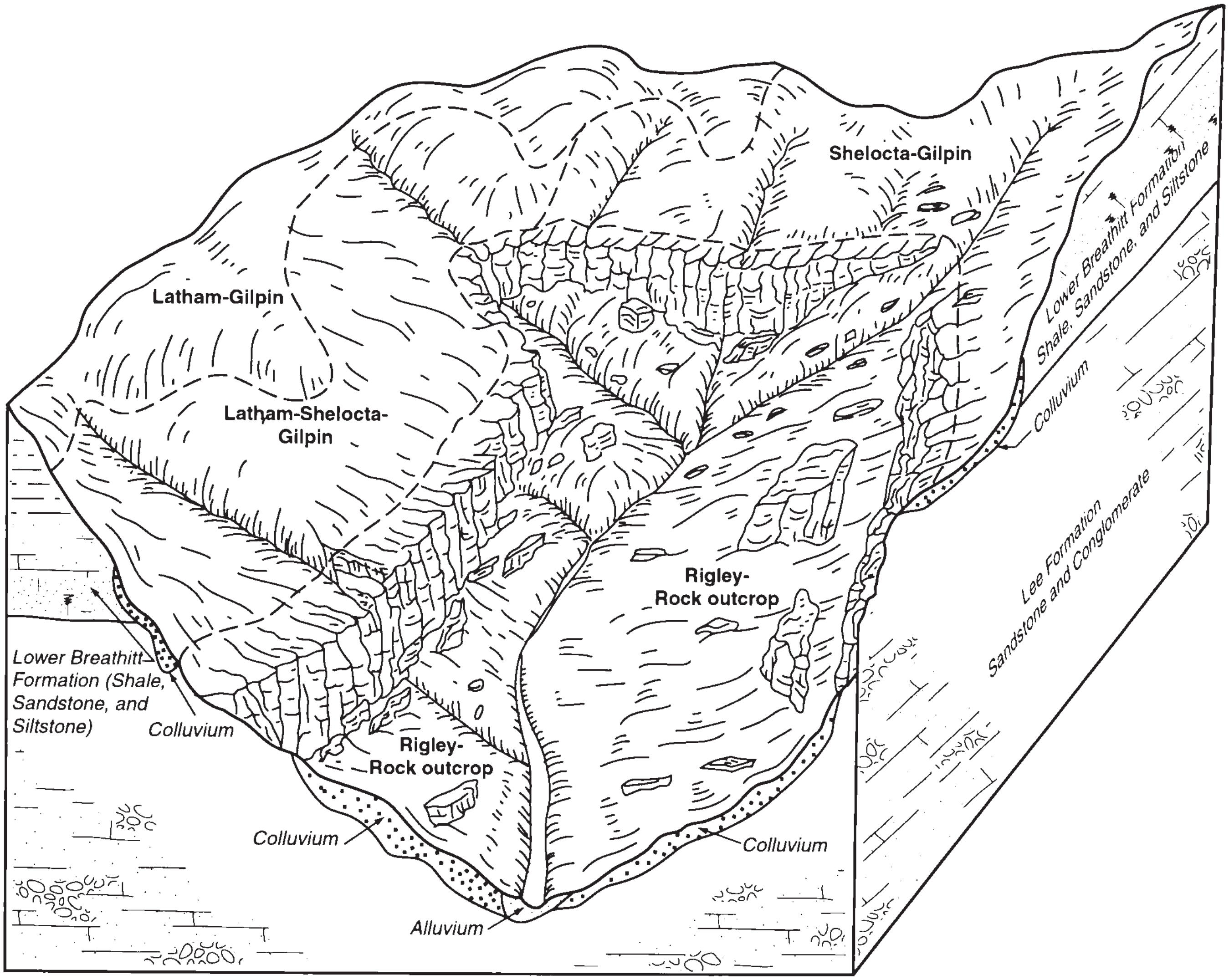


Figure 11.—Typical pattern of soils and their relationship to geology and topography in the Rigley-Shelocta-Gilpin-Rock outcrop general soil map unit in Morgan County.

moderately steep ridgetops are suited to cultivated crops, hay, or pasture. Less than 5 percent of the minor soils in this map unit are suited to farming.

This map unit is suited to woodland. Productivity is moderate on the ridgetops and on the south- and west-facing side slopes. It is high on the north- and east-facing side slopes. Common trees are sugar maple, yellow-poplar, pignut hickory, northern red oak, red maple, and American basswood. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

This map unit is suited to woodland wildlife habitat. The prevention of fires is a management concern.

Most areas of this map unit are not suited to development because of the steep and very steep slopes and the sandstone rock outcrop. The map unit is suited to recreational activities, which include hunting, fishing, camping, hiking, and riding all-terrain vehicles.

6. Rigley-Bledsoe-Alticrest-Berks

Very deep and moderately deep, well drained and somewhat excessively drained, moderately steep to very steep soils that have a loamy or clayey subsoil; on hillsides

This map unit consists of an irregularly shaped area in the northwestern part of Morgan County. It is along the Licking River and in the watersheds of Craney Creek, Minor Creek, Mine Branch, Bear Branch, Yocum Creek, and Spaws Creek. The landscape is deeply dissected and characterized by benches, side slopes, and footslopes below areas of sandstone and limestone rock outcrop and by narrow ridgetops that have short shoulder slopes above areas of sandstone rock outcrop (fig. 12).

The soils in this map unit are underlain by bedrock that is level-bedded and stratified and includes members of the Pennsylvanian and Mississippian Systems. Most ridgetops are capped by Pennsylvanian shale and sandstone of the Breathitt Formation; however, in areas where the Breathitt Formation has been removed by erosion, the soils on ridgetops and side slopes have been influenced by the sandstone and conglomerate of the Lee Formation. The Lee Formation commonly occurs as sandstone rock outcrop in the form of jointed cliffs and bluffs. A narrow, erosional bench, which weathered mostly from shale and siltstone, is below the areas of sandstone rock outcrop. It forms the lower tongue of the Breathitt Formation and grades into heavier clay shales of the Pennington Formation, which is the uppermost member of the Mississippian System. Below the erosional bench are low bluffs and narrow bands of the Newman Limestone, which commonly crops out. Below the Newman Limestone, the Borden Formation forms a steep side slope that includes some calcareous shale and dolomitic limestone but is primarily siltstone. Elevations range from about 700 feet along the Licking River to about 1,150 feet on narrow ridgetops. Slopes range from 2 to 75 percent but are dominantly 20 to 60 percent in most of the area.

Most of this map unit is used as woodland. The small acreage that is farmed consists mostly of the sloping and moderately steep areas above the rock outcrop and the areas of minor soils on flood plains and stream terraces.

The majority of the acreage in this map unit is owned and managed by the U.S. Department of Agriculture, Forest Service. It is used as woodland and for wildlife habitat and recreational activities.

This map unit makes up about 3 percent of Morgan County. It is about 21 percent Rigley and similar soils,

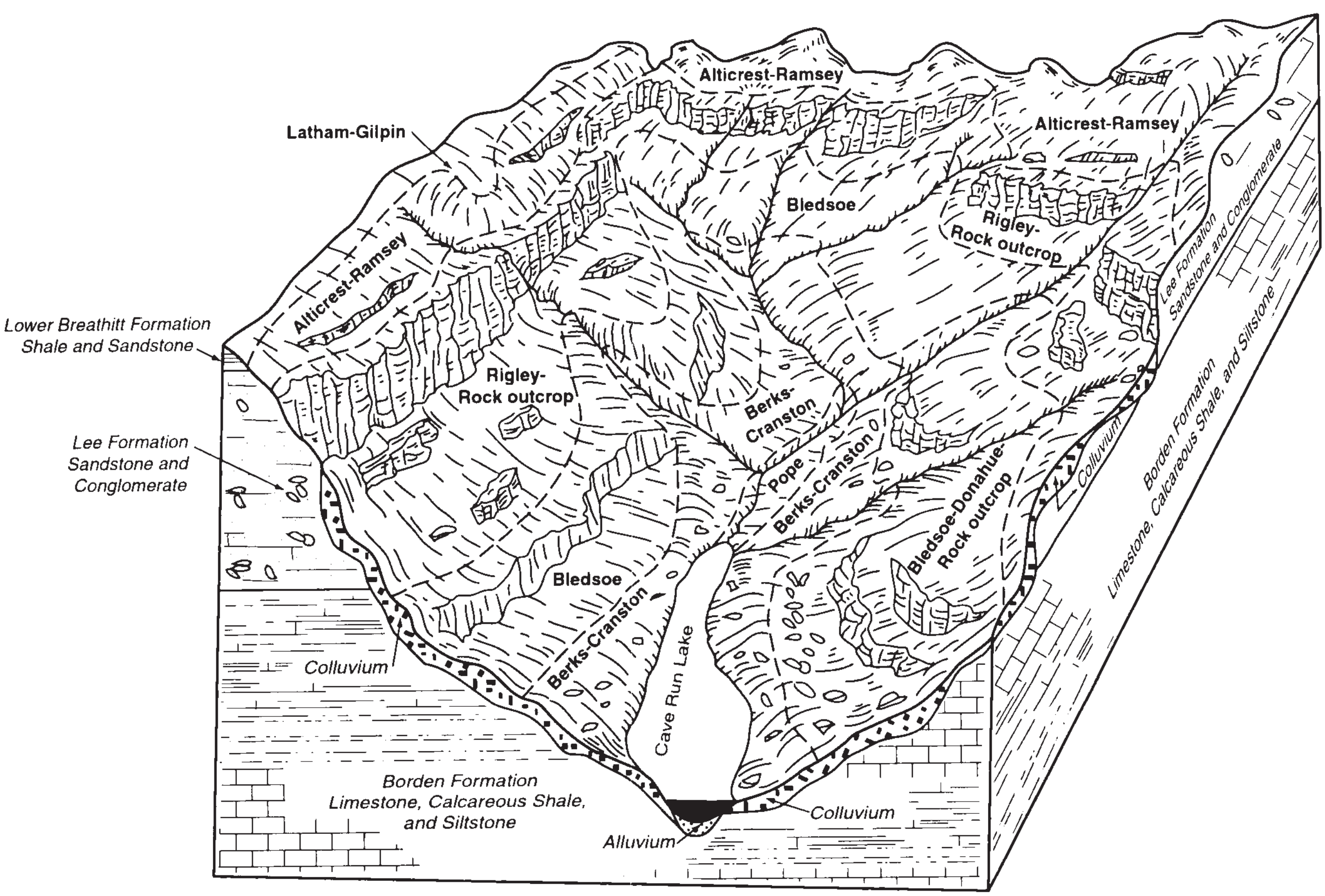


Figure 12.—Typical pattern of soils and their relationship to geology and topography in the Rigley-Bledsoe-Alticrest-Berks general soil map unit in Morgan County.

10 percent Bledsoe and similar soils, 9 percent Alticrest and similar soils, and 9 percent Berks and similar soils. The remaining 51 percent is minor soils.

The very deep, well drained Rigley soils are on footslopes and benches below areas of sandstone rock outcrop. Slopes range from 25 to 60 percent. These soils formed in colluvium derived from sandstone and are underlain by interbedded sandstone, siltstone, or shale. Typically, the surface layer is sandy loam. The subsoil is sandy loam, channery sandy loam, and very channery sandy loam. Permeability is moderately rapid.

The very deep, well drained Bledsoe soils are in coves and on side slopes, footslopes, and benches associated with limestone rock outcrop. Slopes range from 15 to 50 percent but are dominantly 30 to 50 percent. These soils formed in mixed colluvium derived from sandstone, siltstone, limestone, and calcareous shales. Typically, the surface layer is silt loam. The subsoil is silty clay loam and channery silty clay loam in the upper part and very channery silty clay loam and channery silty clay in the lower part. Permeability is moderately slow.

The moderately deep, somewhat excessively drained Alticrest soils are on shoulder slopes, side slopes, and narrow benches above sandstone rock outcrop. Slopes range from 20 to 40 percent. These soils formed in loamy residuum over sandstone. Typically, the surface layer is channery sandy loam. The subsoil is sandy loam and channery sandy loam. Permeability is moderately rapid.

The moderately deep, well drained Berks soils are on side slopes and nose slopes below areas of limestone rock outcrop. Slopes range from 40 to 60 percent. These soils formed in loamy residuum and colluvium weathered from siltstone. Typically, the surface layer is channery silt loam. The subsoil is very channery silt loam and extremely channery silt loam. Permeability is moderate or moderately rapid.

Of minor extent in this map unit are Allegheny, Cranston, Donahue, Gilpin, Helechawa, Latham, Lily, Pope, Ramsey, Rayne, and Shelocta soils. Allegheny soils are on stream terraces. Cranston and Donahue soils are on side slopes and benches below the areas of limestone rock outcrop. Gilpin and Latham soils are on narrow ridgetops. Rayne soils are on relatively broad ridgetops. Helechawa soils are on hillsides. Lily soils are on narrow ridgetops that are capped with soft sandstone. Pope soils are on well drained flood plains. Ramsey soils are on nose slopes and narrow benches on ridgetops and hillsides. Shelocta soils are on hillsides in areas above sandstone rock outcrop.

These soils are generally not suited to farming because of the steep and very steep slopes and the rock outcrop. Some areas of the included minor soils on the nearly level flood plains and the gently sloping to moderately steep terraces and ridgetops are suited to cultivated crops, hay, or pasture. The acreage of minor soils suited to farming makes up less than 5 percent of the map unit.

These soils are suited to woodland. Productivity is moderate on ridgetops and on the south- and west-facing, lower side slopes. It is high on the north- and east-facing, lower side slopes. Common trees are American beech, white oak, chestnut oak, sugar maple, and yellow-poplar. The major management concerns are the hazard of erosion, the equipment limitation, and plant competition.

These soils are suited to woodland wildlife habitat. Establishment of nesting areas for water fowl and protection of the Cave Run Lake watershed from litter and siltation are management priorities.

Most of this map unit is not suited to urban uses because of the moderately steep to very steep slopes; however, some gently sloping and sloping areas on ridgetops are suitable as sites for summer cottages and recreation homes. Permanent homes in this map unit generally are built near major roads.

These soils are suited to recreational activities because of their proximity to Cave Run Lake. Common activities are hunting, fishing, camping, hiking, and riding all-terrain vehicles.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

In the descriptions the suitability of the soils for various uses is described. *Well suited* indicates that the soils have favorable properties for the specified use and that limitations are easy to overcome. Good performance and low maintenance can be expected. *Suited* indicates that the soils have moderately favorable properties for the selected use. One or more properties make these soils less desirable than well suited soils. *Poorly suited* indicates that the soils have one or more properties unfavorable for the selected use. Overcoming the limitations requires special design, extra maintenance, or costly alteration. *Generally not suited* indicates that the soils do not meet the requirements for the selected use or that extreme measures are needed to overcome the limitations.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Allegheny loam, 2 to 6 percent slopes, is a phase of the Allegheny series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Kaymine, Bethesda, and Fiveblock soils, 0 to 20 percent slopes, stony, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Dumps, coal, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

AbB—Allegheny loam, 2 to 6 percent slopes

This very deep, well drained, gently sloping soil is on stream terraces along the Licking River and major tributaries throughout the survey area. Slopes are smooth and slightly convex but are dissected by narrow drainageways. Most areas are nearly oval or are somewhat irregularly shaped bands. Individual areas range from 3 to about 90 acres in size.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil extends to a depth of about 53 inches. The upper part of the subsoil, to a depth of about 41 inches, is brown and brownish yellow loam. The lower part is yellowish brown, mottled loam. The substratum is yellowish brown, strong brown, and light yellowish gray channery sandy loam. Sandstone bedrock is at a depth of about 62 inches. In some areas the subsoil is sandy loam. In other areas it has more rock fragments.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is slow. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots. Depth to bedrock ranges from 60 to 120 inches or more.

Included with this soil in mapping are small areas of Ezel soils on shoulder slopes and Gilpin soils on head slopes of drainageways; nearly level areas of Cotaco soils and a soil that is compact and brittle in the subsoil; areas of Orrville, Grigsby, and Pope soils in drainageways; and areas of Shelocta soils on some narrow footslopes. Included soils make up about 15 percent of the map unit. Individual areas commonly are less than 2 acres in size.

This Allegheny soil is used for cultivated crops, hay, or pasture. Corn and tobacco are the major cultivated crops. Many areas are used as sites for homes, gardens, or public or commercial buildings.

This soil is suited to cultivated crops. High yields can be obtained if the soil is properly managed. Erosion is a hazard. A crop rotation in which grasses and legumes are grown 1 out of every 4 years is needed if conventional tillage is used. Contour farming, stripcropping, and conservation tillage help to control erosion. In some areas runoff from the adjacent hillsides can cause gully erosion and deposit rock fragments on the surface. This runoff can be controlled by diversion ditches or grassed waterways. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soil and using grasses and legumes as cover crops help to maintain tilth and a good supply of organic matter.

This soil is suited to hay and pasture. High yields can be obtained if the soil is properly managed. Improved varieties of grasses and legumes should be selected for planting, and pasture renovation should be frequent enough to maintain the desired plants. Grazing when the soil is saturated damages plants, and overgrazing results in compaction, a sparse vegetative cover, an increase in the runoff rate, and weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for producing high-quality hay and forage.

This soil is suited to woodland, although most areas of the soil have been cleared. Yellow-poplar, eastern white pine, shortleaf pine, black walnut, and northern red oak are suitable trees for planting. Plant competition is the major management concern because site conditions favor the growth of invading species. A new forest crop can be established by managing existing stands, applying herbicides, or cutting. See table 7 for specific information on potential productivity and trees to plant.

The potential for openland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Field borders are good wildlife areas. Trees and shrubs in small areas and in fence rows can break up large open areas and provide food and cover for wildlife. The habitat in areas of native plants can be improved by disking and applying fertilizer. Ponds can be developed to provide wildlife water supplies.

This soil is suited to most urban uses; however, depth to bedrock can be a limitation on sites for septic tank absorption fields and dwellings with basements in included areas where the soils are less than 60 inches deep over bedrock. This limitation may be reduced by careful site selection and layout. A few low areas may be subject to rare flooding by backwater on the Licking River.

This soil is in capability subclass IIe.

AbC—Allegheny loam, 6 to 15 percent slopes

This very deep, well drained, sloping and moderately steep soil is on stream terraces along the Licking River and major tributaries throughout the survey area. Slopes are smooth and convex but are dissected by small drainageways. Most areas are in the shape of narrow bands or are nearly oval. Individual areas range from 2 to about 75 acres in size.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil extends to a depth of about 53 inches. The upper part of the subsoil, to a depth of about 41 inches, is brown and brownish yellow loam. The lower part is yellowish brown, mottled loam. The substratum is yellowish brown, strong brown, and light yellowish gray channery sandy loam. Sandstone bedrock is at a depth of about 62 inches. In some areas the subsoil is sandy loam. In other areas it has more rock fragments.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots. Depth to bedrock ranges from 60 to 120 inches or more.

Included with this soil in mapping are small areas of Ezel soils on shoulder slopes and Gilpin soils on head slopes of drainageways; areas of Orrville, Grigsby, and Pope soils in drainageways; areas of Shelocta soils on some narrow footslopes; and areas of a moderately deep soil that formed in alluvium and is between narrow bands of sandstone rock outcrop on steep shoulder slopes. Inclusions make up about 15 percent of the map unit. Individual areas commonly are less than 2 acres in size.

This Allegheny soil is used mostly for hay and pasture. In some areas it is used for cultivated crops, mainly corn or tobacco. Areas of the soil are also used as sites for homes, gardens, or public or commercial buildings.

This soil is suited to cultivated crops. High yields can be obtained if the soil is properly managed. Erosion is a hazard. A crop rotation in which grasses and legumes are grown 2 out of every 4 years is needed if conventional tillage is used. Contour farming, stripcropping, and conservation tillage help to control erosion. In some areas runoff from adjacent hillsides can cause gully erosion and deposit rock fragments on the surface. This runoff can be controlled by diversion ditches or grassed waterways. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soil and using grasses and legumes as cover crops help to maintain tilth and a good supply of organic matter.

This soil is suited to hay and pasture. High yields can be obtained if the soil is properly managed. Pastures should be renovated frequently enough to maintain the desired plants. Grazing before plants are well established, overgrazing, or grazing when the soil is wet damages pasture plants and results in a thin vegetative cover and increased weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for producing quality hay and forage.

This soil is suited to woodland, although most areas of the soil have been cleared. Yellow-poplar, eastern white pine, shortleaf pine, black walnut, and northern red oak are suitable trees for planting. Plant competition is the major management concern because site conditions favor the growth of invading species. A new forest crop can be established by managing the existing stand, applying herbicides, or cutting. See table 7 for specific information on potential productivity and trees to plant.

The potential for openland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Field borders are good wildlife areas. Trees and shrubs in small areas and in fence rows can break up large open areas and provide food and cover for wildlife. The habitat in areas of native plants can be improved by disking and applying fertilizer. Ponds can be developed to provide wildlife water supplies.

This soil is suited to most urban uses, but slope is a limitation. Depth to bedrock can be a limitation on sites for septic tank absorption fields and dwellings with basements in included areas where soils are less than 60 inches deep over bedrock. Careful site selection and proper installation can minimize the limitations.

This soil is in capability subclass IIIe.

ArF—Alticrest-Ramsey complex, rocky, 20 to 60 percent slopes

These steep and very steep, somewhat excessively drained soils are on narrow ridgetops and hillsides in the northern part of Morgan County. They commonly are in areas above sandstone rock outcrop. The moderately deep Alticrest soil is on shoulder slopes, side slopes, and narrow benches in areas that have slopes ranging from 20 to 40 percent. The shallow Ramsey soil is on nose slopes and narrow benches in areas that have slopes ranging from 20 to 60 percent. These soils occur in a regular, repeating pattern on the landscape, but they are so intermingled that they could not be separated at the scale selected for mapping. Mapped areas are long, winding bands that commonly include ridgetops and narrow areas of sandstone rock outcrop. In places the narrow areas pinch off when they become too small to be shown at the scale selected for mapping. Individual areas range from 7 to about 230 acres in size.

Alticrest soil makes up about 60 percent of this map unit, and Ramsey soil makes up about 20 percent. Inclusions make up the remaining 20 percent.

Typically, the surface layer of the Alticrest soil is brown sandy loam about 5 inches thick. The upper part of the subsoil, to a depth of about 9 inches, is brown sandy loam that is slightly lighter in color than the surface layer. The middle part, to a depth of about 15 inches, is brownish yellow sandy loam. The lower part is yellowish brown channery sandy loam. Sandstone bedrock is at a depth of about 38 inches. In some areas the subsoil is loam. In other areas it has more rock fragments.

The Alticrest soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is moderately deep. Depth to bedrock ranges from 20 to 40 inches.

Typically, the surface layer of the Ramsey soil is brown channery sandy loam about 4 inches thick. The subsoil is brownish yellow channery loam to a depth of about 14 inches. The substratum is yellowish brown very channery sandy loam. Fractured sandstone bedrock is at a depth of about 18 inches. In some areas the subsoil is loamy sand. In other areas it has more rock fragments.

The Ramsey soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is very low. Surface runoff is rapid. The root zone is shallow. Depth to bedrock ranges from 10 to 20 inches.

Included with these soils in mapping are small areas of Dekalb, Gilpin, Lily, and Rayne soils on ridgetops and narrow bands of Hazleton, Helechawa, and Rigley soils on benches, on shoulder slopes, and in drainageways. Hazleton, Helechawa, and Rigley soils are lower on the landscape than the Alticrest and Ramsey soils. Individual areas commonly are less than 5 acres in size.

These Alticrest and Ramsey soils are mostly used as woodland. They are forested with secondary growth hardwoods or pine plantations. They are generally not suited to pasture, hay, or cultivated crops because of the steepness of slope, the equipment limitation, and the severe hazard of erosion.

These soils are suited to woodland. Chestnut oak, white oak, black oak, scarlet oak, red maple, Virginia pine, and pitch pine are common trees. Eastern white pine, shortleaf pine, and black oak are suitable trees for planting. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The equipment limitation, plant competition, seedling mortality, and the hazard of erosion are the major concerns in managing timber. Erosion is a hazard along haul roads and skid trails. It can be reduced by establishing a grade of less than 10 percent along the roads and trails and by limiting the area of surface disturbance to 10 percent or less. Permanent access roads can be protected by water bars, culverts, and gravel. Southern exposures of these soils are droughty and limit production during dry years. The seedling mortality rate is increased by the shallow rooting depth in the Ramsey soil. Trees in areas of the Ramsey soil and in some areas of the Alticrest soil are likely to be uprooted during high winds because the rooting depth is limited by the underlying bedrock. The stands in areas of these soils should be thinned less intensively and more frequently than those in areas where windthrow is less likely. The rock outcrop and the steepness of slope restrict the use of wheeled and tracked equipment and may cause breakage and hinder yarding. In many areas roads cannot be built because of cliffs.

The potential for woodland wildlife habitat is very poor to fair. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Brushy thickets can be established by clearing small areas in tracts of woodland. Food plots or areas of green browse can be established along logging roads and trails. The habitat in areas of native plants can be improved by disking and applying fertilizer. Den trees should not be harvested. Brush piles or other nesting sites are needed.

These soils are generally not suited to urban uses because of the steepness of slope, the hazard of erosion, the equipment limitation, and the depth to bedrock.

These soils are in capability subclass VIIe.

BcF—Berks-Cranston complex, 40 to 60 percent slopes, very stony

These very steep, well drained soils are on hillsides along the Licking River and major streams in the northern part of Morgan County. Slopes are linear or slightly convex and are dissected by narrow drainageways. Flagstones and other stones commonly cover about 1 to 5 percent of the surface. The very deep Cranston soil is on the lower side slopes and footslopes. The moderately deep Berks soil is generally on the upper side slopes and nose slopes above the Cranston soil. These soils occur in a regular, repeating pattern on the landscape, but they are so intermingled that they could not be separated at the scale selected for mapping. Mapped areas are narrow, winding bands. They range from 30 to about 700 acres in size.

Berks and similar soils make up about 55 percent of this map unit, and Cranston and similar soils make up about 30 percent. Inclusions make up the remaining 15 percent.

Typically, the surface layer of the Berks soil is brown channery silt loam about 5 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is light yellowish brown very channery silt loam. The lower part, to a depth of about 33 inches, is light brown extremely channery silt loam. The substratum is fractured siltstone grading to unweathered siltstone bedrock at a depth of about 38 inches. In some areas the subsoil is silty clay loam. In other areas it has fewer rock fragments.

The Berks soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is low. Surface runoff is rapid. The root zone is moderately deep, but the rock fragments hinder penetration by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Typically, the surface layer of the Cranston soil is dark grayish brown channery silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 16 inches, is brownish yellow silt loam. The middle part, to a depth of about 25 inches, is yellowish brown very channery silt loam. The lower part, to a depth of about 50 inches, is yellowish brown extremely channery silt loam. The substratum is yellowish brown and strong brown extremely channery silty clay loam. Fractured siltstone bedrock is at a depth of about 62 inches. In some areas the subsoil is silty clay loam. In other areas it has fewer rock fragments.

The Cranston soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is very deep, but the rock fragments hinder penetration by plant roots. Depth to bedrock ranges from 5 to 20 feet.

Included with these soils in mapping are small areas of Donahue soils on nose slopes, Bledsoe soils on benches, and Allegheny and Whitley soils on narrow stream terraces and areas of soils that are extremely stony or rubbly. Donahue and Bledsoe soils are in the higher positions on the landscape. Also included, on narrow flood plains, are areas of Pope soils and a soil that has more than 35 percent rock fragments in the subsoil. Individual areas of included soils commonly are less than 5 acres in size.

These Berks and Cranston soils are used as woodland. They are not suited to cultivated crops, hay, or pasture because of the steep and very steep slopes, the stones on the surface, and the equipment limitation.

These soils are suited to woodland. American beech, northern red oak, and red maple are some of the native trees on cool aspects. White oak, chestnut oak, and hickories are some of the native trees on warm aspects. The understory is mainly redbud, sassafras, flowering dogwood, sourwood, spicebush, Christmas fern, and greenbrier. Some trees preferred for planting are eastern white pine, northern red oak, yellow-poplar, and white oak. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, seedling mortality, and plant competition are the main concerns in managing timber. Careful harvesting techniques minimize disturbance of the surface layer. The very steep slopes and the rock outcrop restrict the use of wheeled and tracked equipment. When openings are made in the canopy, the uncontrolled invasion of brushy plants can delay natural regeneration. Cut slopes are subject to slumping in areas where the bedrock is highly fractured.

The potential for woodland wildlife habitat is poor or fair. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Brushy thickets can be established by clearing small areas in tracts of woodland. Food plots or areas of green browse can be established along logging roads and trails. Nest boxes for ducks should be established in areas close to water. Den trees should not be harvested. Brush piles or other nesting sites are needed.

These soils are generally not suited to urban uses because of the steepness of slope, the stoniness, and the hazard of slippage.

These soils are in capability subclass VIIe.

BdF—Bledsoe silt loam, 30 to 50 percent slopes, very stony

This very deep, well drained, very steep soil is on side slopes and footslopes along the Licking River and major streams in the northern part of Morgan County. The upper boundary of the mapped area is a narrow bench above areas of limestone rock outcrop. The underlying bedrock is mostly level-bedded, soft shale, limestone, or siltstone. Slopes are complex and are influenced by colluvium deposited from hillsides and by sandstone rock outcrop in areas above this soil. Flagstones and other stones cover about 1 to 5 percent of the surface in most areas. Mapped areas are long, narrow bands that pinch off in places. They range from 10 to about 175 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The upper part of the subsoil, to a depth of about 11 inches, is yellowish brown channery silty clay loam. The middle part, to a depth of about 41 inches, is strong brown channery and very channery silty clay loam. The lower part is strong brown, mottled channery silty clay. Limestone bedrock is at a depth of more than 65 inches. In some areas the subsoil is sandy clay loam. In other areas depth to bedrock ranges from 40 to 60 inches.

This soil is high in natural fertility and moderate in organic matter content. Available water capacity is high, and permeability is moderately slow. Surface runoff is rapid. The lower part of the subsoil has a moderate shrink-swell potential. The root zone is very deep and is easily penetrated by plant roots. Depth to soft shale, limestone, or siltstone bedrock is more than 65 inches.

Included with this soil in mapping are small areas of Berks, Cranston, Donahue, and Rigley soils. Berks and Donahue soils are on nose slopes adjacent to the Bledsoe soil. Cranston soils are on the lower side slopes below the Bledsoe soil. Rigley soils are on benches and footslopes above the Bledsoe soil. Also included are rubble, which consists of irregular piles of stones and boulders; low bluffs or narrow ledges of limestone rock outcrop; and areas of moderately deep and shallow soils that formed in clayey residuum on narrow benches and nose slopes. The rubble covers more than 10 percent of the surface. The limestone rock outcrop makes up as much as 10 percent of some areas. Inclusions make up about 20 percent of the map unit. Most individual areas are less than 5 acres in size.

This Bledsoe soil is used as woodland. Most areas have limited accessibility and are isolated from development by the Licking River below the map unit and by the sandstone rock outcrop above the map unit.

This soil is generally not suited to hay, pasture, or cultivated crops because of the steepness of slope, the equipment limitation, the hazard of erosion, the stoniness, and the inaccessibility.

This soil is suited to woodland. Yellow-poplar, American beech, and white ash are some of the native trees on cool aspects. White oak, red maple, and mockernut hickory are some of the native trees on warm aspects. The understory is mainly redbud, sassafras, flowering dogwood, sourwood, spicebush, Christmas fern, and greenbrier. Some trees preferred for planting are eastern white pine, northern red oak, yellow-poplar, and white oak. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, and plant competition are the main concerns in managing timber. The seedling mortality rate is moderate on warm aspects. Careful harvesting techniques minimize disturbance of the surface layer. The steepness of slope, the limestone rock outcrop, and the stoniness restrict the use of wheeled and tracked equipment. The soil is subject to landsliding and slumping because it is very plastic when wet and is underlain by highly fractured bedrock. When openings are made in the canopy, the uncontrolled invasion of brushy plants can delay natural regeneration.

The potential for woodland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Brushy thickets can be established by clearing small areas in tracts of woodland. Food plots or areas of green browse can be established along logging roads and trails. Nest boxes for ducks should be established in areas close to water. Den trees should not be harvested. Brush piles or other nesting sites are needed.

This soil is generally not suited to urban uses because of the steepness of slope, the stoniness, the inaccessibility, and the hazard of slippage.

This soil is in capability subclass VIIe.

BeE—Bledsoe-Donahue-Rock outcrop complex, 15 to 30 percent slopes

This map unit occurs as areas of well drained, moderately steep and steep soils intermingled with areas of Rock outcrop. It is on hillsides along the Licking River and major tributary streams in the northern part of Morgan County. The Bledsoe and Donahue soils and the areas of limestone rock outcrop are so intricately mixed that they could not be separated at the scale selected for mapping. The upper boundary of the mapped area is a bench that is above areas of Rock outcrop. The underlying bedrock is mostly limestone or level-bedded, calcareous shale. Mapped areas are narrow bands or are oval. They range from 8 to about 200 acres in size.

Soil and slope patterns are very complex because they have been influenced by the intricate shape and geometric form of the nose slopes, benches, and coves. Also, sandy colluvium has been deposited from slopes and sandstone rock outcrop above this map unit. These sandy deposits contain rock fragments ranging from quartz pebbles to house-sized boulders. The very deep Bledsoe soil formed in colluvium derived from sandstone, limestone, and shale. It is in coves, on side slopes, and on benches, generally below the Donahue soil. The moderately deep Donahue soil formed in sandy colluvium that is underlain by limestone residuum. It is on nose slopes and benches. The Rock outcrop occurs as exposed areas of weathered Newman Limestone. Sinkholes occur in some coves and drainageways.

Bledsoe and similar soils make up about 40 percent of this map unit, Donahue and similar soils make up about 30 percent, and Rock outcrop makes up about 15 percent. Inclusions make up the remaining 15 percent.

Typically, the surface layer of the Bledsoe soil is very dark grayish brown and dark grayish brown loam about 8 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is strong brown channery sandy clay loam. The middle part, to a depth of about 28 inches, is strong brown and light olive brown clay. The lower part, to a depth of about 43 inches, is strong brown and light olive brown channery clay. The substratum is strong brown, mottled channery clay loam. Soft, calcareous shale, interbedded with limestone, is at a depth of about 63 inches. In some areas the subsoil is mottled. In other areas depth to bedrock is 40 to 60 inches.

The Bledsoe soil is high in natural fertility and moderate in organic matter content. Available water capacity is high, and permeability is moderately slow. Surface runoff is rapid. The lower part of the subsoil has a moderate shrink-swell potential. The root zone is very deep and is easily penetrated by plant roots. Depth to soft shale or limestone bedrock is more than 60 inches.

Typically, the surface layer of the Donahue soil is dark brown loam about 7 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is yellowish brown sandy clay loam. The lower part, to a depth of about 33 inches, is yellowish brown silty clay. The substratum is soft, greenish gray, calcareous shale. Unweathered, calcareous shale, interbedded with limestone, is at a depth of about 39 inches. In some areas the surface layer is silt loam. In other areas the subsoil is sandy loam.

The Donahue soil is medium in natural fertility and low in organic matter content. Available water capacity is moderate, and permeability is moderately slow. Surface runoff is rapid. The lower part of the subsoil has a moderate shrink-swell potential. The root zone is moderately deep and is easily penetrated by plant roots. Depth to shale or limestone bedrock is 20 to 40 inches.

Typically, the Rock outcrop consists of narrow bands of Newman Limestone separated by strips of colluvial or residual soils. It supports little or no vegetation; however, hardy tree species live in areas of Rock outcrop by sending roots into nearby soils.

Included in this unit in mapping are small areas of Berks, Cranston, and Rigley soils. Berks soils are on nose slopes and Cranston soils on side slopes below the Bledsoe and Donahue soils and the Rock outcrop. Rigley soils are on footslopes and benches above the Bledsoe and Donahue soils and the Rock outcrop. Also included are areas where sandstone boulders and flagstones cover benches and fill drainageways and bands of shallow, clayey soils on nose slopes. These bands of soil are separated by narrow ledges of limestone rock outcrop. Individual areas of inclusions commonly are less than 3 acres in size.

This map unit generally is not suited to cultivated crops and hay because of the steepness of slope, the Rock outcrop, and the equipment limitation. Some of the less steep areas are used as pasture.

This map unit is suited to woodland. Yellow-poplar, American beech, and white ash are some of the native trees on cool aspects. White oak, red maple, and hickories are some of the native trees on warm aspects. The understory is mainly redbud, sassafras, flowering dogwood, sourwood, spicebush, Christmas fern, and greenbrier. Some trees preferred for planting are eastern white pine, northern red oak, yellow-poplar, and white oak. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion and plant competition are the main concerns in managing timber. The seedling mortality rate is moderate on warm aspects. Careful harvesting techniques minimize disturbance of the surface layer. The steep slopes and the Rock outcrop restrict the use of wheeled and tracked equipment. These soils are sticky and plastic when wet. As a result, trafficability is reduced. The seedling mortality rate can be reduced by selecting areas of soils with cool aspects for planting. When openings are made in the canopy, the uncontrolled invasion of brushy plants can delay natural regeneration in areas of the Bledsoe soil with cool aspects.

The potential for woodland wildlife habitat is fair or good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Brushy thickets can be established by clearing small areas in tracts of woodland. Food plots or areas of green browse can be established along logging roads and trails. The habitat in areas of native plants can be improved by disking and applying fertilizer. Den trees should not be harvested. Brush piles or other nesting sites are needed.

This map unit is poorly suited to urban uses because of the steepness of slope, inaccessibility, and the hazard of slippage.

The Bledsoe and Donahue soils are in capability subclass VIe. The Rock outcrop is in capability subclass VIIIs.

CoB—Cotaco loam, 1 to 4 percent slopes

This very deep, moderately well drained, nearly level and gently sloping soil is on stream terraces along the Licking River and its major tributary streams and on a few strath terraces in the northern part of Morgan County. Slopes are slightly convex or linear. Mapped areas are small ovals or narrow bands. They range from 4 to about 40 acres in size.

Typically, the surface layer is brown loam about 11 inches thick. The subsoil is light olive brown, mottled loam to a depth of about 35 inches. The substratum is firm and compact, brownish yellow, mottled loam. Depth to bedrock is more than 6 feet.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is slow. The soil is easy to till, but care must be taken to minimize puddling and crusting of the surface layer. The root zone is very deep and is easily penetrated by plant roots. Depth to bedrock is more than 60 inches.

Included with this soil in mapping are small areas of Allegheny, Barbourville, Ezel, Riney, and Shelocta soils and areas of Knowlton soils. Allegheny, Ezel, and Riney soils are in convex areas on strath terraces along the Licking River. Barbourville soils are on colluvial fans at the mouth of drainageways. Shelocta soils are on narrow footslopes. Knowlton soils are in seepy spots and drainageways. They make up as much as 10 percent of some areas. Also included are a few areas of a Cotaco soil that is on low stream terraces and is flooded once in about every 5 years; areas of a soil that has more coarse fragments in the surface layer and subsoil than is typical for this Cotaco soil and that is in similar landscape positions; and areas of a soil that is compact and brittle in the subsoil, rather than in the substratum, and is in nearly level areas of strath and stream terraces where runoff is restricted. Included soils make up about 20 percent of the map unit. Individual areas commonly are less than 2 acres in size.

This Cotaco soil is used mainly for pasture and hay. In some small areas it is used for cultivated crops, mostly corn or tobacco.

This soil is suited to cultivated crops, but the wetness is a limitation. Moderate yields can be obtained if a drainage system is installed. Tile drains and open ditches improve drainage, and in some areas ditches help to control surface runoff and overwash. Applications of fertilizer and lime are needed to amend the acid subsoil. Cover crops help to control runoff from adjacent hillsides. Returning crop residue to the soil and including grasses and legumes in the crop rotation help to maintain tilth and a good supply of organic matter.

This soil is suited to hay and pasture. High yields can be obtained if the soil is properly managed. Plants that can tolerate the wetness should be selected for planting. Pastures should be renovated frequently enough to maintain the desired plants. Grazing when the soil is saturated damages pasture plants, and overgrazing results in a sparse cover of grasses and legumes and increased weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for maintaining high-quality hay and forage.

This soil is suited to woodland, although most of it has been cleared. Yellow-poplar, eastern white pine, northern red oak, and black walnut are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on trees to plant and potential productivity.

The potential for openland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Field borders are good wildlife areas. Trees and shrubs in small areas and fence rows can break up large open areas and provide food and cover for wildlife. Pit ponds can be developed to provide wildlife water supplies. The habitat in areas of native plants can be improved by disking and applying fertilizer. Brush piles or other nesting sites are needed.

This soil is poorly suited to most urban uses because of the wetness. The seasonal high water table is a limitation on sites for septic tank absorption fields. Adding fill material or selecting an alternate means of sewage disposal can minimize this limitation.

This soil is in capability subclass IIw.

DgF—Dekalb-Gilpin-Marrowbone complex, very rocky, 20 to 60 percent slopes

These moderately deep, well drained, steep and very steep soils are on ridgetops in the southern part of Magoffin County. The Dekalb soil is on sharp crests and nose slopes. The Gilpin soil is on rounded crests and narrow saddles. The Marrowbone soil is on shoulder slopes, head slopes of drainageways, and the upper side slopes. Slopes are linear or convex. These soils occur in a repeating pattern on the landscape, but they are so intermingled that they could not be separated at the scale selected for mapping. Mapped areas are long, winding, narrow bands or isolated ovals cut off by strip mining. They range from 50 to about 500 acres in size but generally are less than 10 acres.

Dekalb soil makes up about 30 percent of this map unit, Gilpin soil makes up about 30 percent, Marrowbone soil makes up about 20 percent, sandstone rock outcrop and sandstone rubble make up about 10 percent, and included soils make up about 10 percent.

Typically, the surface layer of the Dekalb soil is very dark grayish brown sandy loam about 3 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is yellow very channery sandy loam. The lower part, to a depth of about 29 inches, is very pale brown and strong brown very channery sandy loam. The substratum is strong brown and light yellowish brown very channery sandy loam. Fractured sandstone bedrock is at a depth of about 32 inches.

The Dekalb soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and the available water capacity is low. Surface runoff is rapid. The root zone is moderately deep, but the rock fragments hinder penetration by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Typically, the surface layer of the Gilpin soil is brown channery silt loam about 5 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is yellowish brown silt loam. The lower part is yellowish brown channery and very channery silt loam. Fractured sandstone bedrock is at a depth of about 30 inches.

The Gilpin soil is medium in natural fertility and low in organic matter content. Permeability and available water capacity are moderate. Surface runoff is rapid. The root zone is moderately deep and is easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Typically, the surface layer of the Marrowbone soil is dark yellowish brown loam about 3 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is brownish yellow loam. The lower part is yellowish brown channery fine sandy loam. Rippable sandstone bedrock is at a depth of about 27 inches.

The Marrowbone soil is low in natural fertility and low to moderate in organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is moderately deep and is easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Included with these soils in mapping are small areas of Fedscreek, Kimper, and Shelocta soils and areas of Hazleton, Latham, and Ramsey soils. Fedscreek, Kimper, and Shelocta soils are on the upper side slopes and on head slopes of drainageways. Latham soils are in saddles and on nose slopes. Hazleton soils are on rounded crests. Ramsey soils are in narrow saddles. Individual areas of included soils commonly are less than 5 acres in size; however, in some of the mapped areas, there are no included soils. Areas of sandstone rock outcrop and sandstone rubble, which consists of flagstones, other stones, and boulders, also are included with these soils in mapping.

This map unit is used mainly as woodland. It is forested with secondary growth hardwoods and isolated stands of native pitch pine.

These soils are generally not suited to cultivated crops, hay, or pasture because of the steep slopes, the hazard of erosion, the stones on the surface, and the sandstone rock outcrop.

These soils are suited to woodland. White oak, black oak, scarlet oak, pignut hickory, red maple, and pitch pine are native trees. Isolated stands of northern red oak, sugar maple, and yellow-poplar are on the lower, more moist sites. Eastern white pine, shortleaf pine, and black oak are the preferred trees for planting. See table 7 for specific information on potential productivity.

The severe hazard of erosion, the equipment limitation, seedling mortality, and plant competition are the main concerns in managing timber. Steep skid trails and roads are subject to rilling and gullying unless they are protected by adequate water bars or plant cover, or both. The steep slopes restrict the use of wheeled and tracked equipment on skid trails. Cable skidding is safer and disturbs the soil less than using wheeled and tracked equipment. The seedling mortality rate is severe on warm aspects in summer because of high temperatures and inadequate soil moisture. Reforestation after harvest must be managed carefully to minimize undesirable plant competition.

The potential for woodland wildlife habitat is poor or fair. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Brushy thickets can be established by clearing small areas in tracts of woodland. Food plots or areas of green browse can be established along logging roads and trails. Den trees should not be harvested. Brush piles or other nesting sites are needed.

These soils are generally not suited to urban uses because of the steep slopes and the moderate depth to bedrock.

These soils are in capability subclass VIIe.

Dm—Dumps, coal

This map unit consists of coal stockpiles and coal refuse dumps from coal mining activities. The stockpiles and dumps are nearly level to very steep. Coal processing plants, coal tipples, railways, and areas that have been filled with coal waste material also are in areas of this map unit. The stockpile areas consist of large piles of coal and the associated facilities for loading, processing, and storing the coal. The mine dumps, or "gob piles," are heaps of coal that contain too many impurities to be of commercial value. The heaps are commonly sloping to steep, flat-topped hills. The map unit is in scattered areas throughout Magoffin and Morgan Counties.

The stockpiles consist of black pebbles and channers of coal. They are generally temporary, but some are constantly being depleted and replenished. The associated loading, processing, and storage facilities include buildings, parking areas, roadways, and railways. Most areas are irregularly shaped ovals or bands. They range from 3 to about 30 acres in size.

The mine dumps consist of very dark grayish brown or black channers of coal and shale. The content of rock fragments commonly ranges, by volume, from 75 to 100 percent. The fragments are about 1/12 inch to 6 inches long. The mine dumps also include heaps of "red dog," or the residue of impure coal or shale that has burned.

Included in this map unit are small areas of Pope, Rowdy, and Orrville soils and areas of Udorthents. Pope, Rowdy, and Orrville soils are on valley floors. Udorthents formed in fill material. Included soils make up about 10 percent of the map unit. Individual areas are generally less than 1 acre in size.

This map unit generally is not vegetated or has only a sparse cover of grasses, forbs, or dwarfed trees. The main limitations affecting the establishment of vegetation are acidity, droughtiness, and very low fertility. In places a high content of rock fragments in the surface layer or the steep slope is a limitation. The steeper areas can be smoothed. Applying lime and fertilizer, mulching, and selecting plant species that are suited to the acid, droughty soil material help to establish a plant cover. Some areas should be topdressed with soil material that is better suited to plants.

The capability subclass is VIIIs.

EgB—Ezel-Gilpin complex, 2 to 6 percent slopes

These well drained, gently sloping soils are on strath terraces above the Licking River and a few major streams in the northern part of Magoffin County and throughout Morgan County. The deep Ezel soil is on the broadest and smoothest landforms, generally above the Gilpin soil. The moderately deep Gilpin soil is on shoulder slopes and head slopes of drainageways in areas where alluvium has been removed during an earlier cycle of erosion. Mapped areas are small ovals or irregularly shaped bands. They range from 3 to about 90 acres in size.

Ezel soil makes up about 60 percent of the map unit, and Gilpin soil makes up about 25 percent. Inclusions make up the remaining 15 percent.

Typically, the surface layer of the Ezel soil is dark brown loam about 11 inches thick. The upper part of the subsoil, to a depth of about 39 inches, is brownish yellow loam. The lower part, to a depth of about 47 inches, is brownish yellow, mottled loam. The substratum is brownish yellow, very pale brown, and strong brown loam. Sandstone bedrock is at a depth of about 53 inches. In some areas the subsoil is silt loam. In other areas it has more rock fragments.

The Ezel soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas it has fewer rock fragments.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Allegheny, Cotaco, Rayne, Riney, and Shelocta soils. These included soils are on landforms similar to those of the Ezel and Gilpin soils. Also included are areas of Orrville and Knowlton soils in seepy spots and drainageways. Orrville and Knowlton soils commonly are near hillsides. Most individual areas of included soils are less than 2 acres in size.

These Ezel and Gilpin soils are used for cultivated crops, hay, or pasture. Corn and tobacco are the major cultivated crops. Many areas of these soils are also used as sites for homes, gardens, or buildings.

These soils are suited to cultivated crops. High yields can be maintained on the Ezel soil and moderate yields on the Gilpin soil if the soils are properly managed. Erosion is a hazard. A crop rotation in which grasses and legumes are grown 1 out of every 3 years is needed if conventional tillage is used. Contour farming, stripcropping, and conservation tillage help to control erosion. In some areas runoff from adjacent hillsides can cause gully erosion and deposit rock fragments on the surface. This runoff can be controlled by diversion ditches or grassed waterways. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soils and using grasses and legumes as cover crops help to maintain tilth and a good supply of organic matter.

These soils are suited to hay and pasture. High yields can be obtained on the Ezel soil and moderate yields on the Gilpin soil if the soils are properly managed. Improved varieties of grasses and legumes should be selected for planting, and pasture renovation should be frequent enough to maintain the desired plants. The moderately deep root zone and the lack of moisture during dry periods limit production on the Gilpin soil. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Grazing when the soils are saturated damages pasture plants, and overgrazing results in compaction, a sparse vegetative cover, an increase in the runoff rate, and weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for producing high-quality hay and forage.

These soils are suited to woodland, although most areas have been cleared. Yellow-poplar, eastern white pine, shortleaf pine, black walnut, and northern red oak are suitable trees for planting. Plant competition is the major management concern. Site conditions favor the growth of invading species. A new forest crop can be established by managing the existing stand, applying herbicides, or cutting. See table 7 for specific information on potential productivity and trees to plant.

The potential for openland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Field borders are good wildlife areas. Trees and shrubs in small areas and fence rows can break up large open areas and provide food and cover for wildlife. The habitat in areas of native plants can be improved by disking and applying fertilizer. Small ponds can be developed to provide wildlife water supplies.

These soils are suited to most urban uses. The depth to bedrock is a limitation on sites for septic tank absorption fields and dwellings with basements in areas of the Gilpin soil. Careful site selection and layout can minimize the limitation.

These soils are in capability subclass IIe.

EgC—Ezel-Gilpin complex, 6 to 15 percent slopes

These well drained, sloping and moderately steep soils are on strath terraces above the Licking River and major streams in the northern part of Magoffin County and throughout Morgan County. The deep Ezel soil is on the broadest and smoothest landforms, generally above the Gilpin soil. The moderately deep Gilpin soil is on shoulder slopes and head slopes of drainageways in areas where alluvium has been removed during an earlier cycle of erosion. Mapped areas are small ovals or irregularly shaped bands. They range from 3 to about 90 acres in size.

The Ezel soil makes up about 60 percent of the map unit, and the Gilpin soil makes up about 20 percent. Inclusions make up the remaining 20 percent.

Typically, the surface layer of the Ezel soil is dark brown loam about 11 inches thick. The upper part of the subsoil, to a depth of about 39 inches, is brownish yellow loam. The lower part, to a depth of about 47 inches, is brownish yellow, mottled loam. The substratum is brownish yellow, very pale brown, and strong brown loam. Sandstone bedrock is at a depth of about 53 inches. In some areas the subsoil is silt loam. In other areas it has more rock fragments.

The Ezel soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas it has fewer rock fragments.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. The surface runoff is medium. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Allegheny, Cotaco, Rayne, Riney, and Shelocta soils. These included soils are on landforms similar to those of the Ezel and Gilpin soils. Also included are areas of Orrville and Knowlton soils in seepy spots and drainageways. Orrville and Knowlton soils are commonly near hillsides. Most individual areas of included soils are less than 2 acres in size.

These Ezel and Gilpin soils are used mostly for hay and pasture. In some areas they are used for cultivated crops, mainly corn or tobacco. Areas of these soils are also used as sites for homes, gardens, or buildings.

These soils are suited to cultivated crops. High yields can be obtained on the Ezel soil and moderate yields on the Gilpin soil if the soils are properly managed. Erosion is a hazard. A crop rotation in which grasses and legumes are grown 2 out of every 4 years is needed if conventional tillage is used. Contour farming, stripcropping, and conservation tillage help to control erosion. In some areas runoff from adjacent hillsides can cause gully erosion and deposit rock fragments on the surface. This runoff can be controlled by diversion ditches or grassed waterways. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soils and using grasses and legumes as cover crops help to maintain tilth and a good supply of organic matter.

These soils are suited to hay and pasture. Moderate to high yields can be obtained if these soils are properly managed. Pastures should be renovated frequently enough to maintain the desired plants. Grazing before plants are well established, overgrazing, or grazing when the soils are wet damages pasture plants and results in a thin cover and increased weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for producing quality hay and forage.

These soils are suited to woodland, although most areas have been cleared. Yellow-poplar, eastern white pine, shortleaf pine, and northern red oak are suitable trees for planting. Plant competition is the major management concern. Site conditions favor the growth of invading species. A new forest crop can be established by managing the existing stand, applying herbicides, or cutting. See table 7 for specific information on potential productivity and trees to plant.

The potential for openland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Field borders are good wildlife areas. Trees and shrubs in small areas and along fence rows can break up large open areas and provide food and cover for wildlife. The habitat in areas of native plants can be improved by disking and applying fertilizer.

These soils are suited to most urban uses, but the slope is a limitation. The depth to bedrock is a limitation on sites for septic tank absorption fields and dwellings with basements in areas of the Gilpin soil. Careful site selection and proper installation can minimize these limitations.

These soils are in capability subclass IIIe.

GIC—Gilpin silt loam, 4 to 12 percent slopes

This moderately deep, well drained, gently sloping and sloping soil is on ridgetops and hillsides in the northern and western parts of Morgan County and on low nose slopes along the Licking River and some of its major tributaries. Slopes are linear or convex. Mapped areas are small ovals or irregularly shaped bands. They range from 2 to about 50 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum, to a depth of about 32 inches, is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas it is only 18 inches thick.

This soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Latham, Lily, and Rayne soils on ridgetops. Latham soils are on saddles and nose slopes. Lily soils are on sharp crests. Rayne soils are on broad, rounded crests. Also included are small areas of Shelocta soils on shoulder slopes and the upper side slopes, below the Gilpin soil. Any of these included soils may make up as much as 10 percent of the mapped area, but they do not occur in a regular, repeating pattern on the landscape. Included soils make up about 25 percent of the map unit. Individual areas commonly are less than 2 acres in size.

This Gilpin soil is used for cultivated crops, hay, or pasture. Areas of the soil are also used as sites for homes, barns, or other buildings. Corn and tobacco are the major cultivated crops. Some areas are used as woodland.

This soil is suited to cultivated crops. Erosion is a hazard if conventional tillage is used. Moderate yields can be obtained if the soil is properly managed. Applications of fertilizer and lime are needed to amend the acid subsoil. Planting a cover crop of grasses and legumes reduces the hazard of erosion. Returning crop residue to the soil helps to maintain tilth and organic matter content. Keeping drainageways in permanent vegetative cover helps to control gully erosion.

This soil is suited to hay and pasture. Moderate yields can be obtained if the soil is properly managed. The moderately deep root zone and the lack of moisture during dry periods limit production. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for producing high-quality hay and forage.

This soil is suited to woodland, although most of it has been cleared. Eastern white pine, shortleaf pine, black oak, and northern red oak are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The potential for openland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, water, nesting areas, and den sites. Field borders are good wildlife areas. Trees and shrubs in small areas and fence rows can break up large open areas and provide food and cover for wildlife. The habitat in areas of native plants can be improved by disking and applying fertilizer. Brush piles or other nesting sites are needed.

This soil is suited to some urban uses. The depth to bedrock and the slope are limitations on sites for septic tank absorption fields and dwellings with basements. Proper design and installation can minimize these limitations.

This soil is in capability subclass IIIe.

GID—Gilpin silt loam, 12 to 25 percent slopes

This moderately deep, well drained, moderately steep and steep soil is on ridgetops and hillsides in the western part of Morgan County and on low nose slopes along the Licking River and its major tributaries. Slopes are mostly convex. In some areas they are complex. Mapped areas are irregular ovals or long, narrow bands. They range from 5 to about 370 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 28 inches. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part is yellowish brown channery silty clay loam and channery silt loam. The substratum, to a depth of about 32 inches, is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas it has more rock fragments.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Shelocta soils on footslopes and Rayne soils on broad ridgetops. Also included are areas of Latham soils on shoulder slopes and in saddles and small areas of a shallow loamy soil on nose slopes and in narrow saddles. The shallow loamy soil is weathered from siltstone. Included soils make up about 20 percent of this map unit. Latham soils make up as much as 10 percent of most areas. Most individual areas of included soils are less than 5 acres in size.

Areas of this Gilpin soil on ridgetops are mainly used as woodland, and those on nose slopes and benches are commonly used for hay and pasture.

This soil is poorly suited to cultivated crops. Erosion is a hazard if conventional tillage is used. Moderate yields can be obtained if the soil is properly managed. Including cover crops, grasses, and legumes in a long crop rotation reduces the hazard of erosion. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soil helps to maintain tilth and organic matter content. Keeping drainageways in permanent vegetative cover helps to control gully erosion.

This soil is suited to hay and pasture. Moderate yields can be obtained if the soil is properly managed. The moderately deep root zone and the lack of moisture during dry periods limit production. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for producing high-quality hay and forage.

This soil is suited to woodland. Many areas on ridgetops are forested with secondary growth oaks and hickories. Yellow-poplar, eastern white pine, white oak, northern red oak, and shortleaf pine are the most suitable trees for planting. The hazard of erosion, the equipment limitation, and plant competition are management concerns. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

This soil is poorly suited to most urban uses. The depth to bedrock and the slope are limitations on sites for septic tank absorption fields and dwellings with basements. Special design and proper installation can minimize these limitations.

This soil is in capability subclass IVe.

GnF—Gilpin-Latham-Marrowbone complex, 20 to 60 percent slopes

These moderately deep, well drained and moderately well drained, steep and very steep soils are on ridgetops in the central and eastern parts of Morgan County and the northern part of Magoffin County. The Gilpin soil is on rounded crests and shoulder slopes, the Latham soil is on saddles and nose slopes, and the Marrowbone soil is on narrow saddles and sharp crests. Slopes are linear or convex. These soils occur in a regular, repeating pattern on the landscape, but it was impractical to separate them at the scale selected for mapping. Mapped areas are long, narrow, winding bands. They range from 50 to about 1,000 acres in size.

Gilpin soil makes up about 30 percent of the map unit, Latham soil makes up about 25 percent, and Marrowbone soil makes up about 20 percent. Included soils make up the remaining 25 percent.

Typically, the surface layer of the Gilpin soil is brown channery silt loam about 5 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is yellowish brown silt loam. The lower part is yellowish brown channery and very channery silt loam. Fractured sandstone bedrock is at a depth of about 30 inches. In some areas the subsoil is loam. In other areas it has fewer rock fragments.

The Gilpin soil is medium in natural fertility and low in organic matter content. Permeability and available water capacity are moderate. Surface runoff is rapid. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Typically, the surface layer of the Latham soil is brown silt loam about 3 inches thick. The upper part of the subsoil, to a depth of about 7 inches, is light yellowish brown silt loam. The middle part, to a depth of about 21 inches, is strong brown, mottled silty clay loam. The lower part, to a depth of about 33 inches, is light gray, mottled silty clay. The substratum is soft interbedded shale and siltstone to a depth of about

55 inches. Unweathered shale bedrock is at a depth of about 55 inches.

The Latham soil is low in natural fertility and organic matter content. Permeability is slow, and available water capacity is moderate. Surface runoff is rapid. The soil is easy to till but is subject to compaction, puddling, and crusting if worked when wet. The root zone is moderately deep and is easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Typically, the surface layer of the Marrowbone soil is very dark grayish brown loam about 3 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is brownish yellow loam. The lower part, to depth of about 27 inches, is yellowish brown channery fine sandy loam. Rippable sandstone is at a depth of about 27 inches.

The Marrowbone soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is moderately deep. Depth to bedrock ranges from 20 to 40 inches.

Included with these soils in mapping are small areas of Fedscreek, Helechawa, and Shelocta soils on the upper side slopes and head slopes of drainageways. Also included are areas of Dekalb and Hazleton soils on sharp crests of ridgetops and areas of Ramsey soils on nose slopes and in narrow saddles. Dekalb and Hazleton soils make up about 5 percent of most areas of this map unit, and Ramsey soils commonly make up about 10 percent. Individual areas of included soils commonly are less than 5 acres in size.

These Gilpin, Latham, and Marrowbone soils are used mainly as woodland. They are forested with secondary growth hardwoods. A few areas with good accessibility to roads have been cleared and are used as homesites.

These soils are poorly suited to cultivated crops and pasture because of the steep slopes, the hazard of erosion, the stones on the surface, and rock outcrop.

These soils are suited to woodland. White oak, black oak, scarlet oak, chestnut oak, pignut hickory, red maple, pitch pine, and Virginia pine are native trees on warm aspects. Isolated stands of northern red oak, black oak, and yellow-poplar are on the lower, more moist sites. Eastern white pine, shortleaf pine, and black oak are preferred trees for planting. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, seedling mortality, and plant competition are the main concerns in managing timber. Steep skid trails and roads are subject to rilling and gullying unless they are protected by adequate water bars or plant cover, or both. The steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable skidding generally is safer and disturbs the soils less than using wheeled and tracked equipment. The seedling mortality rate generally is severe on warm aspects in summer because of high temperatures and inadequate moisture in the soil. Reforestation after harvest must be managed carefully to minimize undesirable plant competition.

These soils are generally not suited to urban uses because of the steepness of slope.

These soils are in capability subclass VIIe.

Gr—Grigsby sandy loam, 0 to 4 percent slopes, occasionally flooded

This very deep, well drained, nearly level and gently sloping soil is on flood plains along tributary streams throughout the survey area (fig. 13). Slopes are smooth or slightly convex. Mapped areas are long, narrow bands that commonly make up an entire valley floor. They range from 5 to about 75 acres in size.

Typically, the surface layer is brown sandy loam about 11 inches thick. The upper part of the subsoil, to a depth of about 30 inches, is yellowish brown sandy loam. The lower part is yellowish brown, mottled sandy loam. The substratum, from a depth of 60 to 80 inches, is yellowish brown, mottled sandy loam. Bedrock is at a depth of more than 80 inches. In some areas the surface layer and subsoil are silt loam. In other areas they have more rock fragments.

The Grigsby soil is high in natural fertility and moderate in organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is slow. The soil is subject to occasional flooding; however, it is generally not flooded during the growing season or for a long duration. It is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils on footslopes and areas of Cotaco, Morehead, and Rowdy soils on some of the low stream terraces. Also included are areas of soils on streambanks and some areas of a soil in seepy spots and abandoned stream channels. The soils on streambanks have strata, or bedding planes, of sand and loam that formed as a result of flooding. The strata are throughout the soil profile. The soil in the seepy spots and abandoned stream channels has

Figure 13.—An area of Grigsby sandy loam, 0 to 4 percent slopes, occasionally flooded. Note how flash flooding has resulted in the deposition of sand and the flattening of cornstalks.

redoximorphic features at a depth of about 18 inches. Included soils make up about 15 percent of the map unit. Individual areas commonly are less than 5 acres in size.

This Grigsby soil is used mainly for pasture, hay, or cultivated crops, mostly corn.

This soil is suited to cultivated crops. High yields can be obtained if the soil is properly managed. The soil is subject to occasional flooding, but crops are seldom damaged as most flooding occurs in winter or early spring and is of short duration. Crops respond favorably to fertilizer, but additional lime is not commonly needed. The soil can be cropped year after year if management practices that maintain soil fertility and organic matter content are applied.

This soil is suited to hay and pasture. Grasses and legumes are seldom damaged by the short periods of flooding. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for maintaining yields.

This soil is suited to woodland, although most of it has been cleared. Yellow-poplar, eastern white pine, black cherry, and black walnut are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on potential productivity and trees to plant.

This soil is poorly suited to most urban uses because of the flooding.

This soil is in capability subclass IIw.

KbD—Kaymine, Bethesda, and Fiveblock soils, 0 to 20 percent slopes, stony

These very deep, well drained and somewhat excessively drained, nearly level to moderately steep soils are on ridgetops and benches. They formed in soil material and in material weathered from underlying bedrock in areas that have been strip-mined for coal. Scattered surface stones are common in most areas of this map unit. Slopes are linear or convex and are dissected by diversion ditches. Mapped areas are irregularly shaped bands or elongated ovals. They range from 5 to about 500 acres in size.

In a typical area, the Kaymine soil makes up about 40 percent of the map unit, the Bethesda soil makes up 30 percent, and the Fiveblock soil makes up 20 percent. The pattern and proportion of these soils is not uniform in all mapped areas. Individual areas may contain one, two, or all three soils. This variability is due to differences in parent material and reclamation practices. Individual areas of each soil are generally large enough to be mapped separately, but because of present and predicted uses, the soils were mapped as an undifferentiated unit. Inclusions make up 10 percent of the map unit.

Typically, the surface layer of the Kaymine soil is brown and yellowish brown, mottled very channery loam about 8 inches thick. The fine-earth fraction of the underlying material is yellowish brown and strong brown loam to a depth of more than 65 inches. The content of rock fragments in the underlying material ranges from 20 to 50 percent. The rock fragments are dominantly sandstone, siltstone, and shale channers.

Typically, the surface layer of the Bethesda soil is brown channery silt loam about 8 inches thick. The fine-earth fraction of the underlying material, to a depth of more than 65 inches, is brown, dark grayish brown, and yellowish brown loam, clay loam, and silty clay loam. The content of rock fragments in the underlying material ranges from 25 to 75 percent. The rock fragments are dominantly shale, sandstone, and siltstone channers.

Typically, the surface layer of the Fiveblock soil is yellowish brown channery sandy loam about 9 inches thick. The fine-earth fraction of the underlying material is yellowish brown sandy loam to a depth of more than 65 inches. The content of rock fragments in the underlying material ranges from 30 to 80 percent. The rock fragments are 65 percent or more neutral sandstone. The rest consists of siltstone, shale, or coal.

These soils are low in natural fertility and very low in organic matter content. Permeability is moderately slow in the Bethesda soil, moderate in the Kaymine soil, and moderately rapid in the Fiveblock soil. Available water capacity is low in all three soils. Surface runoff is slow or medium. The root zone in the soils is deep, but the rock fragments hinder penetration by plant roots. Depth to bedrock ranges from 5 to 20 feet.

Included with these soils in mapping are small areas of Dekalb, Gilpin, Latham, and Marrowbone soils on undisturbed ridgetops; areas of Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils on undisturbed hillsides; and, mostly in Morgan County, areas of a nonacid soil that has more clay in the substratum than is typical for the Kaymine soil. Also included are areas of soils that have very strongly acid and neutral layers in the same profile, areas of extremely acid soils that are toxic to plants, areas of soils that are slightly alkaline, and a few areas of soils that are less than 5 feet deep over bedrock Mine dumps, ponded or seepy areas, rock escarpments, and waterways where runoff and sediment accumulate are common in this map unit.

Most of the acreage of these Kaymine, Bethesda, and Fiveblock soils is idle land that has been reclaimed and used for grasses, legumes, or young trees. A few areas are used as pasture (fig. 14), but little management, other than fencing, has been

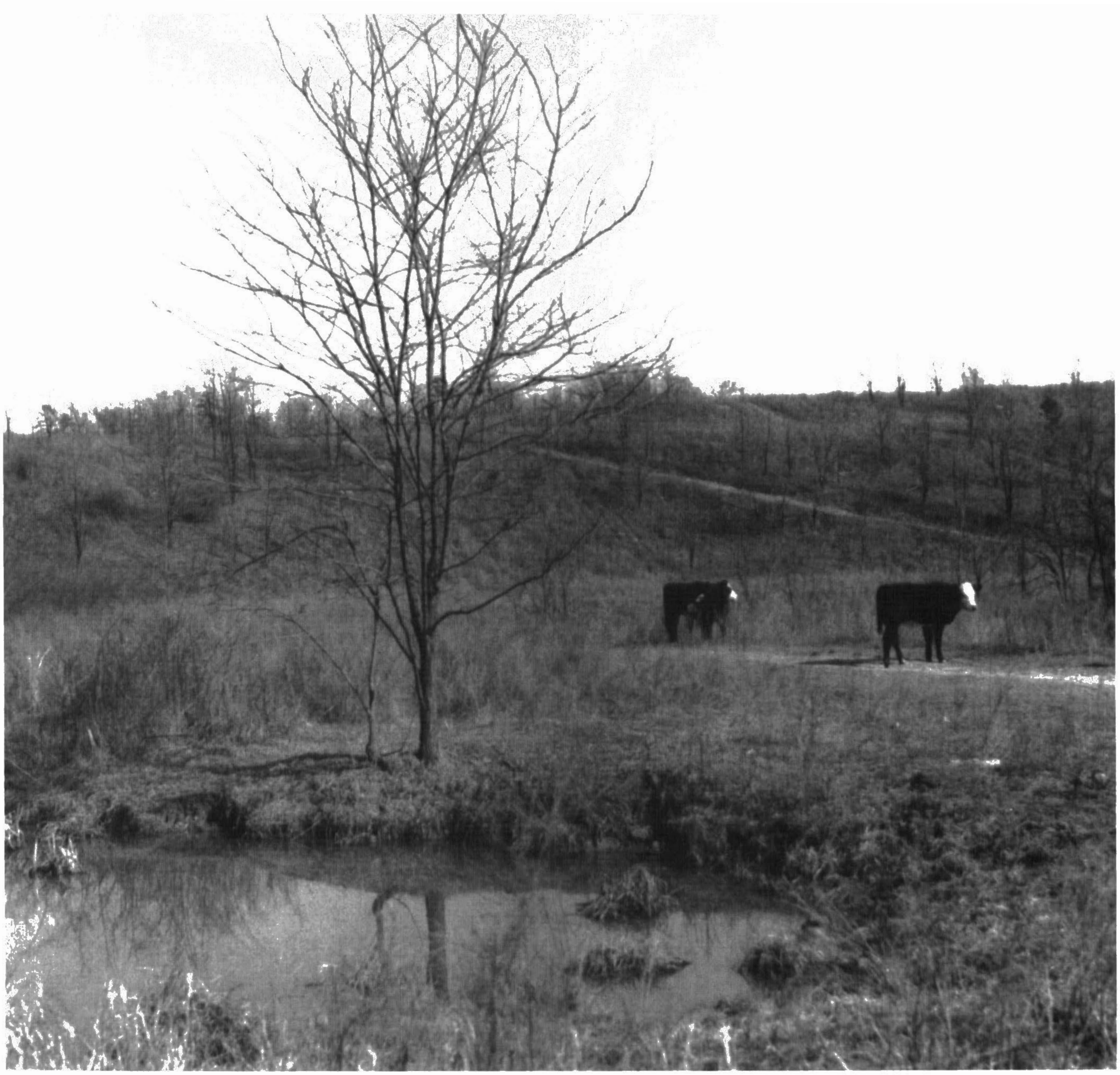


Figure 14.—An area of Kaymine, Bethesda, and Fiveblock soils, 0 to 20 percent slopes, stony, used as pasture. This unit can be used as pasture if roads and livestock water are available.

applied. Most areas have been limed and fertilized at least once during reclamation.

These soils are generally not suited to cultivated crops. The rock fragments interfere with tillage, and the lack of moisture during dry conditions makes good yields unlikely.

These soils are suited to pasture and hay. Most of the grasses and legumes grown in the survey area will grow on these soils. The stones on the surface limit the use of tillage implements, and settling is irregular in places. Establishing a permanent cover of vegetation as soon as possible helps to control erosion. Before areas of these soils are seeded, the spoil must be graded so it is smooth enough that equipment can be used to plant, harvest, and maintain the vegetation.

These soils are suited to woodland. Trees commonly planted during reclamation are eastern white pine, black locust, and royal paulownia. Good-quality stock should be planted for maximum survival and growth. Seedling mortality is a management concern. See table 7 for specific information on potential productivity and trees to plant.

Areas that have been graded, seeded, and planted to either herbaceous or woody plants have good potential as wildlife food and cover. Bicolor lespedeza and autumn olive are good choices for providing winter food for birds and small animals. Any planting that provides adequate vegetative cover and helps to control erosion is beneficial to wildlife. Strip plantings of herbaceous plants and trees are more attractive than solid plantings. A good plant cover requires maintenance, including applying fertilizer and reseeding or replanting spots where vegetation has failed to become established.

These soils have moderate or severe limitations as a site for most urban uses. The soils in nearly level or gently sloping areas are suited to building site development. The moderately slow permeability of the Bethesda soil is a severe limitation on sites for septic tank absorption fields. Foundations need extra reinforcement because they are subject to differential settling, especially during the first few years after mining.

These soils are in capability subclass VIs.

KbF—Kaymine, Bethesda, and Fiveblock soils, benched, 2 to 70 percent slopes, stony

These very deep, well drained and somewhat excessively drained, sloping to very steep soils are on ridgetops, benches, hillsides, and head-of-hollow fills in the central and southern parts of the survey area. They formed in a mixture of soil material and material weathered from underlying bedrock in areas that have been strip-mined for coal. Scattered surface stones are common in most areas of this map unit. Slopes are complex. Mapped areas are irregularly shaped, winding bands that follow the ridgetops or the benched contours of hillsides, including the head-of-hollow fills. They range from 5 to about 500 acres in size.

In a typical area, the Kaymine soil makes up about 45 percent of the map unit, the Bethesda soil makes up about 25 percent, and the Fiveblock soil makes up about 20 percent. The pattern and proportion of these soils is not uniform in all mapped areas. Individual areas may contain one, two, or all three soils. This variability is due to differences in parent material and reclamation practices. Individual areas of each soil are generally large enough to be mapped separately, but because of present and predicted uses, the soils were mapped as an undifferentiated unit. Inclusions make up 10 percent of the map unit.

Typically, the surface layer of the Kaymine soil is brown and yellowish brown, mottled very channery loam about 8 inches thick. The fine-earth fraction of the underlying material is yellowish brown and strong brown loam to a depth of about 65 inches. The content of rock fragments in the underlying material ranges from 20 to 50 percent. The rock fragments are dominantly sandstone, siltstone, and shale channers.

Typically, the surface layer of the Bethesda soil is brown channery silt loam about 8 inches thick. The fine-earth fraction of the underlying material, to a depth of more than 65 inches, is brown, dark grayish brown, and yellowish brown loam, clay loam, and silty clay loam. The content of rock fragments in the underlying material ranges from 25 to 75 percent. The rock fragments are dominantly shale, sandstone, and siltstone channers.

Typically, the surface layer of the Fiveblock soil is yellowish brown very channery sandy loam about 9 inches thick. The fine-earth fraction of the underlying material is yellowish brown sandy loam to a depth of more than 65 inches. The content of rock fragments in the underlying material ranges from 30 to 80 percent. The rock fragments are 65 percent or more neutral sandstone. The rest consist of siltstone, shale, or coal.

These three soils are low in natural fertility and very low in organic matter content. Permeability is moderately slow in the Bethesda soil, moderate in the Kaymine soil, and moderately rapid in the Fiveblock soil. The available water capacity is low in all three soils. Surface runoff is slow or medium in gently sloping and sloping areas and rapid or very rapid in steep and very steep areas. The root zone in the soils is deep, but the rock fragments hinder penetration by plant roots. Depth to bedrock ranges from 4 to 20 feet.

Included with these soils in mapping are small areas of Dekalb, Gilpin, Latham, and Marrowbone soils on undisturbed ridgetops; small areas of Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils on undisturbed hillsides; and, mostly in Morgan County, areas of a nonacid soil that has more clay in the subsoil than is typical for the Kaymine soil. Also included are areas of soils that have very strongly acid and neutral layers in the same profile; areas of extremely acid soils that are toxic to plants; areas of soils that are slightly alkaline; a few areas of soils that are less than 5 feet deep over bedrock; and a bedrock escarpment, 30 to 75 feet high, on some of the older benches. The escarpment is locally known as a highwall. Some areas of soils do not have a protective cover of vegetation because they have been severely eroded, deeply gullied, or only recently mined. Many small bodies of water, adjacent to the highwall or in drainageways, are in this unit.

In most of the recently disturbed areas, the Kaymine, Bethesda, and Fiveblock soils have been shaped and seeded to grasses and legumes or planted to black locust, autumn olive, or pines. In some of the older disturbed areas, the soils have revegetated by natural processes. Many of the mined areas in the southern part of Magoffin County are used as pasture, but little management, other than fencing, has been applied. These soils are generally not suited to cultivated crops, hay, or pasture because the stones on the surface and the steep and very steep slopes limit the use of tillage and mowing equipment; however, the soils in the gently sloping to moderately steep areas are suited to hay and pasture. Even after extensive grading and smoothing, the soils on steep and very steep slopes require very heavy applications of fertilizer and, in some areas, lime to establish stands of grasses and legumes that can withstand mowing or grazing. Most of the grasses and legumes grown in the survey area will grow on these soils. The stones on the surface limit the use of tillage implements, and settling is irregular in places. Establishing a permanent cover of vegetation as soon as possible helps to control erosion. Before areas of these soils are seeded, the spoil must be graded so it is smooth enough that equipment can be used to plant, harvest, and maintain the vegetation.

These soils are suited to woodland. Eastern white pine, black locust, royal paulownia, and shortleaf pine are the preferred trees for planting, especially on cool aspects. Seedling mortality is a management concern. Because of the short, steep slopes, planting and harvesting equipment generally cannot be used until the soils have been graded and smoothed. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

These soils have mixed potential for providing adequate wildlife habitat. Areas that have been graded, seeded, and planted to either herbaceous or woody plants have good potential as wildlife food and cover. Bicolor lespedeza and autumn olive are good choices for providing winter food for birds and small animals. Wildlife plantings should consist of herbaceous plants, trees, and shrubs that provide food and cover; however, any planting that provides adequate vegetative cover and helps to control erosion is beneficial to wildlife. Strip plantings of herbaceous plants and trees are more attractive than solid plantings. A good plant cover requires maintenance, including applying fertilizer and reseeding or replanting spots where vegetation has failed to become established.

Most areas of these soils are generally not suited to urban uses because of the steep and very steep slopes. A few of the gently sloping to moderately steep areas may have some potential as building sites. Differential settling and slippage are management concerns.

These soils are in capability subclass VIIs.

KfF—Kimper-Fedscreek complex, 30 to 80 percent slopes, stony

These very deep, well drained, steep and very steep soils are in the southern part of Magoffin County on hillsides that have cool aspects. The Kimper soil is in coves, on benches, and on concave footslopes. The Fedscreek soil is on linear side slopes, benches, and convex footslopes. The hillsides are dissected by a dendritic drainage pattern of small drainageways that start near the ridgetops and eventually join larger streams. Areas between the drainageways are characterized by sharp nose slopes. Scattered stones and boulders are throughout areas of the map unit but are more common in drainageways and on benches. Because much of the acreage of these soils was once cleared and used for cultivated crops and pasture, eroded spots and piles of rubble are common even in heavily wooded areas. These soils are so closely intermingled that they could not be separated at the scale selected for mapping. Mapped areas are wide bands separated from warm aspects by narrow ridgetops. They range from 5 to about 600 acres in size.

Kimper and similar soils make up about 45 percent of the map unit, and Fedscreek and similar soils make up about 30 percent. Included soils make up the remaining 25 percent.

Typically, the surface layer of the Kimper soil is very dark grayish brown fine sandy loam about 6 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is dark brown channery fine sandy loam. The lower part, to a depth of about 50 inches, is yellowish brown channery fine sandy loam and channery loam. The substratum is yellowish brown and light brownish gray channery sandy loam. Bedrock is at a depth of more than 80 inches. In some areas the surface layer is more than 10 inches thick. In other areas the subsoil has more rock fragments.

The Kimper soil is high in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is medium. The root zone is very deep and is easily penetrated by plant roots. Depth to bedrock ranges from 60 to 100 inches or more.

Typically, the surface layer of the Fedscreek soil is dark brown channery loam about 3 inches thick. The upper part of the subsoil, to a depth of about 17 inches, is brownish yellow and yellowish brown sandy loam. The next part, to a depth of about 45 inches, is yellowish brown channery sandy loam and very channery sandy loam. The lower part is yellowish brown very stony sandy loam. Bedrock is at a depth of more than 80 inches. In some areas the subsoil is mixed colluvium deposited over silty or clayey residuum. In other areas the depth to bedrock is 40 to 60 inches.

The Fedscreek soil is medium in natural fertility and moderate in organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is very deep and is easily penetrated by plant roots. Depth to bedrock is more than 60 inches.

Included with these soils in mapping are small areas of Dekalb, Gilpin, and Marrowbone soils on the upper side slopes and nose slopes; areas of Grigsby and Orrville soils in narrow drainageways; and areas of Shelocta and Hazleton soils on hillsides. The Shelocta soils make up about 10 percent of hillsides in areas with warm aspects and the Hazleton soils make up about 5 percent. Also included are areas of a moderately deep soil on hillsides that have been undercut by streams and a moderately deep soil on head slopes of drainageways. The soil on hillsides formed in material weathered from shale, and the soil on head slopes has a thick, dark surface layer. Individual areas of included soils commonly are less than 5 acres in size.

These Kimper and Fedscreek soils are mainly used as woodland. They are forested with secondary growth hardwoods and some scattered plantations of pine.

These soils are generally not suited to cultivated crops, hay, or pasture because of the steep slopes, the hazard of erosion, rock outcrop, and the stones on the surface.

These soils are suited to woodland. Yellow-poplar, white basswood, sweet birch, northern red oak, black locust, cucumbertree, white ash, and sugar maple are native trees. Understory plants include Virginia creeper, spicebush, ginseng, jewelweed, violets, wood nettle, black snakeroot, jack in the pulpit, yellow mandarin, Christmas fern, poison ivy, waterleaf, bedstraw, bloodroot, sweet anise, pawpaw, grape fern, wood anemone, maidenhair fern, silvery gladefern, wood sorrel, wild geranium, and Solomons seal. Yellow-poplar, white oak, northern red oak, black walnut, and eastern white pine are preferred trees for planting. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, and plant competition are the main concerns in managing timber. Steep skid trails, roads, and firebreaks are subject to rilling and gullying unless they are protected by adequate water bars or plant cover, or both. The main limitation affecting harvest is the steep and very steep slopes. Using standard wheeled and tracked equipment when the soils are wet results in the formation of ruts and in compaction. Puddling can also occur. Cable yarding systems are safer than standard wheeled and tracked equipment, minimize damage to the soil, and help to maintain productivity. Reforestation after harvest must be managed carefully to reduce plant competition.

These soils are generally not suited to urban uses because of the steep and very steep slopes, the hazard of erosion, and the stones on the surface.

These soils are in capability subclass VIIe.

Kn—Knowlton silt loam, rarely flooded

This very deep, poorly drained, nearly level soil is on low stream terraces, in sloughs, and in abandoned channels along the Licking River and larger tributary streams throughout the survey area. Slopes are smooth or slightly concave and range from 0 to 2 percent. Mapped areas are irregular ovals or are narrow or broad bands that are commonly adjacent to streams. They range from 4 to about 50 acres in size.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of more than 80 inches. The upper part of the subsoil, to a depth of about 19 inches, is light brownish gray silt loam. The lower part, to a depth of more than 80 inches, is gray silt loam. In some areas drainage has been improved. In other areas suitable outlets for drainage are not available.

The Knowlton soil is medium in natural fertility and low in organic matter content. Permeability is slow, and available water capacity is high. Surface runoff is slow. The soil is subject to rare flooding in most areas, but the flooding generally is brief in duration. Frequency of the flooding ranges from none to five times in 100 years. The soil is easy to till but must be worked only when it is dry to minimize crusting and puddling. The root zone is deep, but the wetness limits penetration by plant roots. The water table is within a depth of 1 foot late in winter and in spring, which is commonly well into the growing season.

Included with this soil in mapping are small areas of Grigsby and Orrville soils in drainageways and areas of Cotaco and Morehead soils on low, convex mounds or stream terraces. These soils make up about 10 percent of the map unit. Individual areas commonly are less than 2 acres in size.

This Knowlton soil is used mainly for hay and pasture. In a few areas, a drainage system has been installed and cultivated crops, mainly corn, are grown. Most areas of the soil meet the criteria for wetlands.

If drained, this soil is suited to cultivated crops. In undrained areas, however, it is generally not suited because of the seasonal high water table. Tile drainage lines and open ditches are commonly used to help control the wetness. Even in drained areas, the soil generally remains too wet to plow for several days longer than the better drained soils in the survey area, resulting in delayed planting. Moderate yields can be obtained in years with below average rainfall. Crops respond favorably to fertilizer and lime. Applying a system of conservation tillage, returning crop residue to the soil, and planting cover crops help to maintain tilth and organic matter content.

This soil is suited to hay and pasture. Plants that can tolerate the wetness should be selected for planting. They include tall fescue, reed canarygrass, big bluestem, alsike clover, and ladino clover. Reed canarygrass grows exceptionally well in the wettest areas because it is tolerant of standing water. Both tall fescue and reed canarygrass form a sod firm enough for cattle to graze without excess miring. Deep-rooted plants, such as alfalfa, are not recommended on this soil. High yields of water-tolerant pasture and hay plants can be obtained if the soil is properly managed. Measures that prevent overgrazing and maintain good stands are needed. Overgrazing weakens stands and allows weeds to grow. Rushes and sedges are common in overgrazed areas and in unimproved areas. Applications of lime and fertilizer, proper stocking rates, a rotation grazing system, and weed control are important practices for maintaining high-quality forage.

This soil is suited to woodland, although most of it has been cleared. In an average stand that is fully stocked, pin oak can reach a height of about 96 feet in 50 years. The main management concerns are the equipment limitation, the hazard of windthrow, and plant competition. The seedling mortality rate can be high because of standing water and the seasonal high water table. A desirable stand can be established through reinforcement planting, or the soil can be ridged and trees planted on the ridges. Excessive rutting and miring can occur if the soil is worked when wet. If possible roads should be built on nearby soils that are less prone to damage. Stands of trees on this soil should be thinned less intensively and more frequently than those in areas where the hazard of windthrow is slight. Eastern white pine, green ash, sweetgum, pin oak, and red maple are the most suitable trees for planting. See table 7 for specific information on potential productivity and trees to plant.

The potential for wetland wildlife habitat is good. The habitat can be maintained or improved by providing food, cover, nesting areas, and den sites. Wood duck boxes should be located near water sources. Pit ponds can be developed to provide water supplies.

This soil is poorly suited to urban uses because of the wetness. The seasonal high water table is a limitation on sites for sanitary facilities.

This soil is in capability subclass IIIw.

LgD—Latham-Gilpin complex, 4 to 20 percent slopes

These moderately deep, well drained and moderately well drained, gently sloping to moderately steep soils are on ridgetops in the northern part of Morgan County and on nose slopes along the Licking River. Slopes are linear or convex. The Latham soil is on smooth crests, convex saddles, and shoulder slopes. The Gilpin soil is on rounded crests and nose slopes. These soils occur in a regular, repeating pattern on the landscape, but they could not be separated at the scale selected for mapping. Mapped areas are narrow, winding bands or ovals. They range from 10 to about 1,400 acres in size.

Latham soil makes up about 50 percent of the map unit, and Gilpin soil makes up about 30 percent. Included soils make up the remaining 20 percent.

Typically, the surface layer of the Latham soil is brown silt loam about 3 inches thick. The upper part of the subsoil, to a depth of about 7 inches, is light yellowish brown silt loam. The next part, to a depth of about 21 inches, is strong brown, mottled silty clay loam. The lower part, to a depth of about 38 inches, is light gray, mottled silty clay. The substratum is soft interbedded shale and siltstone to a depth of about 55 inches. Unweathered shale bedrock is at a depth of about 55 inches. In some areas the subsoil is redder. In other areas the surface layer is eroded.

The Latham soil is low in natural fertility and organic matter content. Permeability is slow, and available water capacity is moderate. Surface runoff is medium or rapid. The soil is easy to till but must be worked only when it is dry to minimize compaction, puddling, and crusting. The root zone is moderately deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone at a depth of about 38 inches. In some areas the subsoil is loam. In other areas the surface layer is eroded.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium or rapid. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Alticrest, Lily, Ramsey, Rayne, and Shelocta soils on ridgetops. Individual areas of inclusions commonly are less than 3 acres in size.

These Latham and Gilpin soils are mainly used for hay or pasture or as woodland. In some small areas they are used for cultivated crops, mainly tobacco.

Most areas of this map unit are poorly suited to cultivated crops, except for in the gently sloping areas on saddles and benches. Erosion is a hazard if conventional tillage is used. Applications of fertilizer and lime are needed to help amend the acid subsoil. Contour farming, stripcropping, conservation tillage, and cover crops reduce the hazard of erosion. Returning crop residue to the soils helps to maintain tilth and organic matter content.

These soils are suited to hay and pasture. Moderate yields can be obtained if the soils are properly managed. The moderately deep root zone and the lack of moisture during dry periods limit production. Plants that can withstand the dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices.

These soils are suited to woodland. Moderate yields can be obtained if proper management practices are applied. Black oak, eastern white pine, black cherry, and shortleaf pine are suitable trees for planting. Plant competition and seedling mortality are management concerns. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The Latham soil is poorly suited to most urban uses because of the slow permeability, the depth to bedrock, the wetness, and the hazard of slippage. The Gilpin soil is suited to some urban uses. The slope and the depth to bedrock are limitations in areas of the Gilpin soil. Limiting site selection to gently sloping areas and using proper design and careful installation procedures can minimize these limitations.

These soils are in capability subclass IVe.

LsE—Latham-Shelocta-Gilpin complex, 12 to 30 percent slopes

These well drained and moderately well drained, moderately steep and steep soils are on hillsides in the northern part of Morgan County and along the Licking River between West Liberty and Salyersville. Slopes are complex. The moderately deep Latham soil is on the upper side slopes, benches, and nose slopes; the deep Shelocta soil is in coves and on side slopes, generally below the Latham soil; and the moderately deep Gilpin soil is on footslopes that have been undercut by streams, on head slopes of drainageways, and in areas underlain by sandstone or siltstone on the upper side slopes. These soils occur in a regular, repeating pattern on the landscape, but it was not practical to separate them at the scale selected for mapping. Mapped areas are wide bands that include some narrow ridgetops. They range from 12 to about 3,000 acres in size.

Latham soil makes up about 30 percent of the map unit, Shelocta soil makes up about 30 percent, and Gilpin soil makes up about 25 percent. Included soils make up the remaining 15 percent. A few areas of this map unit, mostly in Magoffin County and in the southern part of Morgan County, have higher percentages of Shelocta and Gilpin soils than is typical for the rest of the survey area. Onsite investigation may be necessary to determine the dominant soils in these areas.

Typically, the surface layer of the Latham soil is brown silt loam about 3 inches thick. The upper part of the subsoil, to a depth of about 7 inches, is light yellowish brown silt loam. The next part, to a depth of about 21 inches, is strong brown, mottled silty clay loam. The lower part, to a depth of about 38 inches, is light gray, mottled silty clay. The substratum is soft interbedded shale and siltstone to a depth of about 55 inches. Unweathered shale bedrock is at a depth of about 55 inches. In some areas the subsoil is redder. In other areas the surface layer is eroded.

The Latham soil is low in natural fertility and organic matter content. Permeability is slow, and available water capacity is moderate. Surface runoff is medium or rapid. The soil is easy to till but must be worked only when it is dry to minimize crusting, puddling, and compaction. The root zone is moderately deep and is easily penetrated by plant roots.

Typically, the surface layer of the Shelocta soil is dark brown silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is yellowish brown silt loam. The lower part, to a depth of about 43 inches, is strong brown silt loam. The substratum is yellowish brown silt loam. Soft siltstone bedrock is at a depth of about 59 inches. In some areas the subsoil is loam. In other areas depth to bedrock is more than 60 inches.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium or rapid. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum, to a depth of about 32 inches, is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas the surface layer is eroded.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium or rapid. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Grigsby, Orrville, Marrowbone, and Rayne soils. Grigsby and Orrville soils are in narrow drainageways. They make up as much as 5 percent of some areas. Marrowbone soils are on the upper side slopes. Rayne soils are on narrow benches on sloping and moderately steep hillsides. Individual areas of included soils commonly are less than 3 acres in size.

These Latham, Shelocta, and Gilpin soils are primarily used for hay, pasture, or woodland (fig. 15). In some small areas, mainly on sloping benches, footslopes, or included ridgetops, they are used for cultivated crops, mostly tobacco.

Most areas of this map unit are not suited to cultivated crops, except for areas on sloping and moderately steep benches, nose slopes, and footslopes. Erosion is a hazard if conventional tillage is used. Applications of fertilizer and lime are needed to amend the acid subsoil. Contour farming, stripcropping, conservation tillage, and cover crops reduce the hazard of erosion. Including grasses and legumes in a long crop rotation and returning crop residue to the soils help to maintain tilth and organic matter content.

These soils are suited to hay and pasture. Moderate yields can be obtained if the soils are properly managed. The moderately deep root zone in the Latham and Gilpin soils and the lack of moisture during dry periods limit production. Plants that can withstand the dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for producing quality forage.

These soils are suited to woodland. Moderate yields can be obtained if proper management practices are applied. Black oak, eastern white pine, yellow-poplar, black cherry, and shortleaf pine are suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on potential productivity and trees to plant.

The Latham soil is poorly suited to most urban uses because of the slow permeability, the slope, the depth to bedrock, and the hazard of slippage. The Gilpin soil is poorly suited because of the slope and the depth to bedrock. The Shelocta soil is suited to most urban uses; however, the slope is a severe limitation affecting septic tank absorption fields and building site development. Limiting site selection to moderately steep areas and using proper design, proper site preparation, and careful installation procedures can minimize these limitations.

These soils are in capability subclass VIe.

LyD—Lily sandy loam, 6 to 20 percent slopes

This moderately deep, well drained, sloping and moderately steep soil is on narrow ridgetops in the northwestern part of Morgan County and on a few nose slopes along the Licking River in Magoffin County. Slopes are linear or convex and are influenced by a dendritic drainage pattern. Mapped areas are narrow bands or small ovals. They range from 10 to about 80 acres in size.

Typically, the surface layer is yellowish brown sandy loam about 3 inches thick. The upper part of the subsoil, to a depth of about 8 inches, is brownish

Figure 15.—An area of Latham-Shelocta-Gilpin complex, 12 to 30 percent slopes. Most areas of these soils in the northern part of Morgan County have been cleared of trees and are used as pasture.

yellow sandy loam. The next part, to a depth of about 30 inches, is strong brown loam and channery loam. The lower part is strong brown, mottled channery loam. Sandstone bedrock is at a depth of about 38 inches.

The Lily soil is medium in natural fertility and low in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Alticrest soils on shoulder slopes; small areas of Latham soils on saddles; broad, smooth areas of Rayne soils on ridgetops; and areas of Gilpin soils on the upper side slopes and on nose slopes. Gilpin soils make up about 10 percent of most areas of this map unit. Also included are areas of Hazleton and Helechawa soils and soils having a stony surface layer that are intermingled with areas of sandstone rock outcrop on the crest of ridgetops and in narrow drainageways. Inclusions make up about 20 percent of the map unit. Most individual areas are less than 3 acres in size.

This Lily soil is mainly used as woodland. It is forested with secondary growth hardwoods. The woodland in Morgan County is mostly managed by the U.S. Department of Agriculture, Forest Service. A few small areas are used as sites for residential development around the city of Salyersville in Magoffin County.

This soil is poorly suited to cultivated crops. Erosion is a hazard if conventional tillage is used. Moderate yields can be obtained if the soil is properly managed. Applications of fertilizer and lime are needed to amend the acid subsoil. Including cover crops, grasses, and legumes in the cropping system reduces the hazard of erosion. Returning crop residue to the soil helps to maintain tilth and organic matter content.

This soil is suited to hay and pasture, although most areas are used as woodland. Moderate yields can be obtained if the soil is properly managed. The moderately deep root zone and the lack of moisture during dry periods limit production. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applications of lime and fertilizer, proper stocking rates, a rotation grazing system, and weed control are important management practices.

This soil is suited to woodland. Eastern white pine, black oak, and shortleaf pine are the most suitable trees for planting. The hazard of erosion, the equipment limitation, and plant competition are management concerns. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

This soil is poorly suited to most urban uses because of the depth to bedrock and the slope.

This soil is in capability subclass IVe.

MgE—Marrowbone-Gilpin-Latham complex, 15 to 30 percent slopes

These moderately deep, well drained and moderately well drained, moderately steep and steep soils are on ridgetops in the northern and western parts of Morgan County. Slopes are linear or convex. The Marrowbone soil is on sharp crests and shoulder slopes and is underlain by sandstone. The Gilpin soil is on rounded crests and nose slopes and is underlain by interbedded sandstone and siltstone. The Latham soil is on saddles and is underlain by interbedded shale and siltstone. These soils occur in a regular, repeating pattern on the landscape, but it was not practical to separate them at the scale selected for mapping. Mapped areas are long, narrow bands. They range from 10 to about 800 acres in size.

Marrowbone soil makes up about 35 percent of the map unit, Gilpin soil makes up about 25 percent, and Latham soil makes up about 20 percent. Included soils make up the remaining 20 percent.

Typically, the surface layer of the Marrowbone soil is dark yellowish brown loam about 3 inches thick. The upper part of the subsoil, to a depth of about 13 inches, is brownish yellow loam. The lower part is yellowish brown channery fine sandy loam. Rippable sandstone is at a depth of about 27 inches. In some areas the subsoil is sandy loam. In other areas it has more rock fragments.

The Marrowbone soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is medium or rapid. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown channery silt loam about 5 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is yellowish brown silt loam. The lower part is yellowish brown channery and very channery silt loam. Fractured sandstone bedrock is at a depth of about 30 inches. In some areas the subsoil is loam. In other areas the surface layer is eroded.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Typically, the surface layer of the Latham soil is brown silt loam about 3 inches thick. The upper part of the subsoil, to a depth of about 7 inches, is light yellowish brown silt loam. The next part, to a depth of about 21 inches, is strong brown, mottled silty clay loam. The lower part, to a depth of about 38 inches, is light gray, mottled silty clay. The substratum is soft interbedded shale and siltstone to a depth of about 55 inches. Unweathered shale bedrock is at a depth of about 55 inches. In some areas the subsoil is redder. In other areas the surface layer is severely eroded.

The Latham soil is low in natural fertility and organic matter content. Permeability is slow, and available water capacity is moderate. Surface runoff is medium or rapid. The soil is easy to till but must be worked when it is dry to minimize compaction, puddling, and crusting. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Helechawa soils on the head slopes of drainageways and Shelocta soils on the upper side slopes. Also included are areas of a shallow, loamy soil on some of the narrow saddles and shoulder slopes and areas of Lily and Ramsey soils. The shallow, loamy soil formed in material weathered from siltstone. Lily and Ramsey soils are intermingled with areas of the Marrowbone soil and are in similar landscape positions. Individual areas of included soils commonly are less than 5 acres in size.

These Marrowbone, Gilpin, and Latham soils are mostly used as woodland. Some areas have been cleared and are used as permanent pasture or homesites.

These soils are not suited to cultivated crops, except for in the included areas of sloping and moderately steep saddles and crests. Erosion is a hazard even on these landforms if conventional tillage is used. Applications of fertilizer and lime are needed to amend the acid subsoil. Contour farming, stripcropping, conservation tillage, and cover crops reduce the hazard of erosion. Including grasses and legumes in a long crop rotation and returning crop residue to the soil help to maintain tilth and organic matter content.

These soils are poorly suited to hay and pasture. Moderate to low yields can be obtained only if the soils are properly managed. The moderately deep root zone and the lack of moisture during dry periods limit production. Plants that can withstand the dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for producing forage.

These soils are suited to woodland. They are commonly forested with upland oaks and scattered plantations of pine. Eastern white pine, shortleaf pine, and black oak are the most suitable trees for planting. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, and plant competition are moderate management concerns on all aspects of these soils. The seedling mortality rate is moderate on warm aspects.

These soils are poorly suited to most urban uses because of the slope and the depth to bedrock. Limiting site selection to moderately steep areas and using proper design, proper site preparation, and careful installation procedures can minimize these limitations.

These soils are in capability subclass VIe.

Mo—Morehead silt loam, rarely flooded

This very deep, somewhat poorly drained, nearly level soil is on low stream terraces, mostly in the northern part of Morgan County. Slopes are smooth and slightly concave and range from 0 to 2 percent. Mapped areas are irregularly shaped bands or small ovals that parallel streams. They range from 5 to about 90 acres in size.

Typically, the surface layer is yellowish brown silt loam about 9 inches thick. The upper part of the subsoil, to a depth of about 30 inches, is yellowish brown, mottled silt loam. The lower part, to a depth of about 40 inches, is light gray, mottled silt loam. The substratum is yellowish brown, mottled silt loam. Bedrock is at a depth of more than 65 inches.

The Morehead soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is slow. The soil is subject to rare flooding; however, flooding generally does not occur during the growing season. The soil is easy to till but should be worked only when it is dry to minimize puddling and crusting. The root zone is very deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Grigsby, Pope, and Orrville soils in narrow drainageways and concave depressions and small areas of Knowlton soils and other poorly drained soils in seepy spots and sloughs. The soils in the seepy spots and sloughs make up as much as 10 percent of some areas. Included soils make up about 20 percent of the map unit. Most individual areas are less than 2 acres in size.

This Morehead soil is used mainly for hay and pasture. In some areas it has been drained and is used for cultivated crops, mainly corn.

This soil is suited to cultivated crops, but the wetness is a limitation. High yields can be obtained in years with below average rainfall or if a drainage system is installed. Applications of lime may be needed to amend the acid subsoil, but the soil should be tested before lime is applied. Many areas have been heavily limed in the recent past and will not require any amendments. Returning crop residue to the soil and using cover crops help to maintain tilth and organic matter content.

This soil is suited to hay and pasture. Plants that can tolerate the wetness should be selected for planting. Deep-rooted plants, such as alfalfa, are not recommended on this soil. High yields of water-tolerant pasture and hay plants can be obtained if the soil is properly managed. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for producing adequate supplies of forage.

This soil is suited to woodland, although most areas have been cleared. Eastern white pine, shortleaf pine, pin oak, sweetgum, and green ash are the most suitable trees for planting. See table 7 for specific information on potential productivity and trees to plant.

This soil is poorly suited to most urban uses because of the wetness and the flooding. The seasonal high water table is a limitation on sites for septic tank absorption fields.

This soil is in capability subclass IIw.

Or—Orrville loam, frequently flooded

This very deep, somewhat poorly drained, nearly level soil is on flood plains along the Licking River and major tributary streams throughout the survey area. Slopes are smooth and slightly concave and range from 0 to 2 percent. Mapped areas are narrow bands that are parallel to streams. They range from 10 to about 50 acres in size.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is yellowish brown loam that has grayish brown sandy loam bedding planes throughout. The lower part, to a depth of about 48 inches, is dark gray, mottled loam. The substratum is dark gray, stratified loam and sandy loam. Bedrock is at a depth of more than 65 inches. In some areas the surface layer and subsoil are silt loam. In other areas drainage is improved.

The Orrville soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate in the upper part of the profile and moderately rapid in the substratum. Available water capacity is high. Surface runoff is slow. The soil is subject to frequent flooding; however, flooding generally does not occur during the growing season and the duration of the flooding is not long. In winter and early spring, the soil is saturated at a depth of 1 to 2 feet. Tillage is often delayed until late in spring. The root zone is deep, but the wetness limits penetration by plant roots.

Included with this soil in mapping are narrow strips of Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils on footslopes and areas of Grigsby soils on streambanks and low, convex mounds on flood plains. Also included are areas of poorly drained, loamy and silty soils in depressions and seepy spots. The loamy and silty soils make up as much as 10 percent of mapped areas. Included soils make up about 15 percent of the map unit. Individual areas commonly are less than 2 acres in size.

Most of the acreage of this Orrville soil is idle land or is being reforested. In some areas the soil is used for hay and pasture. In other areas it has been drained and is used for cultivated crops.

This soil is suited to cultivated crops, but the wetness is a limitation. High yields can only be obtained in years with below average rainfall or if a drainage system is installed. Crops respond favorably to fertilizer, and occasional applications of lime may be needed. Returning crop residue to the soil and using cover crops help to maintain tilth and organic matter content.

This soil is suited to pasture and hay. High yields can be obtained in years of below average rainfall or if the soil is drained. Some hay crops may be damaged by flooding in late winter and early spring. Plants that can tolerate the wetness should be selected for planting. They include tall fescue, reed canarygrass, big bluestem, alsike clover, and ladino clover. Reed canarygrass grows exceptionally well in the wettest areas because it is tolerant of standing water. Both tall fescue and reed canarygrass form a sod firm enough for cattle to graze without excess miring. Deep-rooted plants, such as alfalfa, are not recommended on this soil. Measures that prevent overgrazing and maintain stands are needed. Overgrazing weakens stands and allows weeds to grow. Rushes and sedges are common in overgrazed areas and in unimproved areas. Management practices that maintain fertility, tilth, and organic matter are needed. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for producing adequate yields of forage.

This soil is suited to woodland. Eastern white pine, green ash, and sweetgum are suitable trees for planting. Plant competition and the equipment limitation are management concerns. See table 7 for specific information on potential productivity and trees to plant.

This soil is poorly suited to urban uses because of the wetness and the flooding.

This soil is in capability subclass IIw.

Oy—Orrville-Grigsby complex, 0 to 3 percent slopes, frequently flooded

These very deep, well drained and somewhat poorly drained, nearly level and gently sloping soils are on flood plains throughout the survey area. The Orrville soil is in concave depressions on the sides of valleys or in sloughs that were recently created when streams were channelized. The Grigsby soil is on convex, natural levees adjacent to streams. These soils occur in a regular, repeating pattern on the landscape, but they could not be separated at the scale selected for mapping. Mapped areas are commonly wide bands that make up an entire valley floor, but in places they are narrow and irregular. They range from 5 to about 100 acres in size.

Orrville soil makes up about 50 percent of the map unit, and Grigsby soil makes up about 35 percent. Included soils make up the remaining 15 percent.

Typically, the surface layer of the Orrville soil is dark brown silt loam about 7 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is dark brown, mottled silt loam. The next part, to a depth of about 29 inches, is light brownish gray, mottled silt loam. The lower part, to a depth of about 34 inches, is gray, mottled loam. The substratum is light brownish gray sandy loam. Bedrock is at a depth of more than 65 inches. In some areas the subsoil is loam. In other areas drainage is improved.

The Orrville soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Available water capacity is high. Surface runoff is slow. The soil is subject to frequent flooding; however, flooding generally does not occur during the growing season. In winter and early spring, the soil is saturated at a depth of 1 to 2 feet. Tillage is often delayed until late in spring. The root zone is deep, but the wetness limits penetration by plant roots.

Typically, the surface layer of the Grigsby soil is brown sandy loam about 11 inches thick. The upper part of the subsoil, to a depth of about 30 inches, is yellowish brown sandy loam. The lower part is yellowish brown, mottled sandy loam. Bedrock is at a depth of more than 80 inches. In some areas the surface layer and subsoil are silt loam. In other areas they have more rock fragments.

The Grigsby soil is high in natural fertility and moderate in organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is slow. The soil is subject to frequent flooding; however, flooding generally does not occur during the growing season nor does it last for a long duration. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Rowdy soils on low stream terraces and smooth alluvial fans; areas of Knowlton soils and other poorly drained soils that are ponded or in abandoned stream channels; and areas of soils that have bedding planes of loam and sand throughout and are on streambanks. Rowdy soils make up about 5 percent of most areas of this map unit. Individual areas of included soils commonly are less than 3 acres in size.

These Orrville and Grigsby soils are mostly used as pasture and hay. A few areas are used for cultivated crops, mainly corn.

These soils are suited to cultivated crops and can be cropped year after year. The wetness is a limitation in areas of the Orrville soil. High yields can be obtained if the soil is properly managed, but flooding limits crop production and a drainage system is often needed in areas of the Orrville soil. Crops respond favorably to fertilizer and lime. Management practices that maintain fertility, tilth, and organic matter are needed.

These soils are suited to pasture and hay. High yields can be obtained if the soils are properly managed. The flooding limits production, and tile drainage lines may be necessary to help overcome the wetness in areas of the Orrville soil. Crops respond favorably to fertilizer and lime. Management practices that maintain the desired plants and control weeds are needed.

These soils are suited to woodland. Eastern white pine, yellow-poplar, green ash, and sweetgum are suitable trees for planting on the Orrville soil. Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white oak, northern red oak, and white ash are the preferred species to plant on the Grigsby soil. See table 7 for specific information on potential productivity and trees to plant.

These soils are poorly suited to urban uses because of the flooding. The wetness is an additional limitation in areas of the Orrville soil.

These soils are in capability subclass IIw.

Pe—Pits, quarries

This map unit consists of areas where limestone bedrock has been quarried and a few areas where stockpiles of gravel are stored for processing into asphalt. The original soil and several feet of bedrock commonly have been removed, leaving a pit that has bedrock at the bottom. Pits generally have vertical walls around most of the areas that have been mined.

Included in mapping are mounds of soil, broken pieces of bedrock, and a few mounds of limestone that has been graded into sizes for riprap or road material or for crushing into agricultural lime. The mounds of soil and pieces of bedrock vary in size. Some areas are mostly soil, others mostly rock. The pieces of bedrock are sandstone, shale, or limestone and range from 1 inch to about 3 feet in diameter. Most areas of this map unit support little or no vegetation.

The capability subclass is VIIIs.

Po—Pope loam, frequently flooded

This very deep, well drained, nearly level soil is on flood plains along the Licking River and a few tributary streams in the northern part of Morgan County. Along the Licking River, the slopes form a network of slightly concave swales and small, convex mounds that were formed by overland flow during flooding (fig. 16). In other areas the slopes are smooth and slightly convex. Slopes range from 0 to 2 percent. Mapped areas are wide bands that are adjacent to streams. They range from 5 to about 75 acres in size.

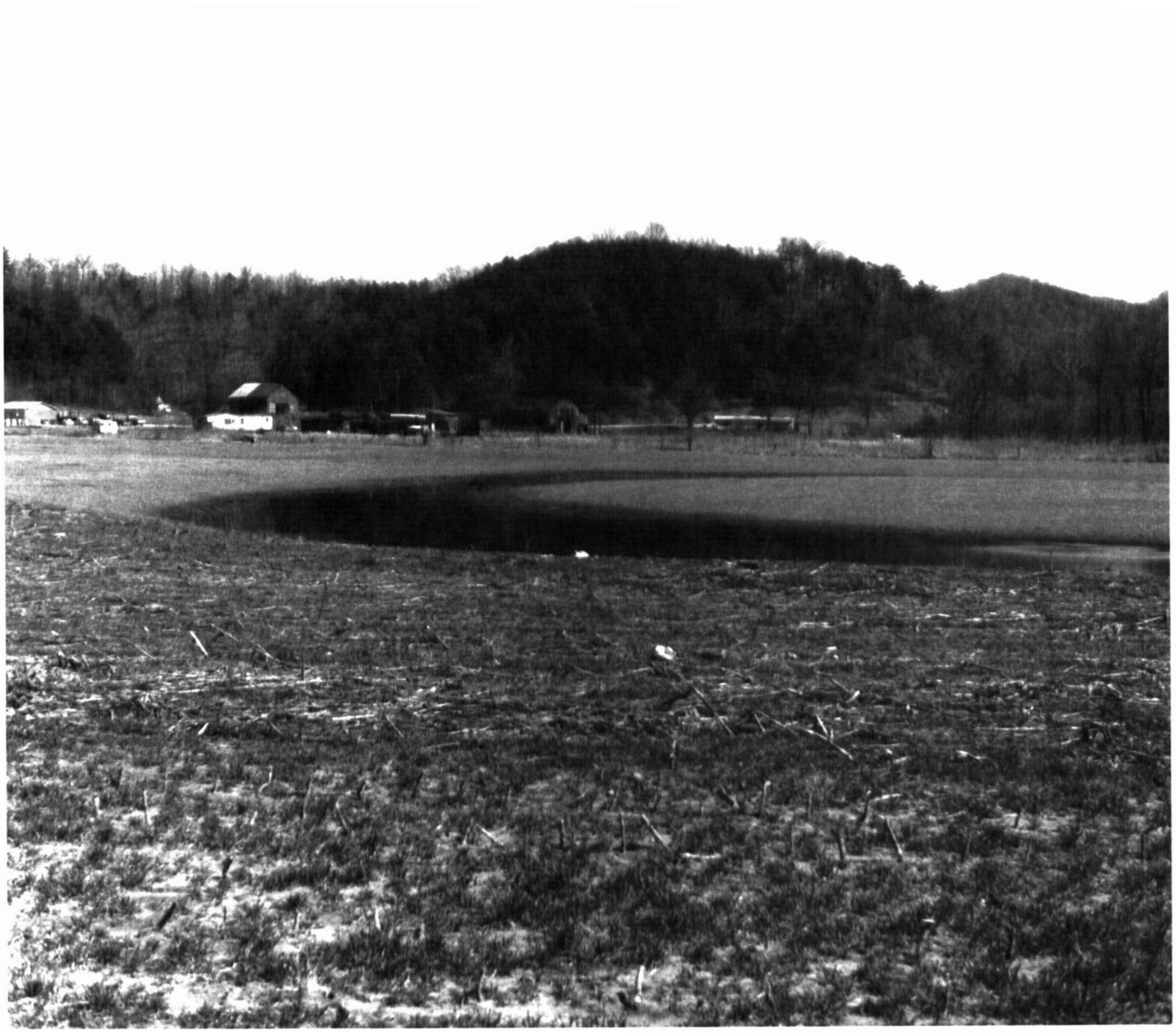


Figure 16.—A pattern of slightly concave swales and low convex mounds characteristic of Pope loam, frequently flooded, along the Licking River. If the map unit is flooded, the swales commonly hold water for days until the floodwater drains into ground-water channels.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil, to a depth of about 45 inches, is yellowish brown loam and sandy loam. The substratum is yellowish brown loamy sand with strata or bedding planes of brownish yellow sandy loam. Bedrock is at a depth of more than 65 inches. In some areas the subsoil is stratified silt loam and loam. In other areas the surface layer is sandy overwash.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is slow. The soil is subject to frequent flooding; however, flooding generally does not occur during the growing season nor does it last for a long duration. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Knowlton and Rowdy soils on low stream terraces and Orrville soils in seepy spots and drainageways. Also included are narrow strips of Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils on footslopes. Included soils make up about 15 percent of the map unit. Most individual areas are less than 5 acres in size.

This Pope soil is used mostly for hay, pasture, or cultivated crops, mainly corn.

This soil is suited to cultivated crops. High yields can be obtained if the soil is properly managed. The soil is subject to frequent flooding, but crops are seldom damaged as most flooding occurs in late winter or early spring and is of short duration. Crops respond favorably to lime and fertilizer. The soil can be cropped year after year if management practices that maintain soil fertility and organic matter content are applied.

This soil is suited to hay and pasture. Grasses and legumes are seldom damaged by flooding of short duration, but pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for maintaining yields of high-quality forage and hay.

This soil is suited to woodland, although most of it is cleared. Yellow-poplar, eastern white pine, and black walnut are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on potential productivity and trees to plant.

This soil is poorly suited to most urban uses because of the flooding.

This soil is in capability subclass IIw.

RgC—Rayne-Gilpin complex, 4 to 12 percent slopes

These well drained, gently sloping and sloping soils are on broad ridgetops in the northwestern part of Morgan County. The Rayne soil is deep and is mostly on gently sloping crests. The Gilpin soil is moderately deep and is on sloping crests and shoulder slopes that have been dissected by narrow drains. Mapped areas are irregular ovals or long, wide bands. They range from 5 to about 110 acres in size.

Rayne soil makes up about 55 percent of the map unit, and Gilpin soil makes up about 25 percent. Included soils make up the remaining 20 percent.

Typically, the surface layer of the Rayne soil is brown silt loam about 11 inches thick. The upper part of the subsoil, to a depth of about 29 inches, is yellowish brown silt loam. The next part, to a depth of about 40 inches, is yellowish brown silty clay loam. The lower part is variegated yellowish brown and strong brown silty clay loam. Siltstone bedrock is at a depth of about 48 inches. In some areas the subsoil is loam. In other areas depth to bedrock is more than 60 inches.

The Rayne soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum, to a depth of about 32 inches, is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas it has fewer rock fragments.

The Gilpin soil is medium in natural fertility and low in organic matter content. Permeability and available water capacity are moderate. Surface runoff is medium. The soil is easy to till and can be worked throughout a moderate range in moisture content. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Lily and Marrowbone soils on shoulder slopes and rounded crests and areas of Latham soils on shoulder slopes and saddles. Latham soils make up as much as 10 percent of some areas. Also included are nearly level areas of a soil that has a brittle, mottled subsoil and is on broad ridgetops where runoff is slow. Most individual areas of included soils are less than 2 acres in size.

These Rayne and Gilpin soils are mainly used as woodland. Most of the forested areas are managed by the U.S. Department of Agriculture, Forest Service. In privately owned areas, these soils have been cleared and are used for hay, pasture, or cultivated crops. A few areas, such as a large part of the town of Ezel, have been developed for commercial and residential purposes.

These soils are suited to cultivated crops. High yields can be obtained on the Rayne soil and moderate yields on the Gilpin soil if the soils are properly managed. Erosion is a hazard if conventional tillage is used. Applications of fertilizer and lime are needed to help amend the acid subsoil. Returning crop residue to the soils and using grasses and legumes in the crop rotation help to maintain tilth and organic matter content.

These soils are suited to hay and pasture. Moderate to high yields can be obtained if the soils are properly managed. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Pastures should be renovated frequently enough to maintain the desired plants. Grazing before plants are well established, overgrazing, or grazing when the soils are wet damages pasture plants and results in a thin cover of grasses and legumes and increased weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for producing quality hay and forage.

These soils are suited to woodland. Shortleaf pine, eastern white pine, white oak, and northern red oak are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on potential productivity and trees to plant.

These soils are suited to some urban uses, but the slope is a limitation. Proper design, site selection, and installation can minimize this limitation.

These soils are in capability subclass IIIe.

RIF—Rigley-Rock outcrop complex, 25 to 60 percent slopes

This map unit occurs as areas of a very deep, well drained, steep and very steep soil intermingled with areas of sandstone rock outcrop. It is along the Licking River and its major tributaries in the northern part of Morgan County and along Mine Fork and Tick Lick Branch in the northeastern part of Magoffin County. The Rigley soil is on footslopes and benches and is generally directly below the sandstone rock outcrop. The Rock outcrop consists of sandstone exposures, bluffs, and large boulders that form nearly vertical escarpments. The Rigley soil and the Rock outcrop occur in a repeating pattern on the landscape, but they are so intricately mixed that they could not be separated at the scale selected for mapping. The upper boundary of the mapped area is the top of the sandstone rock outcrop. The lower boundary is a narrow bench or the valley floor. Slopes are concave or linear. Mapped areas are narrow, winding bands. They range from 12 to about 4,400 acres in size.

Soil patterns are complex because they have been influenced by colluvium derived from the sandstone rock outcrop in the higher landscape positions and deposited onto the footslopes and benches in the lower landscape positions. In the northern part of the survey area, the soils on long footslopes and narrow benches commonly overlie siltstone or shale. These strata of bedrock are tilted to the south and disappear underground in the central part of Morgan County. At the head of narrow drainageways, the footslopes become short and the Rock outcrop is adjacent to the valley floor. The soils in coves, on benches, and in drainageways contain transported rock fragments ranging from quartz pebbles to house-sized sandstone boulders. The largest of these fragments are mapped as Rock outcrop.

Rigley and similar soils make up about 65 percent of the map unit, and Rock outcrop makes up about 15 percent. Included soils make up the remaining 20 percent.

Typically, the surface layer of the Rigley soil is very dark grayish brown and dark grayish brown sandy loam about 8 inches thick. The subsoil, to a depth of about 45 inches, is brownish yellow sandy loam and channery sandy loam. The substratum is yellowish brown and light gray, mottled very channery sandy loam. Sandstone bedrock is at a depth of about 68 inches. In some areas the subsoil is sandy clay loam. In other areas it has more rock fragments.

The Rigley soil is medium in natural fertility and moderate in organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is deep and is easily penetrated by plant roots.

Typically, the Rock outcrop consists of sandstone escarpments and piles of rubble that range from 10 to about 50 feet in height. In places the escarpments are nearly continuous. The Rock outcrop supports little or no vegetation; however, some hardy species of dwarfed trees and undergrowth commonly live in areas of Rock outcrop by sending roots into nearby soils.

Included in this unit in mapping are small areas of Alticrest, Gilpin, Latham, Lily, and Ramsey soils on the upper side slopes and nose slopes; areas of Shelocta soils on the lower side slopes, nose slopes, and benches that do not receive colluvium from sandstone rock outcrop; and, in the northern part of Morgan County, areas of Donahue and Bledsoe soils on some of the lower benches and footslopes. Also included are areas of Helechawa soils intermingled with areas of Rigley soil on footslopes and benches. Helechawa soils make up about 10 percent of most areas of this map unit. Individual areas of included soils commonly are less than 6 acres in size.

This map unit is mostly used as woodland. A large portion of the unit is managed by the U.S. Department of Agriculture, Forest Service, and the U.S. Army Corps of Engineers. A few scattered homesteads or vacation cottages are in areas where roads provide access.

The map unit is generally not suited to hay, pasture, or cultivated crops because of the steepness of slope, the equipment limitation, and a severe hazard of erosion.

This Rigley soil is suited to woodland. Eastern hemlock, yellow-poplar, American beech, and northern red oak are common trees. The preferred trees for planting are white oak, eastern white pine, and northern red oak. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, seedling mortality, and plant competition are the main concerns in managing timber. Steep skid trails and roads are subject to rilling and gullying unless they are protected by adequate water bars or plant cover, or both. The steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable skidding generally is safer and disturbs the soil less than using wheeled and tracked equipment. Seedling mortality generally is severe on warm aspects in summer because of high temperatures and inadequate moisture in the soil. Reforestation after harvest must be managed carefully to minimize undesirable plant competition.

This map unit is not suited to urban uses because of the steepness of slope.

The Rigley soil is in capability subclass VIIe. The Rock outcrop is in capability subclass VIIIs.

RnD—Riney-Ezel complex, 6 to 20 percent slopes

These deep and very deep, well drained, sloping and moderately steep soils are on strath terraces that cap narrow ridgetops and nose slopes along the Licking River. Slopes are short and convex. The Riney soil is on crests and narrow saddles, generally above the Ezel soil. The Ezel soil is on shoulder slopes and the upper side slopes. These soils occur in a regular, repeating pattern on the landscape, but they could not be separated at the scale selected for mapping. Mapped areas are small ovals or narrow bands. They range from 5 to about 75 acres in size.

Riney soil makes up about 50 percent of the map unit, and Ezel soil makes up about 40 percent. Included soils make up the remaining 10 percent.

Typically, the surface layer of the Riney soil is dark yellowish brown loam about 7 inches thick. The subsoil, to a depth of about 45 inches, is yellowish red loam, clay loam, and sandy clay loam. The substratum is yellowish red, mottled sandy loam. Sandstone bedrock is at a depth of more than 65 inches. In some areas the subsoil is silt loam. In other areas it is thicker than 45 inches.

The Riney soil is medium in natural fertility and low in organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Typically, the surface layer of the Ezel soil is dark brown loam about 11 inches thick. The upper part of the subsoil, to a depth of about 39 inches, is brownish yellow loam. The lower part, to a depth of about 47 inches, is brownish yellow, mottled loam. The substratum is brownish yellow, very pale brown, and strong brown loam. Sandstone bedrock is at a depth of about 53 inches. In some areas the subsoil is silt loam. In other areas the surface layer is eroded.

The Ezel soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Shelocta soils on the upper side slopes and Latham soils on saddles. Also included are areas of a loamy soil that formed in alluvium on some shoulder slopes and is less than 40 inches deep over bedrock and areas of a deep, loamy soil that has gray lithochromic mottles in the subsoil. The deep, loamy soil is on the crest of ridgetops where alluvium has been removed during an earlier cycle of erosion. Most individual areas of included soils are less than 2 acres in size.

These Riney and Ezel soils are used mainly for pasture and hay. In some areas they are used for cultivated crops, mainly tobacco. A few areas are used as woodland.

These soils are suited to cultivated crops, but erosion is a hazard if conventional tillage is used. Cover crops, contour farming, and stripcropping reduce the hazard of erosion. Returning crop residue to the soils and using conservation tillage help to maintain tilth and organic matter content.

These soils are suited to hay and pasture. Moderate to high yields can be obtained if the soils are properly managed. Erosion is a hazard, especially on moderately steep slopes. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for maintaining good stands of hay and pasture.

These soils are suited to woodland, although most areas have been cleared. Yellow-poplar, white pine, shortleaf pine, and northern red oak are suitable trees for planting. The hazard of erosion, the equipment limitation, and plant competition are management concerns. See table 7 for specific information on trees to plant and potential productivity.

These soils are suited to most urban uses. The slope is a management concern in the moderately steep areas. Sites for dwellings should be limited to the sloping areas. The depth to bedrock is a moderate concern on sites for dwellings with basements in areas of the Ezel soil. Proper design, site preparation, and installation can minimize these limitations.

These soils are in capability subclass IVe.

RoB—Rowdy loam, 0 to 4 percent slopes, occasionally flooded

This very deep, well drained, nearly level and gently sloping soil is on low stream terraces and alluvial fans throughout the survey area. Slopes are smooth and slightly convex. Mapped areas are long, narrow bands or irregular ovals that are parallel to streams. They make up an entire valley floor in many areas. They range from 6 to about 800 acres in size.

Typically, the surface layer is dark yellowish brown loam about 8 inches thick. The upper part of the subsoil, to a depth of about 50 inches, is yellowish brown and brown, mottled loam. The lower part is brown and grayish brown loam. Bedrock is at a depth of more than 65 inches. In some areas the surface layer and subsoil are silt loam. In other areas they have more rock fragments.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is slow. Most areas of the soil are subject to occasional flooding; however, flooding generally does not occur during the growing season nor does it last for a long duration. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Whitley soils on low stream terraces, Grigsby soils on flood plains, and Shelocta soils on footslopes. Also included are areas of Orrville soils in seepy spots and drainageways. Orrville soils make up as much as 5 percent of some areas. Included soils make up about 15 percent of the map unit. Most individual areas are less than 2 acres in size.

This Rowdy soil is used for hay, cultivated crops, or pasture. It is also used as a site for homes or buildings on alluvial fans where the soil is less subject to flooding.

This soil is suited to cultivated crops. High yields can be obtained if the soil is properly managed. Erosion is a hazard on some slopes if conventional tillage is used. Crops respond favorably to fertilizer and lime. Returning crop residue to the soil and including cover crops, grasses, and legumes in the crop rotation help to maintain tilth and organic matter content.

This soil is suited to hay and pasture. High yields can be obtained if the soil is properly managed. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for maintaining stands of legumes and grasses.

This soil is suited to woodland, although most of it has been cleared. Yellow-poplar, eastern white pine, and black walnut are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on trees to plant and potential productivity.

This soil is poorly suited to most urban uses. The occasional flooding is a limitation on sites for dwellings and sanitary facilities. Limiting site selection to footslopes and alluvial fans above the flood plain can minimize this limitation.

This soil is in capability subclass IIw.

RyB—Rowdy-Grigsby-Barbourville complex, 0 to 8 percent slopes

These very deep, well drained, nearly level to sloping soils are on valley floors in the eastern part of Morgan County and throughout Magoffin County. Slopes are complex. The Rowdy soil is on slightly convex, low stream terraces and smooth alluvial fans. The Grigsby soil is on nearly level flood plains. Slopes range from 0 to 4 percent in areas of the Grigsby and Rowdy soils. The Barbourville soil is on convex alluvial fans at the mouth of drainageways. Slopes range from 0 to 8 percent in areas of the Barbourville soil. These soils occur in a regular, repeating pattern on the landscape, but it was not practical to separate them at the scale selected for mapping. Mapped areas are long, narrow bands that commonly make up an entire valley floor. They range from 30 to about 350 acres in size.

Rowdy soil makes up about 35 percent of this map unit, Grigsby soil makes up about 25 percent, and Barbourville soil makes up about 20 percent. Included soils make up the remaining 20 percent.

Typically, the surface layer of the Rowdy soil is dark yellowish brown loam about 8 inches thick. The upper part of the subsoil, to a depth of about 50 inches, is yellowish brown and brown, mottled loam. The lower part is brown and grayish brown loam. Bedrock is at a depth of more than 65 inches. In some areas the surface layer and subsoil are silt loam. In other areas they have more rock fragments.

The Rowdy soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is slow or medium. In places the soil is subject to occasional flooding; however, flooding generally does not occur during the growing season nor does it last for a long duration. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Typically, the surface layer of the Grigsby soil is brown sandy loam about 11 inches thick. The upper part of the subsoil, to a depth of about 30 inches, is yellowish brown sandy loam. The lower part is yellowish brown, mottled sandy loam. The substratum, from a depth of 60 to 80 inches, is yellowish brown, mottled sandy loam. Bedrock is at a depth of more than 80 inches. In some areas the surface layer and subsoil are loam. In other areas they have more rock fragments.

The Grigsby soil is high in natural fertility and moderate in organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is slow. In most places the soil is subject to occasional flooding; however, flooding generally does not occur during the growing season nor does it last for a long duration. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Typically, the surface layer of the Barbourville soil is very dark grayish brown loam about 11 inches thick. The upper part of the subsoil, to a depth of about 19 inches, is dark yellowish brown channery sandy loam. The next part, to a depth of about 30 inches, is dark brown channery loam. The lower part of the subsoil and the substratum are yellowish brown channery sandy loam. Bedrock is at a depth of more than 60 inches. In some areas the surface layer has more rock fragments. In other areas it is eroded.

The Barbourville soil is high in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is high. Surface runoff is medium. The soil is subject only to rare flooding because it is on alluvial fans at the mouth of drainageways that are commonly above the flood plain. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Included with these soils in mapping are narrow strips of Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils on footslopes. Also included are areas of sandy, somewhat poorly drained soils on flood plains and areas of recent alluvium, consisting of stratified layers of sandy and loamy material, on streambanks. The somewhat poorly drained soils make up as much as 10 percent of some areas. Individual areas of included soils commonly are less than 2 acres in size.

These Rowdy, Grigsby, and Barbourville soils are used for hay, cultivated crops, or pasture. On footslopes and alluvial fans, areas of these soils and some included soils are used as homesites because they are not generally subject to flooding (fig. 17). A few areas remain in woodland.

These soils are suited to cultivated crops. High yields can be obtained if the soils are properly managed. Erosion is a hazard in sloping areas, and flooding limits production on some flood plains. Crops respond favorably to fertilizer and lime. Returning crop residue to the soils and using grasses and legumes in

Figure 17.—An area of Rowdy-Grigsby-Barbourville complex, 0 to 8 percent slopes, used as a homesite, which is above the flood plain on an alluvial fan at the mouth of a small drainageway. The relatively narrow band of these soils is also used to grow corn and tobacco.

the crop rotation help to maintain tilth and organic matter content.

These soils are suited to hay and pasture. High yields can be obtained if the soils are properly managed. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices.

These soils are suited to woodland, although most areas have been cleared. Yellow-poplar, eastern white pine, and black walnut are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on trees to plant and potential productivity.

Most areas of these Rowdy and Grigsby soils are poorly suited to urban uses because of the flooding; however, areas of the Barbourville soil on alluvial fans and the included soils on footslopes are better suited to development. Selecting landscape positions above the flood plain can minimize the flooding.

These soils are in capability subclass IIw.

ShC—Shelocta silt loam, 6 to 12 percent slopes

This deep, well drained, sloping soil is on footslopes and colluvial fans throughout Morgan County and in the northern part of Magoffin County. Slopes are smooth and concave. Mapped areas are irregular in shape or are small ovals. They range from 5 to about 75 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is yellowish brown silt loam. The lower part, to a depth of about 43 inches, is strong brown silt loam. The substratum is yellowish brown silt loam. Siltstone bedrock is at a depth of about 60 inches. In some areas the subsoil is loam. In other areas the surface layer is eroded.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Barbourville soils on alluvial fans, Allegheny soils on stream terraces, and Gilpin soils on nose slopes and areas of Cotaco soils in narrow drainageways and on gently sloping, low stream terraces. Cotaco soils have a gravelly surface layer. Included soils make up about 15 percent of the map unit. Most individual areas commonly are less than 2 acres in size.

This Shelocta soil is used mainly for pasture and hay. In some areas it is used for cultivated crops, mostly tobacco. Many homesites and farm buildings are located in areas of the soil.

This soil is suited to most cultivated crops. High yields can be obtained if the soil is properly managed. Erosion is a hazard. A crop rotation in which grasses and legumes are grown 2 out of every 4 years is needed if conventional tillage is used. Contour farming, stripcropping, and conservation tillage help to control erosion. In some areas runoff from adjacent hillsides can cause gully erosion and deposit rock fragments on the surface. This runoff can be controlled by diversion ditches or grassed waterways. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soil and using grasses and legumes as cover crops help to maintain tilth and a good supply of organic matter.

This soil is suited to hay and pasture. High yields can be obtained if the soil is properly managed. Improved varieties of grasses and legumes should be selected for planting, and pasture renovation should be frequent enough to maintain the desired plants. Grazing when the soil is saturated damages pasture plants, and overgrazing results in compaction, a sparse vegetative cover, an increase in the runoff rate, and weed competition. Applying lime and fertilizer, using proper seeding rates and mixtures, applying a rotation grazing system, and controlling weeds are important practices for producing high-quality hay and forage.

This soil is suited to woodland. Northern red oak, eastern white pine, and black walnut are suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on trees to plant and potential productivity.

This soil is suited to most urban uses. The slope is a limitation. Proper design, site preparation, and installation can minimize this limitation.

This soil is in capability subclass IIIe.

ShD—Shelocta silt loam, 12 to 20 percent slopes

This deep, well drained, moderately steep soil is on footslopes and benches throughout Morgan County and in the northern part of Magoffin County. Slopes are smooth and concave. Mapped areas are small ovals or irregularly shaped bands. They range from 5 to about 75 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is yellowish brown silt loam. The lower part, to a depth of about 43 inches, is strong brown silt loam. The substratum is yellowish brown silt loam. Siltstone bedrock is at a depth of about 60 inches. In some areas the surface layer and subsoil are loam. In other areas the surface layer is severely eroded.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Allegheny soils on stream terraces; Rayne soils on narrow benches; Gilpin soils on side slopes and nose slopes; and Latham soils and shallow, clayey or loamy soils on narrow ledges. Also included are areas of Orrville and Grigsby soils in sloping drainageways. Gilpin soils make up as much as 10 percent of mapped areas. Gilpin, Latham, and the clayey or loamy soils are commonly in landscape positions higher than those of the Shelocta soil. Included soils make up about 15 percent of the map unit. Most individual areas are less than 5 acres in size.

This Shelocta soil is used mainly for pasture and hay. In some small areas it is used for cultivated crops, mostly tobacco.

This soil is poorly suited to cultivated crops. Erosion is a hazard if conventional tillage is used. Moderate yields can be obtained if the soil is properly managed. Including cover crops, grasses, and legumes in a long crop rotation reduces the hazard of erosion. Applications of fertilizer and lime are needed to amend the acid subsoil. Returning crop residue to the soil helps to maintain tilth and organic matter content.

Keeping drainageways in permanent vegetative cover helps to control gully erosion.

This soil is suited to hay and pasture. Moderate yields can be obtained if the soil is properly managed. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Pasture renovation should be frequent enough to maintain the desired plants. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important practices for maintaining yields.

This soil is suited to woodland. Northern red oak, eastern white pine, shortleaf pine, and black walnut are suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on trees to plant and potential productivity.

This soil is poorly suited to most urban uses. The slope is a limitation. Proper design, site preparation, and installation can minimize this limitation.

This soil is in capability subclass IVe.

SlF—Shelocta-Gilpin complex, 25 to 60 percent slopes

These well drained, steep and very steep soils are on hillsides, mostly in the central and northern parts of Morgan County. The deep Shelocta soil is in concave coves and on benches, side slopes, and footslopes. The moderately deep Gilpin soil is on the upper, convex or linear side slopes. These soils are so intermingled that separating them was impractical at the scale selected for mapping. Mapped areas are wide bands that include some narrow ridgetops. They range from 20 to about 9,000 acres in size.

Shelocta soil makes up about 55 percent of the map unit, and Gilpin soil makes up about 35 percent. Inclusions make up the remaining 10 percent.

Typically, the surface layer of the Shelocta soil is brown silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is yellowish brown silt loam. The lower part, to a depth of about 43 inches, is strong brown silt loam. The substratum is yellowish brown silt loam. Siltstone bedrock is at a depth of about 60 inches. In some areas the surface layer and subsoil are loam. In other areas the surface layer is eroded.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is medium. The root zone is deep and is easily penetrated by plant roots.

Typically, the surface layer of the Gilpin soil is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 14 inches, is yellowish brown silt loam. The lower part, to a depth of about 28 inches, is yellowish brown channery silty clay loam and channery silt loam. The substratum, to a depth of about 32 inches, is yellowish brown extremely channery silt loam. Thinly bedded, rippable siltstone, shale, and sandstone bedrock is at a depth of about 32 inches. It grades to hard sandstone bedrock at a depth of about 38 inches. In some areas the subsoil is loam. In other areas the surface layer is eroded.

The Gilpin soil is medium in natural fertility and moderate in organic matter content. Permeability and available water capacity are moderate. Surface runoff is rapid. The root zone is moderately deep and is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Latham, Marrowbone, Ramsey, and Rigley soils on the upper side slopes, nose slopes, and benches. Also included are small areas of sandstone rubble and rock outcrop on head slopes of drainageways and on the upper side slopes. Most individual areas of inclusions commonly are less than 5 acres in size.

These Shelocta and Gilpin soils are used mainly as woodland. In some areas, mostly in the northern and central parts of Morgan County, they have been cleared and are used for pasture or a limited amount of hay.

These soils are generally not suited to cultivated crops, hay, or pasture because of the steep slopes, a severe hazard of erosion, and the equipment limitation.

These soils are suited to woodland. Eastern white pine, shortleaf pine, and white oak are the most suitable trees for planting. A severe hazard of erosion, the equipment limitation, and plant competition are management concerns. See table 7 for specific information on potential productivity and trees to plant on warm and cool aspects.

The hazard of erosion, the equipment limitation, seedling mortality, and plant competition are the main concerns in managing timber. Steep skid trails and roads are subject to rilling and gullying unless they are protected by adequate water bars or plant cover, or both. The steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable skidding generally is safer and disturbs the soil less than using wheeled and tracked equipment. Seedling mortality generally is severe on warm aspects in summer because of high temperatures and inadequate moisture in the soil. Reforestation after harvest must be managed carefully to minimize undesirable plant competition.

These soils are generally not suited to urban uses because of the steep slopes and the moderate depth to bedrock in areas of the Gilpin soil.

These soils are in capability subclass VIIe.

SpF—Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony

These deep and very deep, well drained and somewhat excessively drained soils are extensively mapped on hillsides in the eastern part of Morgan County and throughout Magoffin County. In the southern part of Magoffin County, they are only mapped on hillsides that have warm aspects. In the central and northeastern parts of the survey area, they are on hillsides that have warm or cool aspects. The landforms are dissected by a dendritic drainage pattern of small drainageways that begin near the ridgetops and empty into small streams on narrow flood plains.

Soil and slope patterns are complex because they have been influenced by the intricate shape and geometric form of the nose slopes, benches, and coves. The Shelocta soil is in coves, on benches, and on concave footslopes; the Helechawa soil in on linear side slopes and benches; and the Hazleton soil is on head slopes of drainageways, on benches, and on convex footslopes. Scattered stones, flagstones, and boulders are throughout the complex but are more common on benches, in drainageways, and in the few areas that remain cleared for pasture (fig. 18). Mapped areas are mostly wide bands that have been separated from narrow ridgetops and the wider valley floors. They range from 50 to about 1,200 acres in size.

Shelocta and similar soils make up about 45 percent of the map unit, Helechawa and similar soils make up about 25 percent, and Hazleton and similar soils make up about 15 percent. Included soils make up the remaining 15 percent. The texture of the subsoil varies in the three soils because they formed in material weathered from interbedded sandstone, shale, siltstone, coal, and limestone. These soils are so closely intermingled that they could not be separated at the scale selected for mapping.

Typically, the surface layer of the Shelocta soil is brown loam about 4 inches thick. The upper part of the subsoil, to a depth of about 9 inches, is reddish yellow loam. The next part, to a depth of about 24 inches, is strong brown channery loam. The lower part, to a depth of about 51 inches, is strong brown channery silt loam and channery silty clay loam. The substratum is yellowish brown, mottled very channery silty clay loam. Fractured shale is at a depth of about 60 inches. In some areas the subsoil is loam throughout the profile. In other areas depth to bedrock is more than 60 inches.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is rapid. The root zone is deep and is easily penetrated by plant roots. Depth to bedrock ranges from 40 to 60 inches.

Typically, the surface layer of the Helechawa soil is dark brown sandy loam about 4 inches thick. The upper part of the subsoil, to a depth of about 8 inches, is dark yellowish brown sandy loam. The next part, to a depth of about 31 inches, is strong brown channery sandy loam. The lower part, to a depth of about 52 inches, is yellowish brown very channery sandy loam. The substratum is yellowish brown extremely channery sandy loam. Bedrock is below a depth of 65 inches. In some areas the subsoil is mixed colluvium over silty or clayey residuum. In other areas depth to bedrock is 40 to 60 inches.

The Helechawa soil is low in natural fertility and moderate or high in organic matter content. Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is rapid. The root zone is very deep and is easily penetrated by plant roots.

Typically, the surface layer of the Hazleton soil is very dark grayish brown loam about 2 inches thick. The upper part of the subsoil, to a depth of about 9 inches, is brownish yellow loam. The next part, to a depth of about 31 inches, is yellowish brown channery and very channery loam. The lower part is yellowish brown extremely channery loam. Fractured sandstone bedrock is at a depth of about 48 inches. In some areas the subsoil is silt loam. In other areas depth to bedrock is more than 60 inches.

The Hazleton soil is low in natural fertility and organic matter content. Permeability is moderately rapid, and available water capacity is low. Surface runoff is rapid. The root zone is deep, but rock fragments hinder penetration by plant roots. Depth to bedrock ranges from 40 to 60 inches.

Included with these soils in mapping are small areas of Dekalb, Gilpin, Latham, Marrowbone, and Ramsey soils on the upper side slopes and on nose slopes; a few small areas of Kimper soils in coves with cool aspects; areas of Grigsby and Orrville soils in narrow drainageways; areas of soils that have a gravelly surface layer and are in narrow drainageways; and areas of Fedscreek soils on benches and footslopes. Fedscreek soils make up about 5 percent of areas of this map unit. They are intermingled with

Figure 18.—After fire has removed the leaves and grass cover, surface stones and boulders are visible in areas of Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony. Pastured areas, such as the one shown in this photograph, commonly have more stones on the surface than wooded areas because livestock dislodge stones from the soil as they graze.

areas of Helechawa and Hazleton soils. Individual areas of included soils commonly are less than 10 acres in size.

The Shelocta, Helechawa, and Hazleton soils are used mainly as woodland. They are forested with secondary growth hardwoods.

These soils are generally not suited to cultivated crops, hay, or pasture because of the steepness of slope, the hazard of erosion, the stones on the surface, and rock outcrop.

These soils are suited to woodland. White oak, black oak, scarlet oak, mockernut hickory, red maple, American beech, and pitch pine are native trees. Isolated stands of red oak, sugar maple, and yellow-poplar are on the lower, more moist sites. Understory plants include tick trefoil, pussytoes, sedum, lousewart, flowering dogwood, redbud, mapleleaf viburnum, gall-of-the-earth, New Jersey tea, panicum, early saxifrage, azalea, greenbrier, blackgum, wild grape, Solomons seal, stinging nettle, and horsebalm.

Eastern white pine, shortleaf pine, and northern red oak are the preferred trees for planting. See table 7 for specific information on potential productivity on warm and cool aspects and for trees to plant.

The hazard of erosion, the equipment limitation, seedling mortality, and plant competition are the main concerns in managing timber. Steep skid trails and roads are subject to rilling and gullying unless they are protected by adequate water bars or plant cover, or both. The steepness of slope restricts the use of wheeled and tracked equipment on skid trails. Cable skidding generally is safer and disturbs the soil less than using wheeled and tracked equipment. Seedling mortality generally is severe on warm aspects in summer because high temperatures cause inadequate moisture in the soil. Reforestation after harvest must be managed carefully to minimize undesirable plant competition.

These soils are generally not suited to urban uses because of the steepness of slope.

These soils are in capability subclass VIIe.

Ur—Udorthents, loamy, 0 to 6 percent slopes

These very deep, well drained, nearly level and gently sloping soils are on flood plains and in reconstructed valleys, which were formed by the dumping and spreading of material that was commonly excavated from nearby hillsides. They are in small, scattered areas throughout the survey area, but most of the acreage is along the Licking River and Burning Fork near Salyersville. Mapped areas are irregular in shape. They range from 3 to about 40 acres in size.

These soils have been so altered or obscured that identification of the original soil features is not possible. A typical profile does not exist because the major soil characteristics vary significantly. In most areas the soils are 5 to 30 feet deep to bedrock and contain large rock fragments, which vary in size, shape, and content.

Included with these soils in mapping are small areas of Grigsby, Rowdy, and Pope soils on low stream terraces and flood plains adjacent to the filled areas. Also included are soils that are on short, steep slopes on the edge of filled areas and that break onto the flood plain below. Included soils make up about 25 percent of the map unit.

In most areas the Udorthents are used as sites for dwellings or commercial buildings. Onsite investigation is necessary to determine the limitations and suitability for any proposed use.

Establishing and maintaining a vegetative cover in unprotected areas and providing for proper disposal of surface water help to control erosion and sedimentation.

These soils are in capability subclass VIs.

W—Water

This map unit consists of areas inundated with water for most of the year. It generally includes rivers, lakes, and ponds.

Cave Run Lake accounts for 998 acres of water in Morgan County. An additional 345 acres is made up of farm ponds, pay lakes, sediment ponds, and the Licking River.

Magoffin County has no large bodies of water. About 65 acres in the county is made up of farm ponds, sediment ponds, the Licking River, and a small portion of Paintsville Lake.

No interpretations are given for this map unit.

WhA—Whitley silt loam, 0 to 3 percent slopes, occasionally flooded

This very deep, well drained, nearly level and gently sloping soil is on low stream terraces along the Licking River and tributary streams throughout the survey area. Slopes are linear or slightly convex. Mapped areas are irregularly shaped bands or are small ovals. They range from 6 to about 75 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 15 inches, is dark yellowish brown silt loam. The lower part is yellowish brown silt loam. Bedrock is at a depth of more than 80 inches. In some areas the surface layer is sandy loam overwash. In other areas the subsoil is silty clay loam.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and available water capacity is high. Surface runoff is slow. The soil is subject to occasional flooding, mostly in areas on the Licking River that are used for backwater storage from Cave Run Lake; however, these areas are not commonly flooded during the growing season or for a long duration. Some areas along tributary streams are not subject to flooding or are only rarely flooded. The soil is easy to till and can be worked throughout a wide range in moisture content. The root zone is very deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Allegheny soils on stream terraces, small areas of Grigsby and Pope soils on adjacent flood plains, and areas of Orrville soils in seepy spots and narrow drainageways. Also included are areas of soils formed in stratified sand and loam in drainageways that empty into the Licking River. Included soils make up about 15 percent of the map unit. Most individual areas commonly are less than 2 acres in size.

This Whitley soil is used for pasture, hay, or cultivated crops, mainly corn and tobacco.

This soil is suited to cultivated crops. High yields can be obtained if the soil is properly managed. Crops respond favorably to fertilizer and lime. Returning crop residue to the soil and including cover crops, grasses, and legumes in the crop rotation helps to maintain good tilth and organic matter content.

This soil is suited to hay and pasture. High yields can be obtained if the soil is properly managed. Pastures should be renovated frequently enough to maintain the desired species. Applying lime and fertilizer, using proper stocking rates, applying a rotation grazing system, and controlling weeds are important management practices for producing high yields.

This soil is suited to woodland, although most of it has been cleared. Eastern white pine, northern red oak, black cherry, and black walnut are the most suitable trees for planting. Plant competition is a management concern. See table 7 for specific information on trees to plant and potential productivity.

This soil is poorly suited to most urban uses. The occasional flooding is a severe limitation on sites for dwellings and sanitary facilities.

This soil is in capability subclass IIw.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 14,000 acres in Magoffin County and 17,000 acres in Morgan County meet the soil requirements for prime farmland. The main crops grown on this land are corn, tobacco, and hay. Some areas are used as pasture. Most areas of this land are along the Licking River and its major tributaries. In places, the flood plains have been filled and the prime farmland is being used for industrial or urban purposes.

The map units in the survey area that are considered prime farmland are listed below. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

The map units that meet the requirements for prime farmland in Magoffin and Morgan Counties are:

AbB Allegheny loam, 2 to 6 percent slopes
CoB Cotaco loam, 1 to 4 percent slopes (where drained)
EgB Ezel-Gilpin complex, 2 to 6 percent slopes
Gr Grigsby sandy loam, 0 to 4 percent slopes, occasionally flooded
Kn Knowlton silt loam, rarely flooded (where drained)
Mo Morehead silt loam, rarely flooded (where drained)
Or Orrville loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
Oy Orrville-Grigsby complex, 0 to 3 percent slopes, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
Po Pope loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
RoB Rowdy loam, 0 to 4 percent slopes, occasionally flooded
RyB Rowdy-Grigsby-Barbourville complex, 0 to 8 percent slopes
WhA Whitley silt loam, 0 to 3 percent slopes, occasionally flooded

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops, Pasture, and Hayland

J. David Stipes, agronomist, Natural Resources Conservation Service, helped to prepare this section.

General management needed for crops, pasture, and hayland is suggested in this section. The crops or pasture and hayland plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Most of the areas in Magoffin and Morgan Counties that are not wooded are used for crops or pasture. About 15,000 acres, or 3 percent of the total acreage in the survey area, is used for crops, mainly corn, hay, or tobacco. Other crops are vegetables, small fruits, tree fruits, and nursery plants. A small acreage is used for tomatoes, strawberries, blackberries, melons, sweet corn, peppers, cabbage, or other vegetables or small fruits. Apples and peaches are the most important tree fruits grown in the survey area. The acreage used for crops and pasture has steadily decreased in the last 20 years. Most steep hillsides that were once used for corn or pasture have reverted to woodland, and other areas have been converted to urban uses.

The potential of the soils for increased production is fair. Nearly 31,000 acres in the survey area meets or has the potential to meet the qualifications for prime farmland. An additional 5,500 acres in sloping areas is suited to crops if the soils are adequately protected from erosion. About 32,000 acres of hilly land is best suited to pasture and hay. Another 3,000 acres has been surface mined for coal and has favorable topography, but surface stones hinder its use as pasture or hayland.

Cropland

Production can be increased by applying the latest crop production technology to all of the cropland in the survey area. Differences in suitability and management result from differences in soil characteristics, such as fertility, erodibility, organic matter content, availability of water for plant growth, drainage, and flooding. Cropping systems, tillage, and field size also are important parts of management. This section describes the general principles of soil management that can be applied widely within the survey area.

Water erosion is a major concern on slopes of more than 2 percent. Loss of the surface layer reduces fertility and available water capacity and results in poor tilth. Erosion is especially harmful to soils that have a root-restricting layer within 40 inches of the surface, such as Gilpin and Latham soils. It is less harmful, though still a concern, on soils that have few root-restricting characteristics, such as Allegheny and Shelocta soils. Applications of lime and fertilizer help to offset the lower fertility level caused by erosion, but overcoming much of the damage is difficult or impractical with conventional methods. A carefully timed crop rotation that includes crop residue and applications of barnyard manure as fertilizer is preferable to continuous cropping of any kind because it helps to control erosion. Controlling erosion minimizes the pollution of streams by sedimentation and thus improves water quality for farm, city, and recreational uses and for wildlife habitat.

Erosion-control practices provide a protective cover of crop residue or vegetation. Properly managed permanent pasture or hay rotations that alternate cultivated crops and meadows help to control erosion. Applying a system of conservation tillage that leaves a protective cover of crop residue on the surface throughout the year can reduce sheet erosion by one-half or more, as compared to fall plowing with a moldboard plow.

No-tillage systems that leave nearly all of the crop residue on the surface reduce the hazard of erosion. Both no-tillage and conservation tillage systems are used in Magoffin and Morgan Counties on highly erodible and nonhighly erodible land. Contour farming and contour stripcropping can be used in fields that have smooth, uniform slopes (fig. 19). Terraces that divert surface runoff to safe outlets can be used in some fields. The use of conservation practices on highly erodible land (HEL) used for cultivated crops has increased because of the USDA compliance provisions.

Parallel terraces can be farmed much more easily than contour terraces. Deep and very deep soils, such as Allegheny and Shelocta soils, are better suited to terraces than soils that have bedrock closer to the surface, such as Gilpin and Latham soils. On the moderately deep soils, the possible losses caused by exposing small infertile areas should be considered when the depth of cut and the design of the terrace system are determined.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. In the uplands most soils used for cultivated crops have a surface layer of silt loam that is low in organic matter content. Examples are Latham and Gilpin soils. Generally, tilling these soils weakens the soil structure and increases the degree of compaction and the extent of surface crusting. Tilling when the soils are too wet can further increase the degree of compaction, even below the plow layer. Subsoiling and varying the depth of plowing minimizes compaction and the formation of traffic pans. Regular additions of crop residue, barnyard manure, and other organic materials improve tilth and minimize surface crusting.

Most of the soils on the flood plains in the survey area have a surface layer of sandy loam or loam that is moderate or high in organic matter content. These soils retain favorable tilth under normal tillage operations, but they are susceptible to compaction beneath the tillage zone.

Soil fertility is medium in most of the soils on the flood plains and low in most of the soils on uplands. A few soils, such as Whitley soils on low stream terraces and Barbourville soils on convex alluvial fans, have high natural fertility. Rayne and Shelocta soils, which are on uplands, have medium natural fertility. Almost all of the soils on uplands are moderately acid or strongly acid in the upper part of the root zone. Applications of lime are needed to raise the pH level of these soils for the adequate growth of most crops. Most of the soils on flood plains are slightly acid to strongly acid, but many areas have been heavily limed during past growing seasons and the levels of acidity may or may not affect crop growth in a given year. On all soils, the amount of lime and fertilizer to be applied should be based on the results of soil tests, the needs of the crops, and the expected level of yields. The Cooperative Extension Service can help to determine the kind and amount of lime and fertilizer to be applied.

Organic matter is an important source of nitrogen for crop growth. Also, it helps to maintain good tilth and the proper rate of water infiltration. The content of organic matter is low in most of the cultivated soils on uplands and moderate in the soils on flood plains. The soils throughout the survey area have low levels of phosphorus and low or moderate levels of potassium unless heavy applications of fertilizer have been applied.

The soils on river bottoms are subject to frequent

Figure 19.—Contour stripcropping of tobacco in an area of Latham-Shelocta-Gilpin complex, 12 to 30 percent slopes. The homes and outbuildings in the background are in an area of Latham-Gilpin complex, 4 to 20 percent slopes.

flooding. The flooding generally occurs between December and June and is of brief duration. Flash flooding, a result of sudden, intensive rainfall, can occur along smaller tributary streams at any time of the year.

In soils that have a high water table, such as Orrville soils, a drainage system is needed to reduce wetness during the growing season. Surface ditches or tile drains can be used if suitable outlets are available. In some areas outlets are not available because the wet areas are too low. Even where outlets are available, draining some of the soils generally is only partly effective. As a result, the soils are best suited to pasture and wetland wildlife habitat. Before draining or altering the natural condition of soils that have a high water table, land users should consult the Natural Resources Conservation Service or other appropriate agency to determine whether drainage practices are restricted by Federal or State regulations.

Pasture and Hayland

Pasture and hayland are important land uses in the survey area. A successful livestock program depends on a forage program that can supply large quantities of homegrown feed of adequate quality. Such a program can furnish as much as 78 percent of the feed for beef cattle and 66 percent for dairy cattle (Evans and Lacefield 1977).

The soils in the survey area vary widely in their ability to produce forage because of differences in depth to bedrock, internal drainage, available water capacity, and many other properties. Grasses and legumes and grass-legume combinations vary widely in their ability to persist and provide forage on different soils. Selecting the plant species or mixture of species appropriate to the specific soil helps to realize the greatest returns and the maximum soil and water conservation.

Nearly level to sloping, deep or very deep, well drained soils, such as Grigsby and Whitley soils, should be planted to the highest producing forage species, such as a mixture of alfalfa and orchardgrass or alfalfa and timothy. Sod-forming grasses, such as tall fescue, are needed to minimize erosion on the steeper soils. Alfalfa can be used with a cool-season grass in areas where soils are at least 2 feet deep and are well drained. On soils that are less than 2 feet deep or are not well drained, clover-grass mixtures or pure grass stands should be used. Legumes can be established through renovation in sod that is dominated by grasses.

Plants should be selected according to the type of soil and the intended use. The plants selected should be those that provide maximum quality and versatility in the forage program. Legumes generally produce higher quality feed than grasses and should be used to the maximum extent possible. The taller legumes, such as alfalfa and red clover, are more versatile than other legumes, such as white clover, which is used primarily for grazing. About 1,300 acres of alfalfa hay is produced annually in Morgan County. Four or five cuttings of alfalfa per year are not uncommon; however, care must be taken to time the last yearly cutting after the first freeze in fall to allow growth regulators within the plants to prepare for winter. Cutting before the first freeze in fall can result in a poor stand life and smaller yields.

Orchardgrass, timothy, and tall fescue are better suited to hay and silage grown in areas of moderately deep soils. Tall fescue is an important cool-season grass that is suited to a wide range of soil conditions. It is used for both pasture and hay. Plant growth occurring from August to November is commonly permitted to accumulate in the field for grazing during late fall and winter. Nitrogen fertilizer is needed for maximum production during this rest period. The desired production levels should determine the rates of application.

Reestablishment of pasture or hayland is needed in some areas of Magoffin and Morgan Counties. In many areas renovation or other improvements, such as brush control and protection from overgrazing, are needed. Renovation is one way to increase the yield of pasture and hay fields and maintain a good stand of grass. It improves the fields by partial destruction of the sod followed by applications of lime and fertilizer and seeding to reestablish desirable forage plants. Including legumes in the grass fields provides high-quality feed. Pastures that are properly managed as part of an intensive grazing program can better accommodate larger stocking rates.

Additional information about pasture and hayland management is available at the local office of the Natural Resources Conservation Service or the Kentucky Cooperative Extension Service.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion (USDA 1961). They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table. If the capability subclass is the same for all of the components in a complex or undifferentiated unit, the capability subclass given is for the whole unit, but if the capability subclass is different, each component's capability subclass is given separately for that unit.

Woodland Management and Productivity

Charlie A. Foster, forester, and Patrick S. Aldridge, soil scientist, Natural Resources Conservation Service, helped prepare this section.

Magoffin and Morgan Counties are in the mixed mesophytic forest region of the eastern deciduous forest, an area characterized by steep slopes and narrow valleys (Braun 1942). Except for in small areas of pasture or small areas recently surface mined for coal, the dominant tree species on steep or very steep hillsides are maple, yellow-poplar, oak, and hickory. Forest land dominates the landscape, covering 157,000 acres in Magoffin County and 189,000 acres in Morgan County. Oak-hickory is the major forest type in both counties, comprising about 85 percent of the acreage of forest land. The lesser forest types, which make up the remaining 15 percent of the acreage, are the pines and northern hardwoods. Sawtimber stands make up 55 percent of the acreage of forest land; poletimber, 36 percent; and saplings and seedlings, 9 percent.

About 88 percent of the forest land in Magoffin County and 95 percent in Morgan County is in small, private land holdings that are essentially unmanaged. The remaining 12 percent in Magoffin County is owned by corporations, and the remaining 5 percent in Morgan County is in the Daniel Boone National Forest, an area of about 25,000 acres in the Cave Run Lake watershed.

Currently, there are two large sawmills and three post mills in the survey area. Tree products include rough sawn lumber, mine timbers, shims, blocking, and pine posts (fig. 20). Some mine timbers and fuelwood are cut by landowners.

Most stands have the capability of producing 50 cubic feet of wood per year, but the average net growth is 31 cubic feet. Many forested areas are understocked with trees or have a high percentage of low-quality trees per acre. Several factors tend to

Figure 20.—Bundles of peeled pines from this mill in Morgan County are ready for shipment to a treatment plant where long lasting wood products, such as landscape timbers and posts, will be manufactured.

prevent good forest management. Many landowners own forest land for 10 years of less or for purposes other than timber production. Logging practices that remove only the highest grades of timber often leave poor stocks for forest regeneration. Tract size and owner objectives also affect management decisions.

About 6 percent of the forest land in the survey area is classified as having very good yearly site productivity (120 or more cubic feet per acre), 16 percent as good (85 to 119 cubic feet per acre), 45 percent as fair (50 to 84 cubic feet per acre), and 33 percent as poor (20 to 49 cubic feet per acre). This indicates that all of the forest land in both counties is producing or is capable of producing wood crops.

Soils vary in their ability to produce trees. Available water capacity and depth of the root zone have major effects on tree growth. Fertility and texture also influence tree growth. Elevation, aspect, and climate determine the kinds of trees that can grow on a site. Elevation and aspect are of particular importance in mountainous areas.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to applications of fertilizer than others, some are more susceptible to landslides and erosion after roads are built and timber is harvested, and some require special reforestation efforts. In the section "Detailed Soil Map Units," the description of each map unit in the survey area suitable for timber includes information about productivity, limitations in harvesting timber, and management concerns in producing timber. Table 7 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation or harvesting activities expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion-control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of moderate or severe indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning harvesting and reforestation activities, or the use of special equipment.

Ratings of *equipment limitation* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, stoniness, and susceptibility of the surface layer to compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment is needed. On the steepest slopes, even tracked equipment cannot be operated and more sophisticated systems are needed. The rating is *slight* if equipment use is restricted by wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are so steep that wheeled equipment cannot be operated safely across the slope, if wetness restricts equipment use from 2 to 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is needed to prevent or minimize compaction. The rating is *severe* if slopes are so steep that tracked equipment cannot be operated safely across the slope, if wetness restricts equipment use for more than 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is needed to prevent or minimize compaction. Ratings of moderate or severe indicate a need for woodland managers to choose the best suited equipment and to carefully plan the timing of harvesting and other management activities.

Ratings of *seedling mortality* refer to the probability of the death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall, as influenced by kinds of soil or topographic conditions. Seedling mortality is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, rooting depth, and the aspect of the slope. The mortality rate generally is highest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of moderate or severe indicate that it may be necessary to use containerized or larger than usual planting stock or to make special site preparations, such as bedding, furrowing, installing a surface drainage system, and providing artificial shade for seedlings. Reinforcement planting is often needed if the risk is moderate or severe.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. Plant competition is more severe on the more productive soils, on poorly drained soils, and on soils having a restricted root zone that holds moisture. The risk is *slight* if competition from undesirable plants hinders adequate natural or artificial reforestation but does not necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants hinders natural or artificial reforestation to the extent that intensive site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A moderate or severe rating indicates the need for site preparation to ensure the development of an adequately stocked stand. Managers must plan site preparation measures to ensure reforestation without delays.

The *potential productivity* of *common trees* on a soil is expressed as a *site index* and as a *volume* number. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate. The first tree listed for each soil under the column "Common trees" is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil. The estimates of the productivity of the soils in this survey area are mainly based on regional studies (Beck 1962; Broadfoot and Krinard 1959; Coile and Schumacher 1953; Defler n.d.; Doolittle 1960; Illick and Aughanbaugh 1930; Kellogg 1939; Nelson, Clutter, and Chaiken 1961; Olson 1959; Schnur 1937; and Tennessee Valley Authority n.d.).

The *site index* is determined by taking height measurements and determining the age of selected trees within stands of a given species. This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands.

The *volume* is the yield likely to be produced by the most important trees, expressed in cubic feet per acre per year calculated at the age of culmination of mean annual increment. Cubic feet can be converted to board feet by multiplying by a factor of about 5. For example, a volume of 114 means the soil can be expected to produce about 570 board feet per acre per year.

Trees to plant are those that are used for reforestation or, under suitable conditions, natural regeneration. They are suited to the soils and can produce a commercial wood crop. The desired product, topographic position (such as a low, wet area), and personal preference are three factors among many that can influence the choice of trees for use in reforestation.

Soil and Tree Relationships

A knowledge of soils helps to provide a basic understanding of the distribution of tree species on the landscape and tree growth. Some of these relationships are readily recognized. For example, yellow-poplar grows well on deep or very deep, moist soils, and scarlet and chestnut oaks or pitch and Virginia pines are common where the rooting depth is restricted or the moisture supply is limited. The soil serves as a reservoir for moisture, provides an anchor for roots, and supplies most of the available nutrients. Soil properties that directly or indirectly affect these growth requirements include organic matter content, reaction, fertility, drainage, texture, structure, depth, and landscape position. Elevation and aspect are of particular importance in mountainous areas.

The available water capacity is primarily influenced by texture, organic matter content, rooting depth, and content of rock fragments. In this survey area available water capacity is a limitation affecting tree growth only in shallow soils, such as Ramsey soils, because of the fairly even and abundant rainfall in summer. Changing the physical limitations of the soils is difficult, but timber stand improvement and thinning are useful in management.

The available supply of nutrients affects tree growth. Mineral horizons in the soil are important. Mineralization of the humus releases nitrogen and other nutrients to plants. Calcium, magnesium, and potassium are held within the humus. Very small amounts of these nutrients are made available by the weathering of clay and silt particles. Most of the soils in the uplands have been leached and have only small amounts of these nutrients below the surface layer. Where the surface layer is thin, as in the Hazleton and Marrowbone soils, careful management is needed during site preparation to ensure that the surface layer is not removed or degraded.

The living plant community is part of the nutrient reservoir. The decomposition of leaves, stems, and other organic material recycles the nutrients that have accumulated in the forest ecosystem. Fire, excessive trampling by livestock, and erosion can result in the loss of these nutrients. Forest management should include prevention of wildfires and protection from overgrazing.

Aspect and landscape position influence the amount of available sunlight, air drainage, soil temperature, and moisture retention. North- and east-facing slopes, or cool slopes, are better suited to tree growth than south- and west-facing slopes, or warm slopes. Most of the soils on cool slopes have an A horizon that is thicker and has more humus and clay than that of the soils on warm slopes. The Kimper soils, which are on cool slopes, have a slightly higher capacity to hold water and a much higher capacity to hold nutrients than the soils on warm slopes. The mean annual soil temperature is about 2 degrees F lower on the cool slopes. The difference in temperature is most prevalent during the dormant season. Because less sunlight falls on the canopy in areas of the cool slopes, the air temperature in the canopy and the transpiration rate are lower and thus less water is transpired.

Soils on the lower slopes may receive additional water because of internal waterflow. On the very steep uplands, much of the water movement during periods of saturation occurs as lateral flow within the subsoil.

Soil and air temperatures are lower on the upper slopes than on the lower slopes. Temperature decreases about 1 degree F for every 550-foot increase in elevation. The soils at the base of a warm-aspect hillside receive a shading effect from the cool-aspect hillside. Because the drainageway between the hillsides is so deeply incised and receives little sunlight in winter and much cool air drainage at night, a "spillover" of soils with cool aspect is generally as far as 100 feet above the drainageway or valley floor onto the base of the warm-aspect hillside. This pattern was used to make separations in this survey. As a result, soil lines that divide hillsides follow the drainageways but are mostly at the base of warm-aspect hillsides.

Nutrients, water, and landscape position largely determine which tree species grow on a particular soil. For example, sugar maple-basswood forest grows on soils that have the highest fertility level and moisture content (Muller 1982). Beech forest grows on soils that have a high moisture content and an intermediate fertility level. Chestnut oak-red maple forest grows on soils that have a low fertility level and low moisture content.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In the table, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in the table can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Raymond E. Toor, wildlife biologist, Natural Resources Conservation Service, helped prepare this section.

Magoffin and Morgan Counties have a valuable commodity in their fish and wildlife resources. Streams, rivers, and constructed impoundments provide habitat for fish and waterfowl. The forested areas and interspersed openland provide habitat for woodland wildlife throughout the survey area.

Many of the soils in the survey area are suitable for impounding water. Ponds, small streams, and large impoundments are stocked and managed for largemouth bass, channel catfish, bluegill, walleye, striped bass, and rainbow trout. Blackwater Creek, Caney Creek, Grassy Creek, Lick Creek, Elk Fork, Johnson Fork, Burning Fork, Middle Fork, and Paint Creek are the major tributaries in the survey area. The Licking River is the only major river. Parts of Cave Run Lake and Paint Creek Lake are in the survey area. These two lakes are the only major constructed impoundments in the counties.

Very little aquaculture exists in the survey area. Expansion of aquaculture depends upon adequate water supplies, improved water quality, and market conditions.

The major game species include white-tailed deer, gray squirrel, cottontail rabbit, ruffed grouse, raccoon, and gray and red fox. Bobwhite quail and mourning dove are present in limited numbers. Eastern wild turkey and white-tailed deer are being managed in order to increase their populations throughout eastern Kentucky.

Waterfowl are common in the survey area during their migration period. The wildlife species include mallard, teal, widgeon, and Canada geese. Wood ducks are the more permanent waterfowl residents. They commonly nest along the Licking River.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements (fig. 21), and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrinking and swelling, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

The table also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow

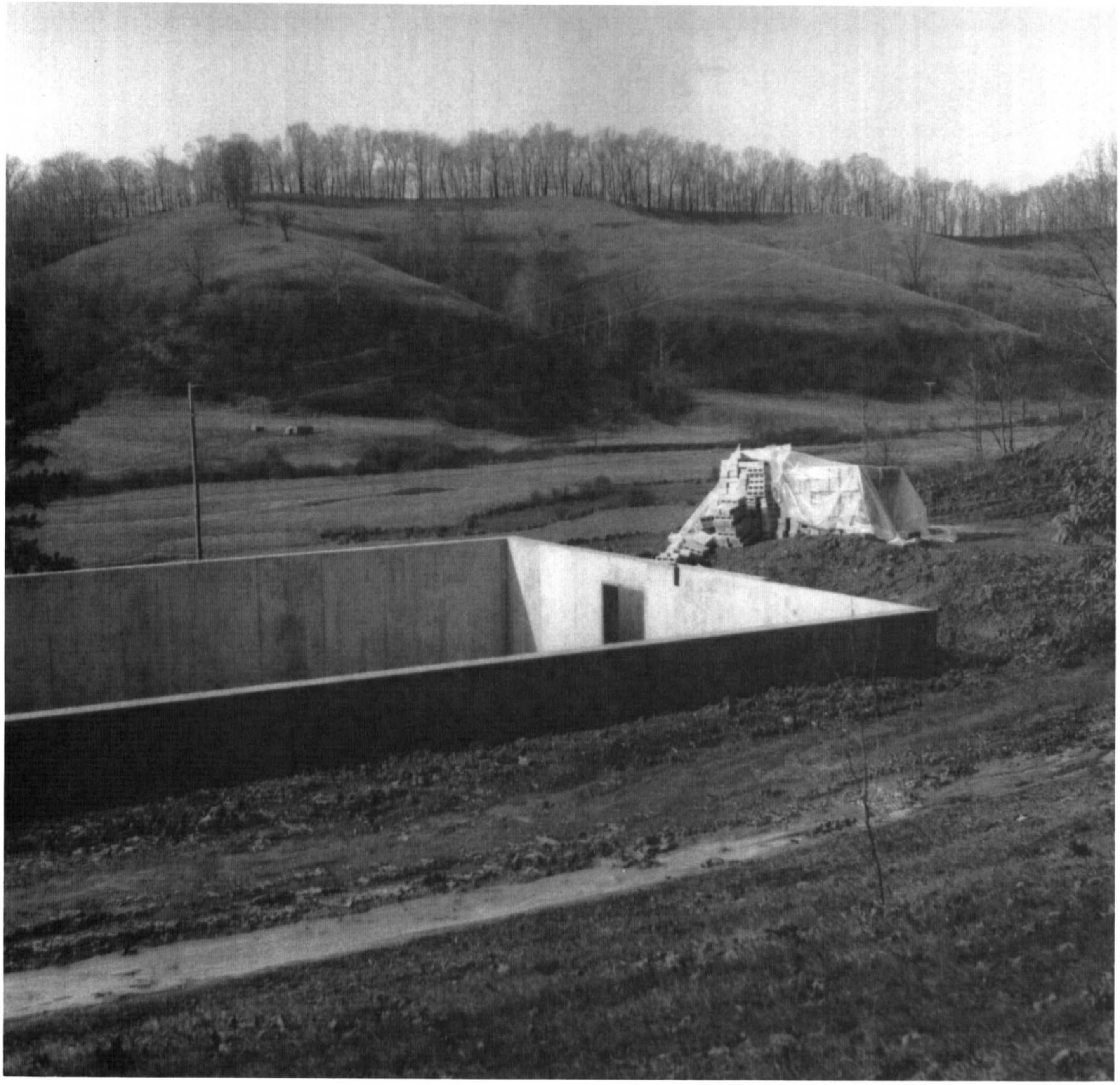


Figure 21.—A single family dwelling under construction in an area of Shelocta silt loam, 6 to 12 percent slopes. The flood plain in the background has been modified by diverting the flow of the stream channel along the base of the hill opposite the homesite. The abandoned stream channel, visible directly to the left of the concrete blocks, is in an area of Orrville loam, frequently flooded.

absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

The table gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in the table are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement, permeability, depth to a high water table or depth of standing water if the soil is subject to ponding, slope, and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas (USDA 1967). Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage *sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields (Uhland and O'Neal 1951).

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on the basis of measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, 6 to 9 percent; and *very high*, more than 9 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.64. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

The table gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in the table are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in the table. An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analyses of several typical pedons in the survey area are given in table 17 and the results of chemical analyses in table 18. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series. They are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the University of Kentucky, Agricultural Experiment Station, Lexington, Kentucky.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (USDA 1996).

Sand—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).
Organic carbon—acid-dichromate digestion, ferric sulfate titration (6A1a).
Extractable acidity—barium chloride-triethanolamine I (6H1a).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).
Cation-exchange capacity—sum of cations (5A3a).
Base saturation—ammonium acetate, pH 7.0 (5C1).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1a).
Available phosphorus—Bray P-1 (6S3).
Field sampling—site selection (1A1).
Field sampling—soil sampling (1A2).
Laboratory preparation—standard (air-dry) material (1B1).
Data sheet symbols (2B).
Particles—greater than 2 mm by field or laboratory weighing (3B1a).
Particles—(specified size) 2 mm (2A2).
Particles—less than 2 mm (2A1).
Extractable bases (5B1a).
Calcium carbonate equivalent—gravimetric (6E1c).

Mineralogy of Selected Soils

The results of mineralogy determinations of several typical pedons are given in table 19. The soils are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were analyzed by the University of Kentucky, Agricultural Experiment Station, Lexington, Kentucky.

The method used in obtaining the data is powder mount, diffractometer recording (7A2g). The code in parentheses refers to a published method (USDA 1996).

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Natural Resources Conservation Service, Soil Mechanics Laboratory, Fort Worth, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Moisture density—T 99 (AASHTO), D 698 (ASTM); and Specific gravity—T 100 (AASHTO), D 854 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aq*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aeric* identifies the subgroup that is drier than is typical for the great group. An example is Aeric Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The Orrville series is an example of a fine-loamy, mixed, nonacid, mesic Aeric Fluvaquent.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA 1975) and in "Keys to Soil Taxonomy" (USDA 1992). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Allegheny Series

The Allegheny series consists of very deep, well drained soils that are moderately permeable. These soils formed in mixed alluvium derived from acid sandstone, siltstone, and shale. They are on stream terraces along the Licking River and major tributaries throughout the survey area. Slopes are smooth and convex and range from 2 to 15 percent. The soils are fine-loamy, mixed, mesic Typic Hapludults (fig. 22).

Allegheny soils are associated on the landscape with Barbourville, Cotaco, Grigsby, Knowlton, Morehead, Orrville, Pope, Rowdy, and Whitley soils. Barbourville soils have a thick, dark surface layer and do not have an argillic horizon. Cotaco soils are moderately well drained. Knowlton soils are poorly drained. Morehead and Orrville soils are somewhat poorly drained. Knowlton, Morehead, and Whitley soils are fine-silty. Grigsby and Pope soils are coarse-loamy. Rowdy soils do not have an argillic horizon.

Typical pedon of Allegheny loam, 6 to 15 percent slopes; 0.5 mile northeast of Lenox, in Morgan County; 1,000 feet south of Elk Fork and 1,100 feet south of Kentucky Highway 172, in a field on a stream terrace; soil map sheet 10; USGS Lenox quadrangle; Kentucky coordinates 2,304,500/168,800:

Ap—0 to 8 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; many fine roots; moderately acid; abrupt smooth boundary.

BE—8 to 12 inches; brown (10YR 5/3) loam; weak fine granular and weak medium subangular blocky structure; very friable; common fine and medium roots; moderately acid; clear wavy boundary.

Bt1—12 to 27 inches; brownish yellow (10YR 6/6) loam; weak medium subangular blocky structure; friable; common fine and medium roots; many faint yellow (10YR 7/6) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—27 to 41 inches; brownish yellow (10YR 6/6) loam; moderate medium subangular blocky structure; friable; few fine roots; many distinct yellowish brown (10YR 5/8) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—41 to 53 inches; yellowish brown (10YR 5/8) loam; weak coarse subangular blocky and prismatic structure; firm; few fine roots; common medium prominent strong brown (7.5YR 5/6) soft masses of iron accumulation with diffuse boundaries in ped interiors; few distinct yellow (10YR 7/6) clay films in ped interiors; very strongly acid; abrupt wavy boundary.

C—53 to 62 inches; variegated yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2) channery sandy loam; massive; extremely firm; 30 percent sandstone channers; very strongly acid; abrupt smooth boundary.

R—62 inches; sandstone bedrock.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 60 inches. The content of quartz pebbles and sandstone channers ranges from 0 to 5 percent in the A horizon, from 0 to 20 percent in the Bt horizon, and from 0 to 35 percent in the C horizon. In unlimed areas reaction ranges from very strongly acid to moderately acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The BE horizon or the BA horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Many thin organic coatings are on the faces of peds in some pedons. The fine-earth fraction is loam, silt loam, or sandy loam.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. The fine-earth fraction is loam, silt loam, sandy clay loam, or clay loam. In some pedons, the lower part of the horizon has subhorizons of sandy loam or the horizon has redoximorphic features in shades of yellow, brown, or gray below a depth of 40 inches.

The C horizon is mottled in shades of brown, yellow, and gray. The fine-earth fraction is loam, sandy loam, sandy clay loam, or loamy sand.

The bedrock is sandstone, siltstone, or shale.

Alticrest Series

The Alticrest series consists of moderately deep, somewhat excessively drained soils that are moderately rapidly permeable. These soils formed in material weathered from acid sandstone. They are on shoulder slopes, side slopes, and narrow benches, commonly above areas of sandstone rock outcrop. They are mostly in the northern part of Morgan County. Slopes are linear or convex and range from 20 to 40 percent. The soils are coarse-loamy, siliceous, mesic Typic Dystrochrepts.

Alticrest soils are mapped in a complex with Ramsey soils. They are also associated on the landscape with Lily and Rigley soils. Ramsey soils are shallow over bedrock. Lily soils have an argillic horizon and are fine-loamy. Rigley soils have an argillic horizon and are very deep.

Typical pedon of Alticrest sandy loam, in an area of Alticrest-Ramsey complex, rocky, 20 to 60 percent slopes; 12 miles northwest of West Liberty, in Morgan County; 200 feet west of Kentucky Highway 519 and 1,000 feet southeast of a gravel quarry, on a wooded side slope; soil map sheet 4; USGS Bangor quadrangle; Kentucky coordinates 2,245,100/194,800:

Oe—1 inch to 0; loose; partially decomposed leaf litter.

A—0 to 5 inches; brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; common fine and few medium roots; 10 percent sandstone channers; strongly acid; clear smooth boundary.

AB—5 to 9 inches; brown (10YR 4/3) sandy loam; many medium distinct brownish yellow (10YR 6/6) lithochromic mottles; weak medium subangular blocky structure; friable; common fine roots; 10 percent sandstone channers; strongly acid; clear smooth boundary.

Bw1—9 to 15 inches; brownish yellow (10YR 6/6) sandy loam; weak medium subangular blocky structure; friable; common fine roots; few medium tubular pores; 10 percent sandstone channers; strongly acid; clear smooth boundary.

Bw2—15 to 22 inches; yellowish brown (10YR 5/6) channery sandy loam; moderate medium subangular blocky structure; friable; few fine roots; 20 percent sandstone channers; very strongly acid; gradual smooth boundary.

BC—22 to 28 inches; yellowish brown (10YR 5/6) channery sandy loam; massive; firm; few fine roots; 20 percent sandstone channers; very strongly acid; gradual smooth boundary.

C—28 to 38 inches; yellowish brown (10YR 5/6) channery sandy loam; massive; firm; few fine roots; 30 percent sandstone channers; very strongly acid; abrupt smooth boundary.

R—38 inches; fractured sandstone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of sandstone channers ranges from 0 to 15 percent in the upper part of the solum and from 0 to 30 percent in the lower part of the solum and in the C horizon. In unlimed areas reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. The fine-earth fraction is sandy loam. The AB horizon, if it occurs, is 1 to 5 inches thick and has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The fine-earth fraction is sandy loam or loam.

The Bw horizon has hue of 10YR and value and chroma of 4 to 6. The fine-earth fraction is sandy loam or loam.

The BC horizon and the C horizon, if it occurs, have hue of 10YR, value of 5 or 6, and chroma of 3 to 6. The fine-earth fraction is loam or sandy loam.

The bedrock is weathered sandstone.

Barbourville Series

The Barbourville series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy alluvium derived from acid sandstone, siltstone, and shale. They are on alluvial fans at the mouth of drainageways in the eastern part of Morgan County and throughout Magoffin County. Slopes are smooth and convex and range from 0 to 8 percent. The soils are fine-loamy, mixed, mesic Typic Haplumbrepts.

Barbourville soils in this survey area are taxadjuncts to the Barbourville series because their control section has less clay than is defined as the range for the series. This difference, however, does not affect use and management of the soils.

Barbourville soils are mapped in a complex with Rowdy and Grigsby soils. They are also associated on the landscape with Allegheny, Cotaco, Knowlton, and Orrville soils. Barbourville soils have a thick, dark surface layer, whereas all of the associated soils have a surface layer that is thinner or lighter in color. In addition, Allegheny, Cotaco, and Knowlton soils have an argillic horizon. Grigsby soils are on flood plains. Knowlton soils are poorly drained. Orrville soils are somewhat poorly drained.

Typical pedon of Barbourville loam, in an area of Rowdy-Grigsby-Barbourville complex, 0 to 8 percent slopes; about 5 miles southeast of Crockett, in Morgan County; 0.7 mile southwest of the junction of Kentucky Highways 172 and 437, on Smith Creek; 100 feet south of Kentucky Highway 437 on an alluvial fan at the mouth of a small drainageway; soil map sheet 15; USGS Dingus quadrangle; Kentucky coordinates 2,356,300/163,700:

A—0 to 11 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak coarse granular structure parting to weak fine subangular blocky; very friable; few fine roots; 10 percent sandstone channers; slightly acid; abrupt wavy boundary.

Bw1—11 to 19 inches; dark yellowish brown (10YR 4/4) channery sandy loam; moderate medium subangular blocky structure; friable; few fine roots; 20 percent sandstone channers; slightly acid; clear smooth boundary.

Bw2—19 to 30 inches; brown (10YR 4/3) channery loam; weak medium subangular blocky structure; firm; few fine roots; 15 percent sandstone channers; strongly acid; clear smooth boundary.

BC—30 to 41 inches; yellowish brown (10YR 5/6) channery loam; weak coarse subangular blocky structure; firm; very few very fine roots; 15 percent sandstone channers; strongly acid; gradual smooth boundary.

C—41 to 65 inches; yellowish brown (10YR 5/6) channery sandy loam; massive; very firm; 15 percent sandstone channers; strongly acid.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock is more than 60 inches. The content of sandstone channers ranges from 0 to 10 percent in the A horizon and from 15 to 35 percent in the Bw and C horizons. In unlimed areas reaction ranges from very strongly acid to moderately acid.

The A or Ap horizon has hue of 10YR, value of 3, and chroma of 1 to 3. The fine-earth fraction is loam.

The BA horizon, if it occurs, has hue of 10YR and value and chroma of 3 or 4. The fine-earth fraction is loam or silt loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth fraction is loam or sandy loam. The lower part of the horizon commonly has mottles in shades of brown or yellow. Gray iron depletions may occur below a depth of 40 inches.

The BC horizon and the C horizon, if it occurs, have colors and textures similar to those of the Bw horizon. They commonly have mottles in shades of brown or yellow. Gray iron depletions may occur below a depth of 40 inches.

Berks Series

The Berks series consists of moderately deep, well drained soils that are moderately rapidly permeable. These soils formed in siltstone residuum that was commonly affected by some downslope movement, particularly near the soil surface. They are on the upper side slopes and nose slopes of hillsides in the northern part of Morgan County. Slopes are linear or slightly convex and range from 40 to 60 percent. The soils are loamy-skeletal, mixed, mesic Typic Dystrochrepts.

Berks soils are mapped in a complex with Cranston soils. They are also associated on the landscape with Bledsoe and Donahue soils. Cranston soils are coarse-loamy. Donahue and Bledsoe soils are in a fine textured family.

Typical pedon of Berks channery silt loam, in an area of Berks-Cranston complex, 40 to 60 percent slopes, very stony; 12 miles north of West Liberty, in Morgan County; 1,000 feet east of Kentucky Highway 519 and 700 feet southeast of a bridge over Cave Run Reservoir, on a very steep, wooded side slope; soil map sheet 4; USGS Bangor quadrangle; Kentucky coordinates 2,246,000/196,800:

A—0 to 5 inches; brown (10YR 5/3) channery silt loam; weak fine and medium granular and weak medium subangular blocky structure; friable; common fine and medium roots; 20 percent siltstone channers; slightly acid; clear smooth boundary.

BA—5 to 9 inches; light yellowish brown (10YR 6/4) very channery silt loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; many medium distinct dark grayish brown (10YR 4/2) coatings on faces of peds and rock fragments; 40 percent siltstone channers; moderately acid; clear smooth boundary.

Bw1—9 to 20 inches; light yellowish brown (10YR 6/4) very channery silt loam; weak fine and medium subangular blocky structure; friable; few fine and medium roots; 45 percent siltstone channers; moderately acid; clear smooth boundary.

Bw2—20 to 33 inches; light brown (7.5YR 6/4) extremely channery silt loam; weak medium subangular blocky structure; friable; few fine and medium roots; 75 percent siltstone channers; moderately acid; clear smooth boundary.

Cr—33 to 38 inches; highly fractured siltstone; clear smooth boundary.

R—38 inches; moderately fractured siltstone bedrock.

The thickness of the solum ranges from 18 to 40 inches. The depth to bedrock ranges from 20 to 40 inches. The content of rock fragments, mostly siltstone channers, ranges from 10 to 40 percent in the A horizon, from 15 to 75 percent in the B horizon, and from 35 to 90 percent in the C horizon. Reaction ranges from extremely acid to slightly acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The fine-earth fraction is silt loam.

The BA horizon has hue of 10YR, value of 4 to 6, and chroma of 4 to 8. The fine-earth fraction is silt loam.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 3 to 6. The fine-earth fraction is silt loam or loam.

The BC or C horizon, if it occurs, has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. Mottles are in shades of gray or brown. The fine-earth fraction is silt loam or loam.

The bedrock is fractured siltstone.

Bethesda Series

The Bethesda series consists of very deep, well drained soils that are moderately slowly permeable. These soils formed in stony, loamy, acid regolith in areas that have been surface mined for coal or in other highly disturbed areas. The regolith is a mixture of fine-earth material and rock fragments that consist of acid shale, siltstone, coal, and medium- and fine-grained sandstone. The soils are on ridgetops, benches, and hillsides and in hollow fills, mostly in the central part of the survey area. Slopes are linear or convex in nearly level to moderately steep areas and complex in steep and very steep areas. They range from 0 to 70 percent. The soils are loamy-skeletal, mixed, acid, mesic Typic Udorthents (fig. 23).

Bethesda soils are mapped in undifferentiated units with Kaymine and Fiveblock soils. They are also associated with Dekalb, Fedscreek, Gilpin, Hazleton, Helechawa, Kimper, Latham, Marrowbone, and Shelocta soils. Kaymine and Fiveblock soils are nonacid and have less clay than the Bethesda soils. Dekalb, Gilpin, Latham, and Marrowbone soils formed in residuum and are on ridgetops and the upper side slopes above or adjacent to mined areas. Fedscreek, Hazleton, Helechawa, Kimper, and Shelocta soils formed in colluvium and are on hillsides below or adjacent to mined areas.

Typical pedon of Bethesda very channery silt loam, in an area of Kaymine, Bethesda, and Fiveblock soils, benched, 2 to 70 percent slopes, stony; about 0.7 mile northeast of Mima, in Morgan County; about 1 mile north of the junction of Gum Bottom Branch Road and Kentucky Highway 437; about 200 feet west of the ridgetop between Cindas Creek and Gum Bottom Branch, on a very steep spoil bank at the head of Cindas Creek; soil map sheet 15; USGS Dingus quadrangle; Kentucky coordinates 2,349,050/163,200:

A—0 to 8 inches; brown (10YR 5/3) very channery silt loam; weak coarse granular structure; friable; many fine roots; 35 percent sandstone, siltstone, and shale channers; very strongly acid; clear wavy boundary.

C1—8 to 14 inches; brown (10YR 5/3) channery loam; few fine distinct gray (10YR 5/1) lithochromic mottles; massive; firm; common fine roots; 30 percent sandstone, siltstone, and shale channers; very strongly acid; clear smooth boundary.

C2—14 to 23 inches; brown (10YR 5/3) very channery clay loam; few fine distinct brownish yellow (10YR 6/6) lithochromic mottles; massive; firm; few fine roots; 45 percent sandstone and siltstone channers and 5 percent ironstone nodules; very strongly acid; clear smooth boundary.

C3—23 to 34 inches; dark grayish brown (10YR 4/2) extremely channery clay loam; massive; firm; 70 percent sandstone, siltstone, shale, and coal channers; very strongly acid; clear smooth boundary.

C4—34 to 50 inches; yellowish brown (10YR 5/6) channery silty clay loam; many medium distinct light brownish gray (10YR 6/2) lithochromic mottles; massive; firm; very few very fine roots; 20 percent sandstone, siltstone, and shale channers; extremely acid; clear smooth boundary.

Cr—50 to 65 inches; variegated pinkish gray (7.5YR 7/2) and reddish yellow (7.5YR 6/6), soft shale that crushes to silt loam.

The thickness of the solum ranges from 0 to 10 inches. The depth to bedrock ranges from 5 to 10 feet or more. The rock fragments of shale, sandstone, siltstone, and coal are mostly channers. Some are flagstones or boulders. The content of rock fragments ranges from 35 to 60 percent in the surface layer and from 30 to 80 percent in the substratum. It averages about 45 percent. Some pedons have thin subhorizons in which the content of rock fragments is less than 30 percent. Reaction ranges from strongly acid to extremely acid, except where the surface layer has been limed during reclamation.

The A horizon has hue of 7.5YR to 2.5Y or is neutral. It has value of 3 to 6 and chroma of 0 to 8. The fine-earth fraction is silt loam.

The C horizon has hue of 10YR or 2.5Y or is neutral. It has value of 3 to 6 and chroma of 0 to 8. The fine-earth fraction is loam, silt loam, silty clay loam, or clay loam.

Bledsoe Series

The Bledsoe series consists of very deep, well drained soils that are moderately slowly permeable. These soils formed in mixed colluvium derived from limestone, siltstone, sandstone, and shale. They are in coves and on benches, side slopes, and foot slopes of hillsides in the northern part of Morgan County. Slopes are linear or slightly concave and range from 15 to 50 percent. The soils are fine, mixed, mesic Typic Hapludalfs.

Bledsoe soils in this survey area are taxadjuncts to the Bledsoe series because they commonly have a higher content of rock fragments in the upper part of the solum than is defined as the range for the series. In addition, the Bledsoe soil in Bledsoe-Donahue-Rock outcrop complex, 15 to 30 percent slopes, has less clay and more sand in the upper part of the subsoil than is defined as the range for the series. These differences, however, do not significantly affect use and management of the soils.

Bledsoe soils are associated on the landscape with Berks, Cranston, Donahue, and Rigley soils and with areas of limestone rock outcrop. Berks soils are loamy-skeletal. Cranston and Rigley soils are coarse-loamy. Donahue soils are moderately deep.

Typical pedon of Bledsoe silt loam, 30 to 50 percent slopes, very stony; about 7 miles north of West Liberty, in Morgan County; 2 miles west of the junction of Kentucky Highways 519 and 1378; about 1,000 feet south of the mouth of Elm Log Branch and 500 feet east of the Licking River, on a wooded, benched side slope near an abandoned limestone quarry; soil map sheet 4; USGS Bangor quadrangle; Kentucky coordinates 2,248,000/190,100:

Oi—3 inches to 0; slightly decomposed leaf litter.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; common fine, medium, and coarse roots; 12 percent sandstone gravel; slightly acid; clear wavy boundary.
Bt1—5 to 11 inches; yellowish brown (10YR 5/8) channery silty clay loam; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; few faint clay films on faces of peds and on rock fragments; 25 percent sandstone channers; moderately acid; clear smooth boundary.
Bt2—11 to 17 inches; strong brown (7.5YR 5/6) channery silty clay loam; moderate fine and medium subangular and angular blocky structure; firm; common fine and medium roots; few fine tubular pores; many prominent light yellowish brown (10YR 6/4) clay films on faces of peds, on rock fragments, and in root channels; 30 percent sandstone channers; moderately acid; clear smooth boundary.
Bt3—17 to 32 inches; strong brown (7.5YR 5/6) very channery silty clay loam; moderate medium subangular and angular blocky structure; firm; common fine roots; common distinct light yellowish brown (10YR 6/4) clay films on faces of peds, on rock fragments, and in root channels; 35 percent sandstone channers; strongly acid; gradual diffuse boundary.
Bt4—32 to 41 inches; strong brown (7.5YR 5/4) channery silty clay loam; moderate fine and medium angular blocky structure; firm; few fine roots; common distinct light yellowish brown (10YR 6/4) clay films on faces of peds and on rock fragments; 20 percent sandstone channers; strongly acid; gradual smooth boundary.
BC—41 to 80 inches; variegated strong brown (7.5YR 5/4), yellowish brown (10YR 5/4), and light brownish gray (10YR 6/2) channery silty clay; weak fine angular blocky structure; firm; few fine roots; common fine prominent very dark gray (10YR 3/1) manganese nodules with sharp boundaries in the matrix; 20 percent sandstone channers; strongly acid.

The thickness of the solum ranges from 48 to more than 80 inches. The depth to soft shale, limestone, or siltstone is more than 60 inches. The content of rock fragments, mostly sandstone channers, ranges from 10 to 35 percent to a depth of about 40 inches and from 0 to 40 percent below a depth of 40 inches. Reaction ranges from neutral to strongly acid.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The fine-earth fraction is silt loam or loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 8. The fine-earth fraction is silty clay loam, clay loam, silty clay, or clay. The upper part of the Bt horizon in the Bledsoe soil in Bledsoe-Donahue-Rock outcrop complex, 15 to 30 percent slopes, is channery sandy clay loam. In some pedons the Bt horizon is mottled in shades of red, brown, or gray below a depth of 40 inches.

The BC and C horizons, if they occur, have colors and textures similar to those of the Bt horizon. However, the colluvial material is thin on some of the lower side slopes and a 2C horizon weathered from soft clay shale is common. The matrix of the 2C horizon has mottles in shades of gray, olive, red, and brown.

Cotaco Series

The Cotaco series consists of very deep, moderately well drained soils that are moderately permeable. These soils formed in loamy alluvium weathered from acid sandstone, siltstone, and shale. They are on stream terraces along the Licking River and on a few strath terraces in the northern part of Morgan County. Slopes are linear or slightly convex and range from 1 to 4 percent. The soils are fine-loamy, mixed, mesic Aquic Hapludults.

Cotaco soils are associated on the landscape with Allegheny, Barbourville, Ezel, Grigsby, Knowlton, Morehead, Orrville, Pope, and Rowdy soils. Allegheny, Barbourville, Ezel, Grigsby, Pope, and Rowdy soils are well drained. Knowlton soils are poorly drained. Morehead and Orrville soils are somewhat poorly drained.

Typical pedon of Cotaco loam, 1 to 4 percent slopes; 0.5 mile southeast of Woodsbend, in Morgan County; 0.5 mile north of the junction of Kentucky Highway 705 and Licking River-Woodsbend Road; 600 feet northeast of the Morgan County tree nursery, in a field on a strath terrace; soil map sheet 18; USGS West Liberty quadrangle; Kentucky coordinates 2,265,300/152,600:

Ap—0 to 11 inches; brown (10YR 5/3) loam; weak fine and medium granular structure; friable; few fine roots; 2 percent sandstone pebbles; moderately acid; clear smooth boundary.
Bt1—11 to 23 inches; light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; few distinct light yellowish brown (10YR 6/4) clay films on faces of peds; common fine faint light yellowish brown (2.5Y 6/4) pore linings; 2 percent sandstone pebbles; strongly acid; clear smooth boundary.
Bt2—23 to 35 inches; light olive brown (2.5Y 5/4)

loam; moderate medium subangular blocky structure; friable; few fine roots; many medium distinct light brownish gray (2.5Y 6/2) iron depletions with diffuse boundaries on faces of peds; common fine prominent reddish brown (5YR 5/4) masses of iron accumulation with sharp boundaries in ped interiors; few prominent light gray (10YR 7/2) clay films on faces of peds; 2 percent sandstone pebbles; very strongly acid; clear smooth boundary.

C—35 to 65 inches; brownish yellow (10YR 6/6) loam; massive, firm and compact; 5 percent sandstone pebbles; common fine prominent light gray (10YR 7/2) iron depletions with diffuse boundaries throughout; common fine prominent black (10YR 2/1) strongly cemented manganese concretions throughout; very strongly acid.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 60 inches. The content of rock fragments of sandstone, siltstone, or shale ranges from 2 to 35 percent in the solum and from 2 to 50 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid.

The Ap horizon dominantly has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. In some pedons it has hue of 2.5Y. The AB horizon, if it occurs, has colors similar to those of the Ap horizon. The fine-earth fraction of the AB horizon is loam, silt loam, or fine sandy loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. The fine-earth fraction is loam, silt loam, clay loam, or sandy clay loam. Most pedons have iron depletions in shades of gray on faces of peds and soft masses of iron accumulation in shades of brown and red in ped interiors. In some pedons the lower part of the Bt horizon has chroma of 1 to 3. The BC horizon, if it occurs, has colors and textures similar to those of the Bt horizon.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 8, and chroma of 1 to 8 or is neutral and has value of 4 to 6. The fine-earth fraction is loam, silt loam, clay loam, or silty clay loam.

Cranston Series

The Cranston series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in colluvium derived mostly from siltstone. They are on the lower side slopes and foot slopes in the northern part of Morgan County. Slopes are linear or slightly concave and range from 40 to 60 percent. The soils are coarse-loamy, mixed, mesic Typic Hapludults.

the Cranston series because they have a higher content of rock fragments in the subsoil than is defined as the range for the series. This difference, however, does not affect use and management of the soils.

Cranston soils are mapped in a complex with Berks soils. They are also associated on the landscape with Bledsoe and Donahue soils. Berks soils are moderately deep. Bledsoe and Donahue soils are in a fine textured family.

Typical pedon of Cranston channery silt loam, in an area of Berks-Cranston complex, 40 to 60 percent slopes, very stony; 12 miles north of West Liberty, in Morgan County; 200 feet west of Kentucky Highway 519 and about 1,000 feet south of a bridge over Cave Run Reservoir, on a steep, wooded side slope along a small drainageway; soil map sheet 4; USGS Bangor quadrangle; Kentucky coordinates 2,244,800/196,450:

Oi—3 inches to 0; slightly decomposed leaf litter.

A—0 to 5 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate fine and medium granular structure; very friable; common fine and medium roots; 18 percent siltstone channers and 2 percent quartz pebbles; neutral; clear wavy boundary.

A/B—5 to 8 inches; silt loam that is 70 percent dark grayish brown (10YR 4/2) A peds and 30 percent yellowish brown (10YR 5/4) B peds; weak medium subangular blocky structure; very friable; common fine and medium roots; 10 percent siltstone channers; neutral; clear wavy boundary.

Bt1—8 to 16 inches; brownish yellow (10YR 6/6) channery silt loam; weak fine and medium subangular blocky structure; very friable; common fine, medium, and coarse roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds and on rock fragments; 15 percent siltstone channers; very strongly acid; clear smooth boundary.

Bt2—16 to 25 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine and medium subangular blocky structure; very friable; common fine, medium, and coarse roots; many faint clay films on faces of peds and on rock fragments; 45 percent siltstone channers; strongly acid; clear smooth boundary.

Bt3—25 to 38 inches; yellowish brown (10YR 5/4) extremely channery silt loam; weak medium subangular blocky structure; friable; few fine and medium roots; many faint clay films on faces of peds and on rock fragments; 65 percent siltstone channers; strongly acid; gradual smooth boundary.

BC—38 to 50 inches; yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; few fine roots; 80 percent siltstone channers; strongly acid; clear smooth boundary.

C—50 to 62 inches; mottled strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) extremely channery silty clay loam; massive; firm; 80 percent siltstone channers and 5 percent siltstone flagstones; strongly acid; abrupt wavy boundary.

R—62 inches; fractured siltstone bedrock.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. The content of coarse fragments, which are mostly siltstone channers and flagstones or quartz pebbles, ranges from 15 to 25 percent in the A horizon, from 15 to 80 percent in the subsoil, and from 30 to 90 percent in the C horizon. In unlimed areas reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The fine-earth fraction is silt loam. The A/B horizon, if it occurs, has properties similar to those of the overlying A horizon and the underlying Bt horizon, except for a lower clay content. The fine-earth fraction is silt loam.

The AB, E, or BE horizon, if it occurs, has hue of 10YR, value of 3 to 5, and chroma of 4 to 6. The fine-earth fraction is silt loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. The fine-earth fraction is silt loam. The BC horizon has colors and textures similar to those of the Bt horizon.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. The fine-earth fraction is silt loam or silty clay loam.

Some pedons have a Cr horizon. This horizon weathered from gray or olive brown, soft clay shale.

The bedrock is fractured siltstone.

Dekalb Series

The Dekalb series consists of moderately deep, well drained soils that are rapidly permeable. These soils formed in gray and brown, acid sandstone residuum that was commonly affected by downslope movement. They are on crests and nose slopes of ridgetops in the southern part of Magoffin County. Slopes are convex and range from 20 to 60 percent. The soils are loamy-skeletal, mixed, mesic Typic Dystrochrepts.

Dekalb soils are mapped in a complex with Gilpin and Marrowbone soils. They are also associated on the landscape with Bethesda, Fedscreek, Fiveblock, Hazleton, Helechawa, Kaymine, Kimper, and Shelocta soils. Gilpin, Kimper, and Shelocta soils are fine-loamy. Fedscreek, Helechawa, and Marrowbone soils are coarse-loamy. Bethesda, Fiveblock, and Kaymine soils are very deep over bedrock. They formed in regolith, mostly from coal mining operations. Hazleton soils are deep over bedrock.

Typical pedon of Dekalb sandy loam, in an area of Dekalb-Gilpin-Marrowbone complex, very rocky, 20 to 60 percent slopes; 0.6 mile northwest of Carver, in Magoffin County; 100 feet east of an access road to a surface mine, on a wooded ridgetop between the forks of Oakley Creek; soil map sheet 46; USGS Salyersville South quadrangle; Kentucky coordinates 2,780,900/490,500:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; very friable; many fine roots; 12 percent sandstone channers; very strongly acid; clear smooth boundary.

E—3 to 6 inches; brown (10YR 5/3) sandy loam; weak fine granular and subangular blocky structure; very friable; many fine and medium roots; 12 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw1—6 to 18 inches; yellow (10YR 7/6) very channery sandy loam; weak fine subangular blocky structure; friable; few fine and medium roots; 45 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw2—18 to 29 inches; very pale brown (10YR 7/4) very channery sandy loam; weak medium subangular blocky structure; friable; few fine roots; 50 percent sandstone channers; very strongly acid; clear smooth boundary.

C—29 to 32 inches; mottled strong brown (7.5YR 5/6) and light yellowish brown (10YR 6/4) very channery sandy loam; single grain; loose; 40 percent sandstone channers and 20 percent sandstone flagstones; extremely acid; abrupt wavy boundary.

R—32 inches; fractured sandstone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of flat sandstone fragments, 1 to 10 inches across, increases with increasing depth. It ranges from 10 to 60 percent in individual horizons of the solum and is as much as 80 percent in the C horizon. Reaction ranges from strongly acid to extremely acid.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The fine-earth fraction is sandy loam.

The E horizon, if it occurs, has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The fine-earth fraction is sandy loam or loam.

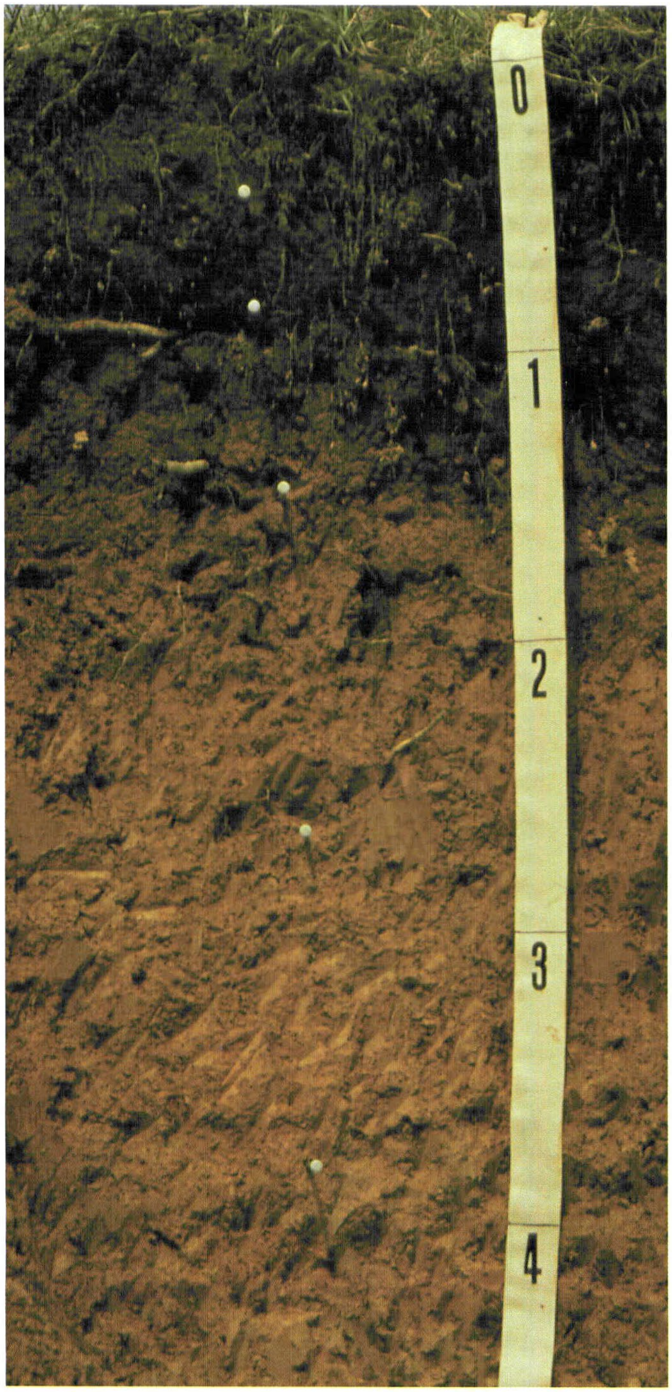


Figure 22.—Typical pedon of Allegheny loam. The white nail heads mark the boundaries of horizons in the profile. Depth is marked in feet.

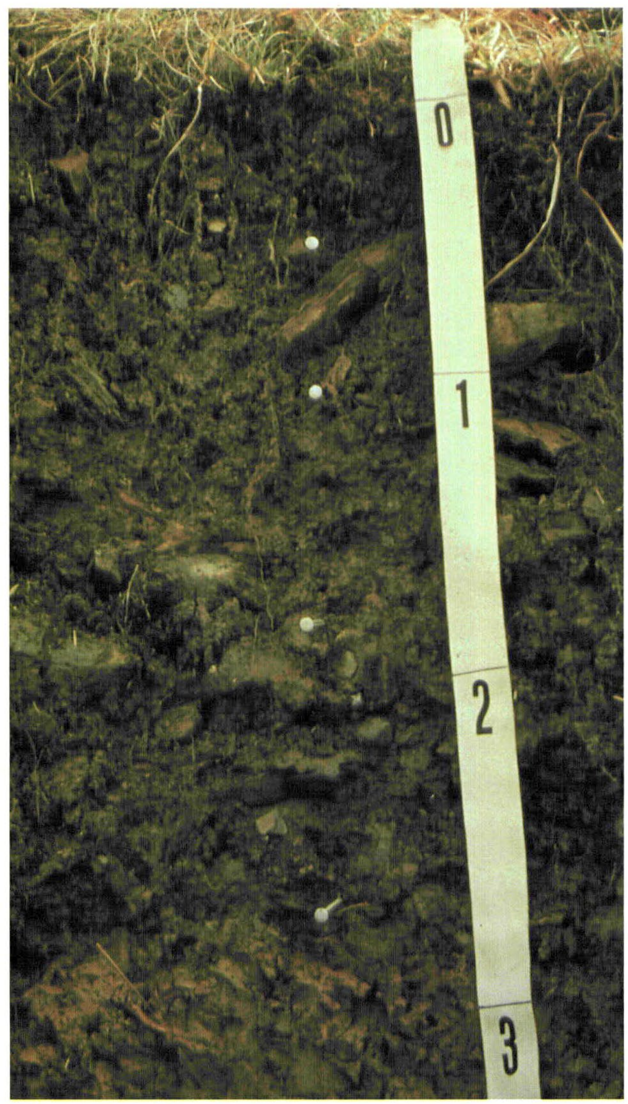


Figure 23.—Typical pedon of Bethesda very channery silt loam. The white nail heads mark the boundaries of horizons in the profile. Depth is marked in feet.

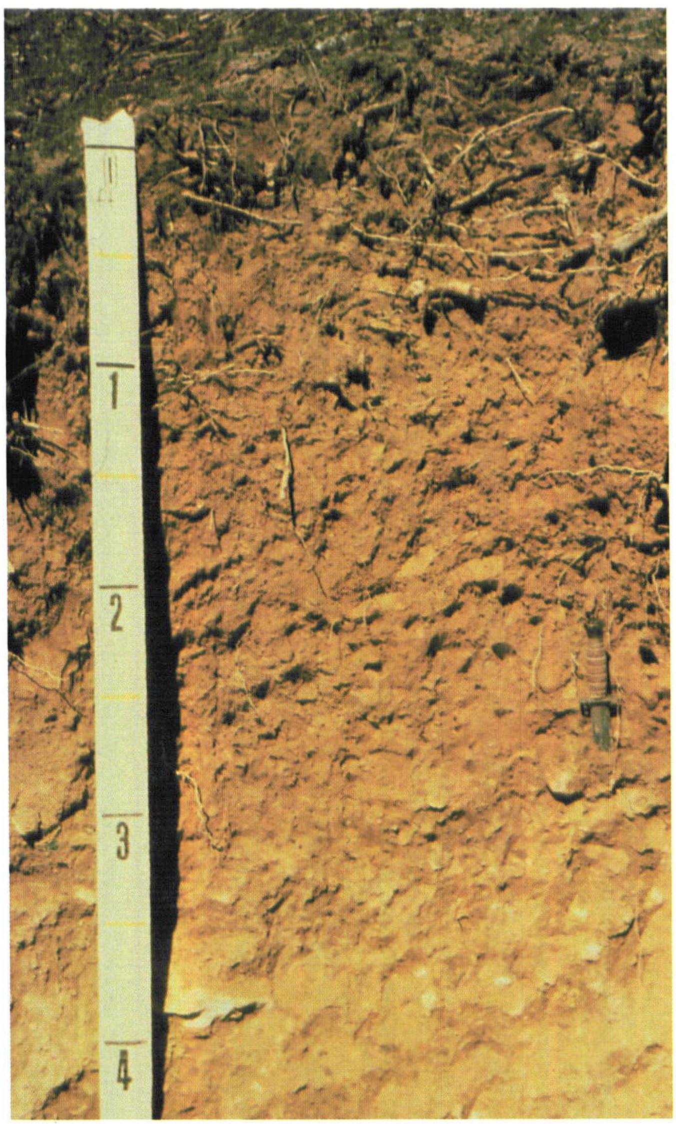


Figure 24.—Typical pedon of Fedscreek channery loam. The knife marks the boundary between older and younger layers of colluvium. Depth is marked in feet.

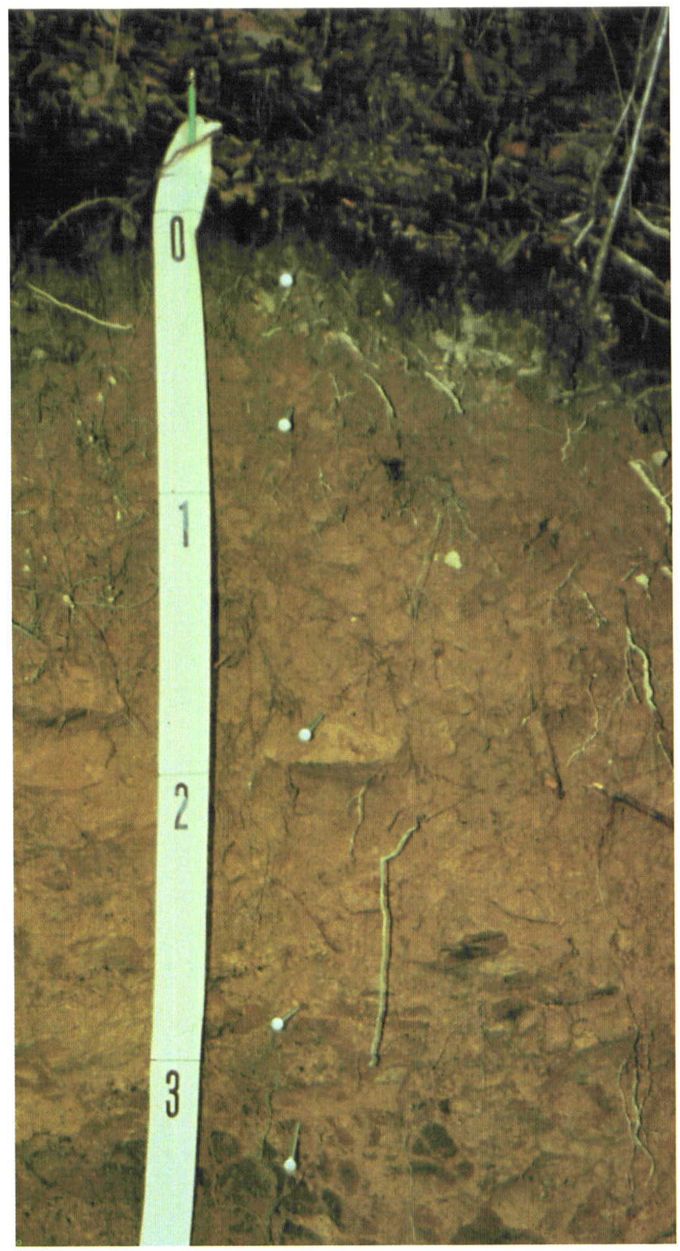


Figure 25.—Typical pedon of Hazleton loam. The white nail heads mark the boundaries of horizons in the profile. Depth is marked in feet.

Figure 26.—Typical pedon of Kimper fine sandy loam. The white nail heads mark the boundaries of horizons in the profile. Depth is marked in feet.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 4 to 6. The fine-earth fraction is sandy loam or loam.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. The fine-earth fraction is sandy loam or loamy sand.

The bedrock is gray or brown sandstone. The hardness of the bedrock varies. The bedrock is commonly fractured without displacement.

Donahue Series

The Donahue series consists of moderately deep, well drained soils that are slowly or moderately slowly permeable. These soils formed in mixed colluvium derived from acid sandstone and siltstone over limestone or calcareous shale residuum. They are on benches, nose slopes, and the upper side slopes of hillsides in the northern part of Morgan County. Slopes are linear or slightly convex and range from 15 to 30 percent. The soils are fine, mixed, mesic Typic Hapludalfs.

Donahue soils are mapped in a complex with Bledsoe soils and areas of limestone rock outcrop. They are also associated on the landscape with Berks, Cranston, and Rigley soils. Bledsoe soils are very deep. Berks soils are loamy-skeletal. Cranston and Rigley soils are coarse-loamy.

Typical pedon of Donahue loam, in an area of Bledsoe-Donahue-Rock outcrop complex, 15 to 30 percent slopes; about 9 miles north of Ezel, in Morgan County; about 0.4 mile southwest of the confluence of Mine Branch and the Licking River, on a north-facing, steep, wooded side slope along Mine Branch; soil map sheet 4; USGS Bangor quadrangle; Kentucky coordinates 2,241,250/189,200:

Oi—3 inches to 0; slightly decomposed leaf litter.

A—0 to 4 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; many fine and medium roots; 2 percent quartz pebbles; slightly acid; gradual wavy boundary.

BA—4 to 7 inches; yellowish brown (10YR 5/4) loam; common fine faint brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; many fine tubular pores; 2 percent quartz pebbles; strongly acid; gradual smooth boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium subangular blocky structure; firm; common fine and medium roots; many fine tubular pores; many distinct brownish yellow (10YR 6/6) clay films on faces of peds and lining pores; strongly acid; gradual smooth boundary.

2Bt2—13 to 23 inches; yellowish brown (10YR 5/8) silty clay; moderate medium subangular blocky structure; firm; few fine and medium roots; many fine tubular pores; many distinct brownish yellow (10YR 6/6) clay films on faces of peds and lining pores; strongly acid; gradual smooth boundary.
2BC—23 to 33 inches; yellowish brown (10YR 5/6) silty clay; many medium prominent reddish brown (5YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine and medium roots; few fine tubular pores; moderately acid; abrupt smooth boundary.
2Cr—33 to 39 inches; soft, greenish gray (5GY 6/1), calcareous shale; clear smooth boundary.
2R—39 inches; unweathered shale bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The thickness of the A horizon and the upper part of the B horizon that contains more than 20 percent sand ranges from 12 to 24 inches. The content of rock fragments, which are mostly sandstone channers and quartz pebbles, ranges from 0 to 25 percent in individual horizons. Reaction is strongly acid to slightly acid in the A and Bt horizons and strongly acid or moderately acid in the 2Bt and 2BC horizons.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3. The fine-earth fraction is loam. The AB or E horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The fine-earth fraction is loam or sandy loam.

The BA horizon, if it occurs, has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 8. The fine-earth fraction is loam or sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. The fine-earth fraction is dominantly loam, clay loam, or sandy clay loam. In a few pedons it is silty clay loam.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 6 or 8. Lithochromic mottles in shades of yellow, brown, or red are common. The fine-earth fraction is dominantly silty clay or clay. In a few pedons it is silty clay loam.

The 2BC horizon has colors and textures similar to those of the 2Bt horizon. Lithochromic mottles in shades of gray, brown, yellow, or red are common.

The 2C horizon, if it occurs, dominantly has hue of 10YR to 5Y, value of 5 to 8, and chroma of 2 to 6. In some pedons it is variegated in color and does not have a dominant matrix hue.

The 2Cr horizon is greenish gray, olive brown, or mottled, soft, calcareous clay shale.

The bedrock is unweathered, calcareous shale or limestone.

Ezel Series

The Ezel series consists of deep, well drained soils that are moderately permeable. These soils formed in loamy alluvium derived from acid sandstone, siltstone, and shale. They are on strath terraces along the Licking River and major streams in the northern part of Magoffin County and throughout Morgan County. Slopes are smooth and convex and range from 2 to 20 percent. The soils are fine-loamy, mixed, mesic Typic Hapludults.

Ezel soils are mapped in complexes with Gilpin and Riney soils. They are also associated on the landscape with Cotaco, Hazleton, Helechawa, Latham, Marrowbone, Rayne, Rigley, and Shelocta soils. Cotaco soils are moderately well drained. Gilpin soils are moderately deep and formed in residuum. Hazleton soils are loamy-skeletal and formed in colluvium or residuum. Helechawa, Rigley, and Marrowbone soils are coarse-loamy and formed in colluvium or residuum. Latham soils are clayey and formed in residuum. Gilpin, Latham, and Marrowbone soils are moderately deep. Rayne soils formed in residuum. Riney soils have redder colors in the subsoil than the Ezel soils. Helechawa and Riney soils are siliceous. Shelocta soils are very deep and formed in colluvium.

Typical pedon of Ezel loam, in an area of Ezel-Gilpin complex, 2 to 6 percent slopes; about 0.7 mile south of Ezel, in Morgan County; 1,700 feet south of the intersection of Kentucky 1010 and U.S. 460 and 1,000 feet southwest of the confluence of Greasy Fork and Meetinghouse Branch, in a field on a strath terrace; soil map sheet 17; USGS Ezel quadrangle; Kentucky coordinates 2,233,400/140,000:

Ap—0 to 11 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; many fine roots; neutral; clear smooth boundary.
BA—11 to 16 inches; brownish yellow (10YR 6/6) loam; 25 percent tonguing and coating of peds with surface material; weak medium subangular blocky structure; very friable; few fine roots; 2 percent quartzite pebbles; few fine faint iron masses with sharp boundaries in ped interiors; neutral; clear wavy boundary.
Bt1—16 to 28 inches; brownish yellow (10YR 6/6) loam; weak medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; 2 percent quartzite pebbles; few fine faint iron masses with sharp boundaries in ped interiors; moderately acid; clear smooth boundary.
Bt2—28 to 39 inches; brownish yellow (10YR 6/6) loam; moderate fine and medium subangular blocky structure; friable; few fine roots; few faint

clay films on faces of peds; 2 percent quartzite pebbles; few fine faint iron masses with sharp boundaries in ped interiors; strongly acid; clear smooth boundary.

BC—39 to 47 inches; brownish yellow (10YR 6/6) loam; common medium distinct very pale brown (10YR 7/3) lithochromic mottles; weak medium subangular blocky structure; friable; very few fine roots; 2 percent sandstone pebbles and 10 percent soft sandstone channers; strongly acid; gradual smooth boundary.

C—47 to 53 inches; mottled brownish yellow (10YR 6/6), very pale brown (10YR 7/3), and strong brown (7.5YR 5/8) loam; massive; friable; 10 percent sandstone channers; strongly acid; abrupt smooth boundary.

R—53 inches; unweathered sandstone bedrock.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock ranges from 40 to 60 inches. The content of pebbles and channers ranges from 0 to 15 percent in the A horizon, from 0 to 30 percent in the Bt horizon, and from 0 to 35 percent in the BC and C horizons. In unlimed areas reaction is moderately acid or strongly acid in the A horizon and in the upper part of the B horizon. It is strongly acid to extremely acid in the lower part of the Bt horizon and in the BC and C horizons.

The A or Ap horizon generally has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 8. In some pedons the A horizon is less than 6 inches thick and has value of 3 and chroma of 1 to 3. The fine-earth fraction of the A or Ap horizon is loam.

The BA or BE horizon, if it occurs, has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. The fine-earth fraction is loam, sandy loam, or silt loam.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. The fine-earth fraction is loam, silt loam, sandy clay loam, or, occasionally, clay loam. In some pedons this horizon has redoximorphic features in shades of brown, red, yellow, or gray below a depth of 40 inches. In most pedons it has relict iron masses but is saturated with water for less than 1 month in most years. In a few pedons it is sandy loam below a depth of about 24 inches.

The BC horizon has colors and textures similar to those of the Bt horizon, but it has lithochromic mottles in shades of brown, red, or yellow.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. The fine-earth fraction is sandy loam, loam, or sandy clay loam. Lithochromic mottles in shades of brown, gray, yellow, or olive are common. In some pedons redoximorphic features of similar colors are below a depth of 40 inches.

The bedrock is mostly unweathered sandstone, siltstone, or shale. Some pedons have a Cr horizon, which is soft, weathered sandstone, siltstone, or shale.

Fedscreek Series

The Fedscreek series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy colluvium derived mostly from sandstone. They are on linear side slopes, benches, and convex foot slopes of hillsides in the southern part of Magoffin County. Slopes are complex and range from 30 to 80 percent. The soils are coarse-loamy, mixed, mesic Typic Dystrochrepts (fig. 24).

Fedscreek soils are mapped in a complex with Kimper soils on hillsides with cool aspects in the southern part of Magoffin County. They are associated on the landscape with Bethesda, Dekalb, Fiveblock, Gilpin, Kaymine, and Marrowbone soils. Bethesda, Fiveblock, and Kaymine soils are loamy-skeletal and formed in regolith, primarily from coal mining operations. Dekalb soils are loamy-skeletal. Gilpin and Kimper soils are fine-loamy. Kimper soils have a dark surface layer. Dekalb, Gilpin, and Marrowbone soils are moderately deep.

Typical pedon of Fedscreek channery loam, in an area of Kimper-Fedscreek complex, 30 to 80 percent slopes, stony; about 18 miles south of Royalton, in Magoffin County; 3 miles south of the junction of Kentucky Highways 7 and 3336; about 1.2 miles northwest of the confluence of Sprucepine Fork and Quicksand Fork, in a road cut on a steep, wooded nose slope along Sprucepine Fork; soil map sheet 53; USGS David quadrangle; Kentucky coordinates 2,811,900/439,200:

Oi—2 inches to 0; slightly decomposed hardwood leaf litter.

A—0 to 3 inches; brown (10YR 4/3) channery loam; weak fine granular structure; very friable; many fine roots; 20 percent sandstone channers; strongly acid; gradual wavy boundary.

BE—3 to 11 inches; brownish yellow (10YR 6/6) sandy loam; weak fine subangular blocky structure; very friable; common fine and medium roots; 10 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw1—11 to 17 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; very friable; common fine and medium and few coarse roots; 12 percent sandstone channers; very strongly acid; gradual smooth boundary.

Bw2—17 to 27 inches; yellowish brown (10YR 5/6) channery sandy loam; moderate fine and medium subangular blocky structure; friable; few fine and medium roots; 20 percent sandstone channers; very strongly acid; gradual smooth boundary.

Bw3—27 to 36 inches; yellowish brown (10YR 5/6) very channery sandy loam; moderate fine and medium subangular blocky structure; friable; few fine and medium roots; 25 percent sandstone channers and 20 percent sandstone flagstones; very strongly acid; clear smooth boundary.

Bw4—36 to 45 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak fine subangular blocky structure; friable; very few very fine roots; 30 percent sandstone channers and 20 percent sandstone flagstones; very strongly acid; clear smooth boundary.

BC—45 to 80 inches; yellowish brown (10YR 5/6) very flaggy sandy loam; weak fine and medium subangular blocky structure; friable; 40 percent sandstone flagstones and 20 percent sandstone channers; very strongly acid.

The thickness of the solum ranges from 40 to 80 inches or more. The depth to bedrock is more than 60 inches. The content of rock fragments ranges from 5 to 60 percent in individual horizons but averages less than 35 percent in the 10- to 40-inch particle-size control section. Reaction is very strongly acid to moderately acid throughout.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The fine-earth fraction is loam.

The BE and Bw horizons have hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. The fine-earth fraction is sandy loam, silt loam, or loam. In some pedons, these horizons have lithochromic mottles in shades of brown, yellow, or red and the lower part of these horizons has lithochromic mottles in shades of gray.

The BC horizon and C horizon, if it occurs, have hue of 10YR, value of 5 or 6, and chroma of 4 to 6. The fine-earth fraction is sandy loam or loam. In some pedons these horizons have lithochromic mottles in shades of brown, yellow, red, or gray.

Fiveblock Series

The Fiveblock series consists of very deep, somewhat excessively drained soils that are moderately rapidly permeable. These soils formed in stony, loamy, nonacid regolith in areas that have been surface mined for coal or in other highly disturbed areas. The regolith is a mixture of fine-earth material and rock fragments that consist of nonacid sandstone and lesser amounts of shale, siltstone, and coal. The soils are on benches, ridgetops, hillsides, and head-of-hollow fills, mostly in the southern part of Magoffin County. Slopes are linear or convex in gently sloping to moderately steep areas and complex in steep and very steep areas. They range from 2 to 70 percent. The soils are loamy-skeletal, mixed, nonacid, mesic Typic Udorthents.

Fiveblock soils are mapped in undifferentiated units with Bethesda and Kaymine soils. They are also associated on the landscape with Dekalb, Fedscreek, Gilpin, Hazleton, Helechawa, Kimper, Latham, Marrowbone, and Shelocta soils. Bethesda and Kaymine soils have more than 18 percent clay in the fine-earth fraction. Dekalb and Marrowbone soils are moderately deep over bedrock and formed in sandstone residuum. Fedscreek, Helechawa, and Marrowbone soils are coarse-loamy. Gilpin, Kimper, and Shelocta soils are fine-loamy and formed in residuum or colluvium. Latham soils are clayey and formed in shale residuum. Hazleton soils are deep and formed in undisturbed colluvium over residuum.

Typical pedon of Fiveblock very channery sandy loam, in an area of Kaymine, Bethesda, and Fiveblock soils, benched, 2 to 70 percent slopes, stony; about 6 miles southeast of Royalton, in Magoffin County; in a steep backfill area of a surface mine at the head of Pigpen Branch; 4,500 feet northeast of the Sub Howard Cemetery; 500 feet west of a small pond and 200 feet southeast of a road that connects a narrow mine bench with the ridgetop; soil map sheet 47; USGS Ivyton quadrangle; Kentucky coordinates 2,816,600/492,600:

A—0 to 9 inches; yellowish brown (10YR 5/4) very channery sandy loam; weak fine granular structure; very friable; few fine roots; 35 percent channers, stones, and boulders (30 percent sandstone and 5 percent siltstone); moderately acid; gradual wavy boundary.

C1—9 to 31 inches; yellowish brown (10YR 5/4) very stony sandy loam; loose; few fine roots; 50 percent stones, channers, and boulders (45 percent sandstone and 5 percent siltstone); slightly acid; gradual smooth boundary.

C2—31 to 65 inches; yellowish brown (10YR 5/4) very stony sandy loam; loose; very few very fine roots; 40 percent stones, channers, and boulders of sandstone; neutral.

The thickness of the solum ranges from 2 to 10 inches. The depth to bedrock is 5 to 10 feet or more. The content of rock fragments ranges from 35 to 60 percent in the surface layer and from 30 to 80 percent in the substratum. Sixty-five percent or more of the rock fragments are gray, neutral sandstone. The remaining fragments are siltstone, shale, or coal. The rock fragments are mostly stones and boulders but include channers. The fine-earth fraction of the control section ranges from 5 to 18 percent clay. In most pedons some or all of the horizons have red, brown, yellow, or gray lithochromic mottles. Reaction ranges from moderately acid to slightly alkaline.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 1 to 4. The fine-earth fraction is sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 6. The fine-earth fraction is sandy loam.

Gilpin Series

The Gilpin series consists of moderately deep, well drained soils that are moderately permeable. These soils formed in material weathered from interbedded acid shale, siltstone, and sandstone. They are on almost all of the ridgetops in the survey area. They are also on hillsides, mostly in the northern part of Morgan County, and on low nose slopes along the Licking River and its major tributaries. Slopes are linear, convex, or complex and range from 2 to 60 percent. The soils are fine-loamy, mixed, mesic Typic Hapludults.

Gilpin soils are associated on the landscape with Bethesda, Dekalb, Ezel, Fedscreek, Fiveblock, Hazleton, Helechawa, Kaymine, Kimper, Latham, Lily, Marrowbone, Rayne, and Shelocta soils. Bethesda, Fiveblock, and Kaymine soils are loamy-skeletal and formed in regolith, primarily from coal mining operations. Dekalb and Hazleton soils are loamy-skeletal. Fedscreek, Marrowbone, and Helechawa soils are coarse-loamy. Helechawa and Lily soils are siliceous. Kimper soils have a dark surface layer and do not have an argillic horizon. Latham soils are in a clayey textural family. Ezel soils are deep and formed in alluvium on strath terraces. Rayne and Shelocta soils are deep.

Typical pedon of Gilpin silt loam, in an area of Shelocta-Gilpin complex, 25 to 60 percent slopes; about 3 miles north of Blaze, in Morgan County; 1,000 feet northeast of Kentucky Highway 1002, on a wooded, north-facing slope at the head of Pup Branch; soil map sheet 3; USGS Wrigley quadrangle; Kentucky coordinates 2,260,400/203,000:

Oi—3 inches to 0; partly decomposed leaf litter.

A—0 to 6 inches; brown (10YR 4/3) silt loam; weak medium granular structure; friable; many fine and medium roots; 12 percent siltstone and sandstone channers; strongly acid; clear smooth boundary.

Bt1—6 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common distinct very pale brown (10YR 7/4) clay films on faces of peds; 12 percent siltstone channers; strongly acid; clear smooth boundary.

Bt2—14 to 24 inches; yellowish brown (10YR 5/6) channery silty clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable; few fine roots; common fine tubular pores; few distinct very pale brown (10YR 7/4) clay films on faces of peds, in pores, and on rock fragments; 25 percent siltstone channers; strongly acid; clear smooth boundary.

BC—24 to 28 inches; yellowish brown (10YR 5/4) channery silt loam; few fine distinct strong brown (7.5YR 5/6) lithochromic mottles; moderate medium subangular blocky structure; firm; few fine roots; 25 percent siltstone channers; strongly acid; clear smooth boundary.

C—28 to 32 inches; yellowish brown (10YR 5/4) extremely channery silt loam; massive; firm; very few very fine roots; 80 percent siltstone channers; strongly acid; clear smooth boundary.

Cr—32 to 38 inches; thinly bedded siltstone, shale, and sandstone; clear smooth boundary.

R—38 inches; fractured sandstone bedrock.

The thickness of the solum ranges from 18 to 38 inches. The depth to rippable bedrock ranges from 20 to 40 inches. The rock fragments are mostly angular to subangular channers of shale, siltstone, and sandstone. The content of rock fragments ranges from 5 to 30 percent in the surface layer, from 5 to 40 percent in the subsoil, and from 30 to 90 percent in the substratum. In unlimed areas reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The Ap horizon, if it occurs, has colors similar to those of the A horizon. The fine-earth fraction of these horizons is silt loam.

The BA or BE horizon, if it occurs, has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 5. The fine-earth fraction is silt loam.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. The fine-earth fraction is silt loam, loam, or silty clay loam. The BC horizon has colors and textures similar to those of the Bt horizon.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 6. The fine-earth fraction is silt loam, loam, or silty clay loam.

The bedrock is mostly thinly bedded, rippable siltstone and sandstone.

Grigsby Series

The Grigsby series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy alluvium derived from sandstone, shale, siltstone, and limestone. They are on flood plains of tributaries throughout the survey area. Slopes are linear or slightly convex and range from 0 to 4 percent. The soils are coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrepts.

Grigsby soils are associated on the landscape with Allegheny, Barbourville, Cotaco, Knowlton, Morehead, Orrville, Rowdy, and Whitley soils and Udorthents. Allegheny, Barbourville, Cotaco, Orrville, and Rowdy soils are fine-loamy. Knowlton, Morehead, and Whitley soils are fine-silty. Udorthents have been altered. They do not have diagnostic horizons other than an ochric epipedon, and their properties vary greatly.

Typical pedon of Grigsby sandy loam, in an area of Rowdy-Grigsby-Barbourville complex, 0 to 8 percent slopes; 0.5 mile northeast of Fritz, in Magoffin County; 1.5 miles west of the junction of Kentucky Highways 30 and 378; about 500 feet north of a bridge on Kentucky Highway 378, in a field along Right Fork of Middle Creek; soil map sheet 42; USGS Seitz quadrangle; Kentucky coordinates 2,752,500/510,300:

Ap—0 to 11 inches; brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; few fine roots; 10 percent sandstone channers; neutral; clear smooth boundary.

Bw1—11 to 30 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; few fine roots; 5 percent sandstone channers; slightly acid; clear smooth boundary.

Bw2—30 to 60 inches; dark yellowish brown (10YR 4/4) sandy loam that has thin strata of yellowish brown (10YR 5/6) loamy sand; moderate medium subangular blocky structure; very friable; few fine roots; 5 percent sandstone channers; slightly acid; clear smooth boundary.

C—60 to 80 inches; yellowish brown (10YR 5/6) sandy loam and light yellowish brown (10YR 6/4) sand; single grain; loose; slightly acid.

The thickness of the solum generally ranges from 30 to 65 inches. Bedrock is at a depth of 5 feet or more. The content of rock fragments, mostly sandstone channers, ranges from 0 to 30 percent to a depth of about 40 inches and from 0 to 60 percent below a depth of 40 inches. Reaction ranges from moderately acid to neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The fine-earth fraction is sandy loam.

The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth fraction is sandy loam, loam, or silt loam. The BC horizon, if it occurs, has colors and textures similar to those of the Bw horizon.

The C horizon has hue of 10YR and value and chroma of 4 to 6. The fine-earth fraction is stratified sandy loam or loamy sand.

Hazleton Series

The Hazleton series consists of deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy colluvium deposited over material weathered from acid sandstone and siltstone. They are on head slopes, benches, and convex foot slopes of hillsides in the eastern part of Morgan County and throughout Magoffin County. They are on warm-aspect slopes in the southern part of Magoffin County and on warm- or cool-aspect slopes in other parts of the survey area. Slopes are complex and range from 30 to 65 percent. The soils are loamy-skeletal, mixed, mesic Typic Dystrochrepts (fig. 25).

Hazleton soils are mapped in a complex with Helechawa and Shelocta soils. They are also associated on the landscape with Bethesda, Dekalb, Ezel, Fiveblock, Gilpin, Kaymine, Latham, and Marrowbone soils. Bethesda, Fiveblock, and Kaymine soils are loamy-skeletal and formed in regolith, primarily from coal mining operations. Dekalb, Gilpin, and Marrowbone soils are moderately deep. Helechawa and Marrowbone soils are coarse-loamy. Ezel, Gilpin, and Shelocta soils are fine-loamy. Latham soils are in a clayey textural family. In addition, Ezel, Gilpin, Latham, and Shelocta soils have an argillic horizon.

Typical pedon of Hazleton loam, in an area of Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony; 2 miles southwest of Salyersville along Gardner Fork, in Magoffin County; 500 feet southeast of the Kentucky 30 interchange, in a road cut on a wooded hillside facing Mountain Parkway; soil map sheet 39; USGS Salyersville South quadrangle; Kentucky coordinates 2,764,300/519,200:

Oi—3 inches to 0; partially decomposed hardwood leaf litter.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; very friable; common medium and fine roots; 5 percent sandstone channers; strongly acid; abrupt smooth boundary.

BE—2 to 9 inches; light yellowish brown (10YR 6/4) loam; weak medium subangular blocky structure; very friable; common fine and medium roots; few fine tubular pores; 10 percent sandstone channers; very strongly acid; clear smooth boundary.
Bw1—9 to 22 inches; yellowish brown (10YR 5/6) channery loam; weak medium subangular blocky structure; friable; common fine roots; 30 percent sandstone channers; very strongly acid; gradual smooth boundary.
Bw2—22 to 31 inches; yellowish brown (10YR 5/6) very channery loam; weak coarse subangular blocky structure; friable; few fine roots; 50 percent sandstone channers; very strongly acid; gradual smooth boundary.
BC—31 to 40 inches; yellowish brown (10YR 5/6) extremely channery loam; weak coarse subangular blocky structure; friable; few fine roots; 70 percent sandstone channers; very strongly acid; gradual smooth boundary.
C—40 to 48 inches; yellowish brown (10YR 5/6) extremely channery loam; massive; firm; very few very fine roots; 80 percent sandstone channers; very strongly acid; abrupt wavy boundary.
R—48 inches; fractured sandstone bedrock.

The thickness of the solum ranges from 25 to 50 inches. The depth to bedrock ranges from 40 to 60 inches. The rock fragments are flat, angular sandstone and are dominantly less than 10 inches in size. The content of rock fragments ranges from 5 to 15 percent in the surface layer, from 5 to 70 percent in the subsoil, and from 35 to 80 percent in the substratum. Reaction is strongly acid to extremely acid.

The A horizon is dominantly thin and has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. The fine-earth fraction is loam.

The BE or E horizon, if it occurs, has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. The fine-earth fraction is loam or sandy loam.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 3 to 8. The fine-earth fraction is sandy loam or loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. In some pedons it has lithochromic mottles in shades of brown, yellow, or gray. Below a depth of 40 inches, the C horizon may also have yellow or brown masses of iron accumulations in ped interiors and gray iron depletions on faces of peds. The fine-earth fraction is loam or sandy loam.

The bedrock is fractured, horizontally bedded sandstone.

Helechawa Series

The Helechawa series consists of very deep, somewhat excessively drained soils that are moderately rapidly permeable. These soils formed in colluvium derived mostly from sandstone. They are on linear side slopes and benches of hillsides in the eastern part of Morgan County and throughout Magoffin County. They are on warm-aspect hillsides in the southern part of Magoffin County and on warm- or cool-aspect hillsides in other parts of the survey area. Slopes are complex and range from 30 to 65 percent. The soils are coarse-loamy, siliceous, mesic Typic Dystrochrepts.

Helechawa soils are mapped in a complex with Shelocta and Hazleton soils. They are also associated on the landscape with Bethesda, Dekalb, Ezel, Fedscreek, Fiveblock, Gilpin, Kaymine, Kimper, Latham, and Marrowbone soils. Bethesda, Fiveblock, and Kaymine soils are loamy-skeletal and formed in regolith, primarily from coal mining operations. Dekalb and Hazleton soils are loamy-skeletal and have bedrock at a depth of less than 60 inches. Ezel, Gilpin, Kimper, and Shelocta soils are fine-loamy. Fedscreek soils have mixed mineralogy. Latham soils are in a clayey textural family. Kimper soils have a thick, dark surface layer. Marrowbone soils are moderately deep.

Typical pedon of Helechawa sandy loam, in an area of Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony; about 5 miles east of West Liberty, in Morgan County; 3 miles southeast of the junction of Kentucky Highways 172 and 437; about 1 mile southwest of the confluence of Tantroft Branch and Williams Creek, on a wooded, southeast-facing hillside along Tantroft Branch; soil map sheet 19; USGS Lenox quadrangle; Kentucky coordinates 2,316,400/153,350:

Oi—2 inches to 0; partially decomposed hardwood leaf litter.
A—0 to 4 inches; brown (10YR 4/3) sandy loam; weak fine granular structure; very friable; many fine roots; 5 percent sandstone channers; very strongly acid; clear smooth boundary.
BA—4 to 8 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine granular and subangular blocky structure; very friable; common fine, medium, and coarse roots; 5 percent sandstone channers; very strongly acid; clear wavy boundary.
Bw1—8 to 20 inches; strong brown (7.5YR 5/6) channery sandy loam; moderate medium subangular blocky structure; very friable; common fine, medium, and coarse roots; 20 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw2—20 to 31 inches; strong brown (7.5YR 5/6) channery sandy loam; moderate medium subangular blocky structure; friable; few fine and medium roots; 30 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw3—31 to 46 inches; yellowish brown (10YR 5/6) channery sandy loam; weak medium subangular blocky structure; friable; few fine roots; 30 percent sandstone channers; very strongly acid; clear smooth boundary.

BC—46 to 52 inches; yellowish brown (10YR 5/6) channery sandy loam; weak fine subangular blocky structure; friable; very few very fine roots; 30 percent sandstone channers; very strongly acid; clear smooth boundary.

C—52 to 65 inches; yellowish brown (10YR 5/6) extremely channery sandy loam; massive; friable; 80 percent sandstone channers; very strongly acid.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 35 percent in the solum and from 5 to 80 percent in the substratum. Reaction ranges from extremely acid to strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The fine-earth fraction is sandy loam.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. The fine-earth fraction is sandy loam or loam.

The C horizon has hue of 10YR, value of 5, and chroma of 4 or 6. It has lithochromic mottles in shades of brown, yellow, red, or gray in some pedons. The fine-earth fraction is sandy loam or loam.

Kaymine Series

The Kaymine series consists of very deep, well drained soils that are moderately permeable. These soils formed in stony, loamy, nonacid regolith in areas that have been surface mined for coal or in other highly disturbed areas. The regolith is a mixture of fine-earth material and rock fragments that consist of nonacid siltstone and sandstone and lesser amounts of shale and coal. The soils are on benches, ridgetops, hillsides, and hollow fills, mostly in the central and southern parts of the survey area. Slopes are linear or convex in nearly level to moderately steep areas and complex in steep or very steep areas. They range from 0 to 70 percent. The soils are loamy-skeletal, mixed, nonacid, mesic Typic Udorthents.

Kaymine soils are mapped in undifferentiated units with Fiveblock and Bethesda soils. They are also associated on the landscape with Dekalb, Fedscreek, Gilpin, Hazleton, Helechawa, Kimper, Latham, Marrowbone, and Shelocta soils. Bethesda soils formed in acid regolith and have moderately slow permeability. Dekalb, Gilpin, Latham, and Marrowbone soils are moderately deep. Fedscreek, Helechawa, and Marrowbone soils are coarse-loamy. Fiveblock soils have less than 18 percent clay in the particle-size control section and have rock fragments that are dominantly sandstone. Latham soils are in a clayey textural family. Gilpin, Kimper, and Shelocta soils are fine-loamy.

Typical pedon of Kaymine very channery loam, in an area of Kaymine, Bethesda, and Fiveblock soils, benched, 2 to 70 percent slopes, stony; 0.5 mile north of Carver, in Magoffin County; between the Forks of Oakley Creek on a surface mined ridgetop; soil map sheet 46; USGS Salyersville South quadrangle; Kentucky coordinates 2,780,900/490,400:

A—0 to 8 inches; mottled brown (10YR 5/3) and yellowish brown (10YR 5/4) very channery loam; weak fine granular structure; friable; few fine roots; 40 percent channers and stones (25 percent sandstone and 15 percent siltstone); slightly acid; clear wavy boundary.

C1—8 to 22 inches; mottled yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) very stony silt loam; massive; firm; few fine roots; 40 percent stones and channers (25 percent sandstone, 10 percent siltstone, and 5 percent shale); moderately acid; gradual smooth boundary.

C2—22 to 33 inches; mottled strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) very channery loam; massive; firm; few fine roots; 40 percent channers and stones (25 percent sandstone, 10 percent siltstone, 3 percent shale, and 2 percent coal); moderately acid; gradual smooth boundary.

C3—33 to 40 inches; yellowish brown (10YR 5/4) very channery loam; many coarse prominent strong brown (7.5YR 5/8) lithochromic mottles; massive; firm; 50 percent channers and stones (25 percent sandstone, 15 percent siltstone, 5 percent shale, and 5 percent coal); moderately acid; gradual smooth boundary.

C4—40 to 65 inches; mottled yellowish brown (10YR 5/4) and light gray (10YR 7/2) very channery loam; massive; firm; 45 percent channers (20 percent shale, 12 percent sandstone, 8 percent siltstone, and 5 percent coal); neutral.

The thickness of the solum ranges from 2 to 12 inches. Bedrock is at a depth of 5 feet or more. The content of rock fragments ranges from 35 to

60 percent in the surface layer and from 30 to 80 percent in the substratum. The rock fragments are sandstone, siltstone, shale, and coal with the percentage of any one type making up less than 65 percent. They are mostly channers but include stones and a few boulders. Reaction ranges from moderately acid to slightly alkaline.

The A horizon has hue of 7.5YR or 10YR or is neutral. It has value of 3 to 5 and chroma of 0 to 4. The fine-earth fraction is loam.

The C horizon has hue of 7.5YR to 2.5Y, value of 2 to 6, and chroma of 1 to 8. The fine-earth fraction is loam or silt loam.

Kimper Series

The Kimper series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy colluvium derived from sandstone, siltstone, and shale. They are in coves and on benches and concave foot slopes of hillsides with cool aspects in the southern part of Magoffin County. Slopes are complex and range from 30 to 80 percent. The soils are fine-loamy, mixed, mesic Umbric Dystrochrepts (fig. 26).

Kimper soils in this survey area are taxadjuncts to the Kimper series because they have an argillic horizon and less clay in the subsoil than is defined as the range for the series. These differences, however, do not affect use and management of the soils.

Kimper soils are mapped in a complex with Fedscreek soils. They are also associated on the landscape with Bethesda, Dekalb, Fiveblock, Gilpin, Kaymine, and Marrowbone soils. All of the associated soils have a surface layer that is lighter colored or thinner than that of the Kimper soils. Bethesda, Fiveblock, and Kaymine soils are loamy-skeletal and formed in regolith, primarily from coal mining operations. Dekalb, Gilpin, and Marrowbone soils are moderately deep.

Typical pedon of Kimper fine sandy loam, in an area of Kimper-Fedscreek complex, 30 to 80 percent slopes, stony; about 0.7 mile southwest of Royalton, in Magoffin County; 500 feet southwest of the Howard-Shepard Cemetery and 25 feet north of Royalton-Oakley Creek Road, on a benched, wooded hillside; soil map sheet 46; USGS Salyersville South quadrangle; Kentucky coordinates 2,788,500/495,700:

Oi—3 inches to 0; partially decomposed hardwood leaf litter.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, brown (10YR 5/3) dry; weak fine and medium granular structure; very friable; many fine and medium roots; 12 percent sandstone channers; moderately acid; clear wavy boundary.

BA—6 to 13 inches; brown (10YR 4/3) channery fine sandy loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; 20 percent sandstone channers; strongly acid; clear smooth boundary.

Bt1—13 to 25 inches; yellowish brown (10YR 5/4) channery fine sandy loam; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; few fine tubular pores; few faint pale brown (10YR 6/3) silt coatings and clay films on faces of peds; 30 percent sandstone channers; strongly acid; clear smooth boundary.

Bt2—25 to 42 inches; yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable; common fine roots; few fine tubular pores; few distinct pale brown (10YR 6/3) silt coatings and clay films on faces of peds and on rock fragments; 30 percent sandstone channers; very strongly acid; gradual smooth boundary.

Bt3—42 to 50 inches; yellowish brown (10YR 5/6) channery fine sandy loam; weak coarse subangular blocky structure; friable; very few very fine roots; few distinct pale brown (10YR 6/3) silt coatings and clay films on faces of peds; 20 percent sandstone channers; very strongly acid; gradual smooth boundary.

BC—50 to 80 inches; variegated yellowish brown (10YR 5/4) and light brownish gray (2.5Y 6/2) channery sandy loam; weak coarse subangular blocky structure; firm; 20 percent sandstone channers; moderately acid.

The thickness of the solum ranges from 40 to 60 inches or more. The depth to bedrock is more than 60 inches. The content of rock fragments ranges from 5 to 15 percent in the surface layer and from 5 to 60 percent in the subsoil and substratum but averages less than 35 percent in the upper part of the subsoil. The rock fragments are mostly channers or flagstones. Reaction ranges from strongly acid to neutral in the A horizon and from very strongly acid to moderately acid in the B and C horizons.

The A and BA horizons generally have hue of 10YR, value of 2 to 4, and chroma of 1 to 3; however, when mixed they have, to a depth of about 7 inches, value of 3 or less when moist and 5 or less when dry. The fine-earth fraction is fine sandy loam.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth fraction is fine sandy loam, sandy loam, loam, or silt loam.

The BC and C horizons, if they occur, have textures and colors similar to those of the Bt horizon. They have lithochromic mottles in shades of brown, yellow, red, or gray in some pedons.

Knowlton Series

The Knowlton series consists of very deep, poorly drained soils that are slowly permeable. These soils formed in alluvium weathered from acid siltstone, sandstone, and shale. They are on low stream terraces, in sloughs, and in abandoned river channels along the Licking River and major tributary streams. Slopes are linear or slightly concave and range from 0 to 2 percent. The soils are fine-silty, mixed, mesic Typic Ochraquults.

Knowlton soils in this survey area are taxadjuncts to the Knowlton series because they have more sand in the subsoil than is defined as the range for the series. This difference, however, does not affect use and management of the soils.

Knowlton soils are associated on the landscape with Allegheny, Barbourville, Cotaco, Grigsby, Morehead, Orrville, Pope, Rowdy, and Whitley soils. Allegheny, Barbourville, Grigsby, Pope, Rowdy, and Whitley soils are well drained. Cotaco soils are moderately well drained. Morehead and Orrville soils are somewhat poorly drained.

Typical pedon of Knowlton silt loam, rarely flooded; about 1 mile east of Mize, in Morgan County; 200 feet south of Highway 460 and about 500 feet north of the confluence of Phils Branch and Grassy Creek, in a cultivated field; soil map sheet 24; USGS Cannel City quadrangle; Kentucky coordinates 2,256,700/133,900:

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; very friable; common fine roots; common fine distinct yellowish brown (10YR 5/4) pore linings with sharp boundaries; neutral; abrupt smooth boundary.

BE—8 to 19 inches; light brownish gray (10YR 6/2) silt loam; moderate medium and coarse subangular blocky structure; friable; few fine roots; moderately acid; clear smooth boundary.

Btg1—19 to 40 inches; gray (10YR 6/1) silt loam; weak coarse subangular blocky structure; friable; few fine roots; many faint light brownish gray (10YR 6/2) clay films on faces of peds; common fine prominent brownish yellow (10YR 6/8) soft rounded masses of iron accumulation with diffuse boundaries in the matrix; moderately acid; gradual smooth boundary.

Btg2—40 to 80 inches; gray (10YR 6/1) silt loam; weak coarse subangular blocky structure; firm; few fine roots; many faint light brownish gray (10YR 6/2) clay films on faces of peds; many fine distinct yellowish brown (10YR 5/4) soft rounded masses of iron accumulation with diffuse boundaries in the matrix; moderately acid.

The thickness of the solum ranges from 40 to 60 inches or more. The depth to bedrock is more than 60 inches. The content of rock fragments, mostly sandstone gravel, ranges from 0 to 5 percent throughout. Reaction is neutral to strongly acid in the A horizon and moderately acid or strongly acid in the B and C horizons.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4.

The BE horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It has iron depletions in shades of gray and olive in some pedons. The fine-earth fraction is silt loam, loam, or silty clay loam.

The Btg horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. It has iron depletions in shades of gray and iron masses in shades of brown in most pedons. The fine-earth fraction is silt loam, loam, or silty clay loam.

The Cg horizon, if it occurs, has hue of 7.5YR to 5Y, value of 2 to 5, and chroma of 1 to 8. The fine-earth fraction is silt loam, loam, or silty clay loam.

Latham Series

The Latham series consists of moderately deep, moderately well drained soils that are slowly permeable. These soils formed in clayey material weathered from interbedded acid shale and siltstone. They are on ridgetops and hillsides in the northern and central parts of the survey area and on nose slopes along the Licking River. Slopes are linear, convex, or complex and range from 4 to 60 percent. The soils are clayey, mixed, mesic Aquic Hapludults.

Latham soils are associated on the landscape with Bethesda, Ezel, Fiveblock, Gilpin, Hazleton, Helechawa, Kaymine, Lily, Marrowbone, Rayne, and Shelocta soils. Bethesda, Fiveblock, Hazleton, and Kaymine soils are loamy-skeletal. Ezel, Gilpin, Lily, Rayne, and Shelocta soils are fine-loamy. Helechawa and Marrowbone soils are coarse-loamy.

Typical pedon of Latham silt loam, in an area of Gilpin-Latham-Marrowbone complex, 20 to 60 percent slopes; 2 miles southeast of West Liberty, in Morgan County; about 1 mile northeast of the junction of Cottle Bend Road and Jones Creek Road at Gordon Ford and 200 feet south of the Licking River, on a narrow, wooded ridgetop; soil map sheet 19; USGS Lenox quadrangle; Kentucky coordinates 2,296,900/145,500:

Oi—3 inches to 0; partially decomposed leaf litter.

A—0 to 3 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; 2 percent siltstone channers; very strongly acid; clear smooth boundary.

E—3 to 7 inches; light yellowish brown (10YR 6/4) silt loam; weak fine granular and subangular blocky structure; very friable; many fine and medium roots; 3 percent siltstone channers; very strongly acid; clear smooth boundary.

Bt1—7 to 21 inches; strong brown (7.5YR 5/8) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few prominent yellowish brown (10YR 5/6) clay films on faces of peds; few fine prominent irregular light gray (10YR 7/2) iron depletions with diffuse boundaries on faces of peds; 3 percent siltstone channers; very strongly acid; clear smooth boundary.

Bt2—21 to 33 inches; light gray (2.5Y 7/2) silty clay; common medium prominent brownish yellow (10YR 6/8) and few medium prominent strong brown (7.5YR 5/8) lithochromic mottles; moderate medium subangular blocky structure; firm; few fine roots; few prominent yellowish brown (10YR 5/6) clay films on faces of peds; few fine distinct irregular light gray (10YR 7/2) iron depletions with diffuse boundaries on faces of peds; 3 percent siltstone channers; very strongly acid; clear smooth boundary.

BC—33 to 38 inches; variegated silty clay loam, 45 percent light gray (10YR 7/2), 30 percent yellow (10YR 7/8), and 25 percent strong brown (7.5YR 5/8); weak medium subangular blocky structure; firm; very few very fine roots; 10 percent siltstone channers; very strongly acid; gradual smooth boundary.

Cr—38 inches; thinly bedded shale and siltstone bedrock.

The thickness of the solum and the depth to paralithic contact range from 20 to 40 inches. The content of rock fragments, mainly thin fragments of shale and siltstone, ranges from 0 to 15 percent in the A and E horizons, from 0 to 20 percent in the Bt horizon, and from 0 to 30 percent in the BC and C horizons. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The A horizon has hue of 10YR and value and chroma of 3 or 4. Pedons in cultivated areas have an Ap horizon, which has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The fine-earth fraction is silt loam.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. The fine-earth fraction is silt loam. Cultivated areas do not have an E horizon. The BA or BE horizon, if it occurs, has colors and textures similar to those of the E horizon.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 8. Few or common iron depletions with chroma of 2 or less are in the upper part of the horizon. Lithochromic mottles of both high and low chroma become more common with increasing depth. The fine-earth fraction is silty clay loam or silty clay.

The BC and C horizons, if they occur, have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. The fine-earth fraction is silty clay loam or silty clay.

The bedrock is weathered, soft shale that is commonly interbedded with siltstone.

Lily Series

The Lily series consists of moderately deep, well drained soils that are moderately rapidly permeable. These soils formed in acid sandstone residuum. They are on narrow ridgetops in the northern part of Morgan County and on a few low nose slopes along the Licking River in Magoffin County. Slopes are linear or convex and range from 6 to 20 percent. The soils are fine-loamy, siliceous, mesic Typic Hapludults.

Lily soils are associated on the landscape with Alticrest, Gilpin, Latham, Ramsey, Rayne, Rigley, and Shelocta soils. Alticrest and Rigley soils are coarse-loamy. Gilpin, Latham, Rayne, and Shelocta soils have mixed mineralogy. Latham soils are in a clayey textural family. Ramsey soils are shallow over bedrock. Rayne soils are deep and formed in material weathered from soft, interbedded siltstone and sandstone. Shelocta soils are deep and formed in mixed colluvium of siltstone and sandstone.

Typical pedon of Lily sandy loam, 6 to 20 percent slopes; about 7 miles north of Ezel, in Morgan County; 0.6 mile southwest of the confluence of Devil Creek and the Licking River; 500 feet northeast of Flaxseed Branch on a narrow, wooded ridgetop; soil map sheet 8; USGS Ezel quadrangle; Kentucky coordinates 2,237,780/178,400:

Oi—3 inches to 0; partially decomposed hardwood leaf litter.

A—0 to 3 inches; brown (10YR 5/3) sandy loam; weak fine granular structure; very friable; common fine and medium roots; 5 percent sandstone channers; strongly acid; clear smooth boundary.

BE—3 to 8 inches; brownish yellow (10YR 6/6) sandy loam; weak medium granular structure; very friable; common fine and medium roots; 5 percent sandstone channers; very strongly acid; clear smooth boundary.

Bt1—8 to 22 inches; strong brown (7.5YR 5/8) loam;

weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; 5 percent sandstone channers; very strongly acid; gradual smooth boundary.

Bt2—22 to 30 inches; strong brown (7.5YR 5/8) channery loam; moderate medium subangular blocky structure; friable; common fine and medium roots; common distinct strong brown (7.5YR 5/6) clay films on faces of peds; 20 percent sandstone channers; very strongly acid; gradual smooth boundary.

BC—30 to 38 inches; strong brown (7.5YR 5/8) channery loam; common medium prominent yellowish brown (10YR 5/6) lithochromic mottles; weak medium subangular blocky structure; friable; few fine and medium roots; 30 percent sandstone channers; extremely acid; gradual smooth boundary.

R—38 inches; weathered sandstone bedrock.

The thickness of the solum and the depth to sandstone bedrock range from 20 to 40 inches. The content of sandstone rock fragments ranges from 0 to 30 percent to a depth of about 24 inches and from 0 to 35 percent below a depth of 24 inches. In unlimed areas reaction ranges from strongly acid to extremely acid.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The fine-earth fraction is sandy loam. Pedons in cultivated areas have an Ap horizon, which has colors and texture similar to those of the A horizon.

The AB, BA, or BE horizon, if it occurs, has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. The fine-earth fraction is sandy loam or loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. The fine-earth fraction is dominantly loam or sandy clay loam. Subhorizons of sandy loam are in the lower part of the horizon in some pedons.

The BC horizon and the C horizon, if it occurs, have colors and textures similar to those of the Bt horizon.

The bedrock is weathered, hard sandstone.

Marrowbone Series

The Marrowbone series consists of moderately deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy residuum or colluvium derived from sandstone and siltstone. They are on ridgetops, mostly in the central and southern parts of the survey area. Slopes are convex and range from 15 to 60 percent. The soils are coarse-loamy, mixed, mesic Typic Dystrochrepts.

Marrowbone soils are associated on the landscape with Bethesda, Dekalb, Ezel, Fedscreek, Fiveblock, Gilpin, Hazleton, Helechawa, Kaymine, Kimper, Latham, and Shelocta soils. Bethesda, Dekalb, Fiveblock, Hazleton, and Kaymine soils are loamy-skeletal. Ezel, Gilpin, Kimper, and Shelocta soils are fine-loamy. Latham soils are in a clayey textural family. Fedscreek and Helechawa soils are very deep.

Typical pedon of Marrowbone loam, in an area of Gilpin-Latham-Marrowbone complex, 20 to 60 percent slopes; about 9 miles northwest of Salyersville, in Magoffin County; 2 miles west of the junction of Kentucky Highway 1081 and U.S. 460, on the crest of a wooded ridgetop at the head of Grandaddy Branch; soil map sheet 30; USGS White Oak quadrangle; Kentucky coordinates 2,740,500/541,200:

Oi—1 inch to 0; partially decomposed hardwood leaf litter.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; very friable; many fine and medium and few coarse roots; 5 percent sandstone channers; very strongly acid; clear wavy boundary.

BE—3 to 13 inches; brownish yellow (10YR 6/6) loam; weak medium subangular blocky structure; very friable; many fine, medium, and coarse roots; 8 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw1—13 to 22 inches; yellowish brown (10YR 5/6) channery fine sandy loam; weak medium subangular blocky structure; very friable; common fine and few medium roots; 15 percent sandstone channers; very strongly acid; clear smooth boundary.

Bw2—22 to 27 inches; yellowish brown (10YR 5/6) channery fine sandy loam; weak medium and coarse subangular blocky structure; friable; few fine roots; 25 percent sandstone channers; very strongly acid; clear smooth boundary.

R—27 inches; sandstone bedrock; weathered in the upper 2 inches.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of rock fragments ranges from 5 to 45 percent in individual horizons but averages less that 35 percent in the particle-size control section. Reaction ranges from very strongly acid to moderately acid.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. The fine-earth fraction is loam.

The BE and Bw horizons have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 8. In some pedons they have lithochromic mottles in shades of brown, yellow, red, or gray. The fine-earth fraction is loam, fine sandy loam, or sandy loam.

The BC and C horizons, if they occur, have colors and textures similar to those of the Bw horizon.

The bedrock is rippable, weathered sandstone grading to hard, unweathered sandstone.

Morehead Series

The Morehead series consists of very deep, somewhat poorly drained soils that are moderately permeable. These soils formed in silty alluvium derived from acid siltstone, sandstone, and shale. They are on low stream terraces along the Licking River and major tributary streams, mostly in Morgan County. Slopes are linear or slightly concave and range from 0 to 3 percent. The soils are fine-silty, mixed, mesic Aquic Hapludults.

Morehead soils are associated on the landscape with Allegheny, Cotaco, Grigsby, Knowlton, Orrville, Pope, Rowdy, and Whitley soils. Allegheny, Grigsby, Pope, Rowdy, and Whitley soils are well drained. Cotaco soils are moderately well drained. Knowlton soils are poorly drained. Allegheny, Cotaco, Orrville, and Rowdy soils are fine-loamy. Grigsby and Pope soils are coarse-loamy.

Typical pedon of Morehead silt loam, rarely flooded; about 1,000 feet northeast of Maytown, in Morgan County; 150 feet south of Kentucky Highway 1010 and 200 feet southwest of a power substation, in a cultivated field along Blackwater Creek; soil map sheet 23; USGS Hazel Green quadrangle; Kentucky coordinates 2,658,500/560,900:

Ap—0 to 9 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium granular structure; very friable; few fine roots; few fine distinct brownish yellow (10YR 6/6) soft masses of iron accumulation with sharp boundaries lining pores; 2 percent sandstone pebbles; neutral; abrupt smooth boundary.

Bt1—9 to 23 inches; light yellowish brown (10YR 6/4) silt loam; weak fine and medium subangular blocky structure; very friable; few fine roots; few faint clay films on faces of peds; common medium distinct light brownish gray (10YR 6/2) irregular iron depletions with clear boundaries on faces of peds; neutral; clear smooth boundary.

Bt2—23 to 30 inches; yellowish brown (10YR 5/8) silt loam; weak medium subangular blocky structure; firm; few fine roots; few prominent pale brown (10YR 6/3) clay films on faces of peds; many medium prominent light brownish gray (10YR 6/2) irregular iron depletions with clear boundaries on faces of peds; few fine prominent black (10YR 2/1) strongly cemented manganese concretions in ped interiors; slightly acid; clear smooth boundary.

Btg—30 to 40 inches; light gray (10YR 7/2) silt loam; weak coarse subangular blocky structure; firm; few fine roots; few faint pale brown (10YR 6/3) clay films on faces of peds; many fine prominent yellowish brown (10YR 5/8) soft masses of iron accumulation with sharp boundaries in ped interiors; strongly acid; gradual smooth boundary.

C—40 to 65 inches; yellowish brown (10YR 5/8) silt loam; massive; firm; common medium prominent light gray (10YR 7/2) iron depletions with clear boundaries in the matrix; common fine distinct brownish yellow (10YR 6/6) soft masses of iron accumulation with sharp boundaries in the matrix; common fine prominent black (10YR 2/1) strongly cemented manganese concretions in the matrix; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. The content of rock fragments is less than 15 percent in all horizons. In unlimed areas reaction is strongly acid or very strongly acid throughout the profile.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 3 to 8. The fine-earth fraction is silt loam or silty clay loam. The horizon has iron depletions in shades of olive or gray and soft masses of iron accumulation in shades of yellow or brown. The extent of iron depletions and masses of iron accumulation increase with increasing depth.

The Btg horizon, if it occurs, has hue of 7.5YR to 2.5Y, value of 5 to 7, and chroma of 1 or 2. It has masses of iron accumulation in shades of yellow or brown and has textures similar to those of the Bt horizon.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 to 8. The fine-earth fraction is silt loam or loam. The Cg horizon, if it occurs, has hue and value similar to those of the C horizon and chroma of 1 or 2. Textures are also similar to those of the C horizon.

Orrville Series

The Orrville series consists of very deep, somewhat poorly drained soils that are moderately permeable. These soils formed in loamy alluvium derived from sandstone, siltstone, and shale. They are in wet spots and depressions on flood plains throughout the survey area. Slopes are slightly concave and range from 0 to 3 percent. The soils are fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents.

The Orrville soil in Orrville loam, frequently flooded, has a surface layer of loam and a subsoil of stratified loam and sandy loam. This difference, however, does not affect use and management of the soil.

Orrville soils are associated on the landscape with Allegheny, Barbourville, Cotaco, Grigsby, Knowlton, Morehead, Pope, and Rowdy soils and Udorthents. Allegheny, Barbourville, Grigsby, and Rowdy soils are well drained. Cotaco soils are moderately well drained. Grigsby and Pope soils are coarse-loamy. Knowlton soils are poorly drained. Knowlton and Morehead soils are fine-silty. Udorthents have been altered. They do not have diagnostic horizons other than an ochric epipedon, and their properties vary greatly.

Typical pedon of Orrville silt loam, in an area of Orrville-Grigsby complex, 0 to 3 percent slopes, frequently flooded; about 0.9 mile east of Royalton, in Magoffin County; 100 feet south of Kentucky Highway 867 and 1,000 feet west of the confluence of Gun Creek and Meatskin Branch, in a field along Meatskin Branch; soil map sheet 43; USGS Salyersville South quadrangle; Kentucky coordinates 2,794,000/500,300:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable; few fine roots; common medium faint light brownish gray (10YR 6/2) iron depletions with diffuse boundaries on faces of peds; slightly acid; clear smooth boundary.

Bw—7 to 18 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common fine roots; common medium faint light brownish gray (10YR 6/2) iron depletions with diffuse boundaries on faces of peds; slightly acid; clear smooth boundary.

Bg1—18 to 29 inches; light brownish gray (2.5Y 6/2) silt loam; weak coarse subangular blocky structure; friable; few fine roots; common fine prominent brown (7.5YR 5/6) soft masses of iron accumulation with sharp boundaries in the matrix; slightly acid; clear smooth boundary.

Bg2—29 to 34 inches; gray (N 6/0) loam, light olive brown (2.5Y 5/4) upon exposure to air; weak coarse subangular blocky structure; friable; few fine roots; common fine prominent strong brown (7.5YR 5/6) soft masses of iron accumulation with sharp boundaries in the matrix; slightly acid; clear smooth boundary.

Cg—34 to 65 inches; light brownish gray (2.5Y 6/2) sandy loam, light yellowish brown (2.5Y 6/4) upon exposure to air; single grain; loose; stratified; slightly acid.

The thickness of the solum ranges from 24 to 50 inches. The depth to bedrock is more than 60 inches. The content of rock fragments, mostly sandstone and siltstone channers, ranges from 0 to 15 percent in the solum and from 0 to 25 percent in the substratum. In unlimed areas reaction ranges from strongly acid to slightly acid.

The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. The fine-earth fraction is silt loam or loam.

The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It has common iron depletions in shades of gray and common soft masses of iron accumulation in shades of yellow and brown. The fine-earth fraction is silt loam or loam.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2, or it is neutral and has value of 4 to 6. It has common iron depletions in shades of gray and common soft masses of iron accumulation in shades of yellow and brown. The fine-earth fraction is silt loam, loam, silty clay loam, or clay loam.

The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2, or it is neutral and has value of 4 to 7. In some pedons it has subhorizons of silty clay loam and clay loam. The fine-earth fraction is dominantly stratified silt loam, loam, or sandy loam. The C horizon, if it occurs, has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 3 to 6. It has textures similar to those of the Cg horizon.

Pope Series

The Pope series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy alluvium derived from acid sandstone, shale, and siltstone. They are on flood plains along the Licking River in Magoffin and Morgan Counties and along a few major streams in the northern part of Morgan County. Slopes are linear or slightly convex and range from 0 to 2 percent. The soils are coarse-loamy, mixed, mesic Fluventic Dystrochrepts.

Pope soils are associated on the landscape with Allegheny, Cotaco, Knowlton, Morehead, Orrville, Rowdy, and Whitley soils and Udorthents. Allegheny, Cotaco, Knowlton, Morehead, Orrville, Rowdy, and Whitley soils are fine-loamy or fine-silty. In addition, Cotaco soils are moderately well drained, Morehead and Orrville soils are somewhat poorly drained, and Knowlton soils are poorly drained. Udorthents have been altered. They do not have diagnostic horizons other than an ochric epipedon, and their properties vary greatly.

Typical pedon of Pope loam, frequently flooded; about 0.3 mile south of Galdia, in Magoffin County; 150 feet west of Kentucky Highway 7 at Little Martha Church and 1,700 feet north of the confluence of the Licking River and Salt Lick, 100 feet east of the Licking River in a wooded field; soil map sheet 47; USGS Ivyton quadrangle; Kentucky coordinates 2,800,100/483,500:

Ap—0 to 8 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; few fine and medium roots; neutral; clear smooth boundary.

Bw1—8 to 15 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; very friable; common fine and medium roots; strongly acid; gradual smooth boundary.

Bw2—15 to 26 inches; yellowish brown (10YR 5/4) loam that has many thin strata of yellowish brown (10YR 5/8) sand; weak medium subangular blocky structure; very friable; few fine roots; strongly acid; clear smooth boundary.

BC—26 to 45 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; few fine roots; strongly acid; gradual smooth boundary.

C—45 to 65 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; common thin strata of brownish yellow (10YR 6/6) sandy loam; strongly acid.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 60 inches. The content of rock fragments, mostly sandstone channers, ranges from 0 to 30 percent to a depth of about 40 inches and from 0 to 60 percent below a depth of 40 inches. Reaction is generally very strongly acid or strongly acid; however, most cultivated fields in the survey area have been limed, resulting in less acid conditions in the upper part of the solum.

The Ap horizon has a hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth fraction is sandy loam, loam, or silt loam. The BC horizon has colors and textures similar to those of the Bw horizon.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 4 or 6. It is stratified. The fine-earth fraction is loamy sand or sandy loam.

Ramsey Series

The Ramsey series consists of shallow, somewhat excessively drained soils that are moderately rapidly permeable. These soils formed in acid sandstone residuum. They are on nose slopes and narrow benches on ridgetops and hillsides in the northern part of Morgan County. Slopes are linear or convex and range from 20 to 60 percent. The soils are loamy, siliceous, mesic Lithic Dystrochrepts.

Ramsey soils are mapped in a complex with Alticrest soils. They are also associated on the landscape with Lily and Rigley soils. Alticrest, Lily, and Rigley soils have bedrock at a depth of more than 20 inches.

Typical pedon of Ramsey channery sandy loam, in an area of Alticrest-Ramsey complex, rocky, 20 to 60 percent slopes; about 12 miles north of West Liberty, in Morgan County; 0.5 mile south of a bridge over Cave Run Reservoir; 200 feet west of Kentucky Highway 519 and 500 feet southeast of a limestone quarry, on a narrow, wooded nose slope; soil map sheet 4; USGS Wrigley quadrangle; Kentucky coordinates 2,244,900/195,200:

A—0 to 4 inches; brown (10YR 5/3) channery sandy loam; weak fine granular structure; friable; common fine and medium roots; 30 percent sandstone channers; very strongly acid; abrupt smooth boundary.

Bw—4 to 14 inches; brownish yellow (10YR 6/6) channery loam; weak medium subangular blocky structure; friable; common fine and medium roots; 30 percent sandstone channers; very strongly acid; clear smooth boundary.

BC—14 to 18 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak coarse subangular blocky structure; firm; few fine and medium roots; 35 percent sandstone channers; very strongly acid; abrupt smooth boundary.

R—18 inches; fractured sandstone bedrock.

The thickness of the solum and the depth to sandstone bedrock range from 10 to 20 inches. The content of sandstone rock fragments ranges from 5 to 35 percent throughout. The rock fragments in the upper part of the solum are generally less than 3 inches in size, while some of the rock fragments in the lower part are as much as 6 inches in size. Flagstones are in some of the lower horizons. Reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The fine-earth fraction is sandy loam.

The Bw horizon has hue of 7.5YR to 10YR, value of 4 to 6, and chroma of 4 to 8. The fine-earth fraction is sandy loam or loam.

The BC and C horizons, if they occur, have colors and textures similar to those of the Bw horizon.

The bedrock is hard sandstone that may be fractured.

Rayne Series

The Rayne series consists of deep, well drained soils that are moderately permeable. These soils formed in material weathered from interbedded, acid, soft sandstone and siltstone. They are on broad ridgetops in the northern part of Morgan County. Slopes are linear or convex and range from 4 to 12 percent. The soils are fine-loamy, mixed, mesic Typic Hapludults.

Rayne soils are mapped in a complex with Gilpin soils. They are also associated on the landscape with Ezel, Latham, Lily, and Shelocta soils. Ezel soils formed in alluvium. Gilpin and Lily soils are moderately deep. Latham soils are in a clayey textural family. Lily soils have siliceous mineralogy. Shelocta soils formed in colluvium.

Typical pedon of Rayne silt loam, in an area of Rayne-Gilpin complex, 4 to 12 percent slopes; in the city limits of Ezel, in Morgan County; 600 feet southeast of a church on a narrow ridgetop and 50 feet south of an improved road between the church and a cemetery; soil map sheet 17; USGS Ezel quadrangle; Kentucky coordinates 2,233,500/143,600:

Ap—0 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; very friable; common fine roots; 2 percent ironstone channers; moderately acid; abrupt smooth boundary.

Bt1—11 to 20 inches; yellowish brown (10YR 5/8) silt loam; weak medium subangular blocky structure; friable; few fine roots; few prominent light yellowish brown (10YR 6/4) clay films on faces of peds; 3 percent sandstone and siltstone channers; strongly acid; clear smooth boundary.

Bt2—20 to 29 inches; yellowish brown (10YR 5/8) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common prominent light yellowish brown (10YR 6/4) clay films on faces of peds; 10 percent sandstone and siltstone channers; strongly acid; clear smooth boundary.

Bt3—29 to 40 inches; yellowish brown (10YR 5/8) silty clay loam; few fine prominent pale brown (10YR 6/3) lithochromic mottles; weak medium subangular blocky structure; friable; few fine roots; many distinct brownish yellow (10YR 6/6) clay films on faces of peds; 10 percent sandstone and siltstone channers; strongly acid; gradual smooth boundary.

BC—40 to 48 inches; variegated yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) channery silt loam; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; firm; 15 percent sandstone and siltstone channers; strongly acid; abrupt smooth boundary.

R—48 inches; interbedded siltstone and sandstone bedrock.

The thickness of the solum and the depth to bedrock range from 40 to 60 inches. The content of rock fragments ranges from 0 to 30 percent in the upper part of the solum and from 15 to 40 percent in the lower part of the solum and in the substratum but averages less than 35 percent in the particle-size control section. In unlimed areas reaction is strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The fine-earth fraction is silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. In some pedons it has redoximorphic features below a depth of 40 inches. The fine-earth fraction is silt loam, loam, or silty clay loam.

The BC horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. The fine-earth fraction is silt loam, loam, or silty clay loam.

The bedrock is interbedded siltstone and sandstone.

Rigley Series

The Rigley series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in colluvium derived mostly from sandstone. They are on footslopes and benches, mostly in the northern and eastern parts of Morgan County, and along a few streams in the northeastern part of Magoffin County. Slopes are complex and range from 25 to 60 percent. The soils are coarse-loamy, mixed, mesic Typic Hapludults.

Rigley soils are mapped in a complex with areas of sandstone rock outcrop. They are also associated on the landscape with Alticrest, Bledsoe, Donahue, Ezel, Gilpin, Lily, Ramsey, and Shelocta soils. Alticrest, Lily, and Ramsey soils have siliceous mineralogy. Bledsoe, Donahue, Ezel, Gilpin, Lily, and Shelocta soils are in a fine or fine-loamy textured family. Alticrest, Donahue, Gilpin, and Lily soils are moderately deep. Ramsey soils are shallow.

Typical pedon of Rigley sandy loam, in an area of Rigley-Rock outcrop complex, 25 to 60 percent slopes; 0.7 mile southwest of Blaze, in Morgan County; on a north-facing, wooded footslope at the mouth of a small drainageway along Yocum Creek; soil map sheet 5; USGS Wrigley quadrangle; Kentucky coordinates 2,261,100/190,300:

Oi—2 inches to 0; partially decomposed hardwood leaf litter.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; very friable; many fine roots; 3 percent sandstone pebbles; very strongly acid; abrupt smooth boundary.

AE—4 to 8 inches; dark grayish brown (10YR 4/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse granular structure; very friable; many fine and medium and few coarse roots; 3 percent sandstone pebbles; strongly acid; abrupt wavy boundary.

E—8 to 15 inches; light yellowish brown (10YR 6/4) sandy loam; weak fine granular structure; very friable; few fine, medium, and coarse roots; thin brown (10YR 5/3) organic coatings on faces of peds and in pores; 10 percent sandstone channers and 2 percent quartz pebbles; moderately acid; clear smooth boundary.

Bt1—15 to 24 inches; brownish yellow (10YR 6/6) sandy loam; common medium distinct light yellowish brown (10YR 6/4) mottles; weak medium and coarse subangular blocky structure; very friable; few fine and medium roots; few fine pores; common distinct yellowish brown (10YR 5/4) clay bridges between sand grains; 10 percent sandstone channers and 2 percent quartz pebbles; strongly acid; clear smooth boundary.

Bt2—24 to 38 inches; brownish yellow (10YR 6/6) sandy loam; moderate medium subangular blocky structure; friable; few fine and medium roots; few fine tubular pores; common distinct yellowish brown (10YR 5/4) clay bridges between sand grains; 10 percent sandstone channers and 2 percent quartz pebbles; very strongly acid; gradual smooth boundary.

Bt3—38 to 45 inches; brownish yellow (10YR 6/6) channery sandy loam; moderate medium subangular blocky structure; friable; few fine roots; few coarse tubular pores; common distinct yellowish brown (10YR 5/4) clay bridges between sand grains; 25 percent sandstone channers and 2 percent quartz pebbles and conglomerate fragments; very strongly acid; gradual smooth boundary.

C—45 to 60 inches; yellowish brown (10YR 5/4) very channery sandy loam; common fine distinct brownish yellow (10YR 6/6) and few medium prominent strong brown (7.5YR 5/8) lithochromic mottles; massive; firm; 45 percent sandstone channers and 5 percent quartz pebbles; very strongly acid; gradual smooth boundary.

2C—60 to 68 inches; variegated light gray (10YR 7/1), strong brown (7.5YR 5/8), and yellowish brown (10YR 5/6) extremely channery loam; massive; very firm; 70 percent sandstone channers; very strongly acid; abrupt smooth boundary.

R—68 inches; sandstone bedrock.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. The content of rock fragments ranges from 2 to 35 percent in the solum and from 20 to 70 percent in the substratum. Reaction ranges from strongly acid to extremely acid, except for in the A horizon where it ranges from very strongly acid to neutral.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3. The fine-earth fraction is sandy loam. The AE horizon has colors similar to those of the A horizon. The fine-earth fraction is sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. The fine-earth fraction is sandy loam or loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. The fine-earth fraction is sandy loam or loam. Some pedons have a 2Bt horizon, which is below a depth of 40 inches and has lithochromic mottles in shades of brown, yellow, or gray.

The C horizon has colors similar to those of the Bt horizon. The fine-earth fraction is sandy loam, loam, or clay loam. Some pedons have a 2C horizon that has hue of 7.5YR or 10YR and is variegated in shades of gray, brown, or red without a dominant matrix hue or chroma. The fine-earth fraction of the 2C horizon is similar to that of the C horizon.

The bedrock is sandstone, siltstone, or shale.

Riney Series

The Riney series consists of very deep, well drained soils that are moderately rapidly permeable. These soils formed in loamy alluvium derived from acid sandstone, siltstone, and shale. They are on strath terraces that cap narrow ridgetops and nose slopes along the Licking River. Slopes are convex and range from 6 to 20 percent. The soils are fine-loamy, siliceous, mesic Typic Hapludults.

Riney soils are mapped in a complex with Ezel soils. They are also associated on the landscape with Gilpin and Shelocta soils. Ezel soils are deep. Gilpin soils formed in residuum and are moderately deep. Shelocta soils formed in colluvium.

Typical pedon of Riney loam, in an area of Riney-Ezel complex, 6 to 20 percent slopes; about 1 mile west of West Liberty, in Morgan County; 0.7 mile northwest of U.S. 460 and 1,800 feet southwest of Daisy Knob, in a pasture on a narrow ridgetop overlooking Neal Valley; soil map sheet 13; USGS West Liberty quadrangle; Kentucky coordinates 2,281,200/153,750:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) loam; common medium prominent yellowish red (5YR 5/6) mottles; moderate fine granular and weak medium subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—7 to 14 inches; yellowish red (5YR 5/8) loam; moderate medium subangular blocky structure; friable; few fine roots; many prominent brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—14 to 22 inches; yellowish red (5YR 5/8) clay loam; moderate fine and medium subangular blocky structure; friable; few fine roots; many prominent reddish brown (5YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—22 to 35 inches; yellowish red (5YR 5/8) sandy clay loam; few fine prominent pink (7.5YR 7/4) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; many prominent reddish brown (5YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt4—35 to 45 inches; yellowish red (5YR 5/8) sandy clay loam; common medium prominent pink (7.5YR 7/4) mottles; weak medium subangular blocky structure; firm; very few very fine roots; few prominent reddish brown (5YR 4/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

C—45 to 65 inches; yellowish red (5YR 5/8) sandy loam; many medium prominent pink (5YR 7/3) mottles; single grain; loose; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock, which is mostly sandstone, is more than 60 inches. The content of quartz pebbles and sandstone fragments ranges from 0 to 10 percent in the solum and from 0 to 15 percent in the substratum. Reaction ranges from very strongly acid to neutral in the surface layer and is very strongly or strongly acid in the lower part of the solum and in the substratum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The fine-earth fraction is loam.

The Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 8. The fine-earth fraction is sandy clay loam, clay loam, or loam.

The C horizon has hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. The fine-earth fraction is sandy loam, sandy clay loam, or loamy sand.

Rowdy Series

The Rowdy series consists of very deep, well drained soils that are moderately permeable. These soils formed in loamy alluvium derived from acid sandstone, shale, and siltstone. They are on low stream terraces and alluvial fans along the Licking River and major streams throughout the survey area. Slopes are linear or slightly convex and range from 0 to 4 percent. The soils are fine-loamy, mixed, mesic Fluventic Dystrochrepts.

Rowdy soils are associated on the landscape with Allegheny, Barbourville, Cotaco, Grigsby, Knowlton, Morehead, Orrville, Pope, and Whitley soils and Udorthents. Allegheny, Cotaco, Knowlton, Morehead, and Whitley soils have an argillic horizon. Barbourville soils have a thick, dark surface layer. Cotaco soils are moderately well drained. Knowlton soils are poorly drained. Morehead and Orrville soils are somewhat poorly drained. Grigsby and Pope soils are coarse-loamy. Udorthents have been altered. They do not have diagnostic horizons other than an ochric epipedon, and their properties vary greatly.

Typical pedon of Rowdy loam, 0 to 4 percent slopes, occasionally flooded; 1.6 miles northeast of Woodsbend, in Morgan County; 2,500 feet southwest of the confluence of Straight Creek and Caney Creek and 2,600 feet southeast of Licking River-Woodsbend Road, in a cultivated field along Straight Creek; soil map sheet 13; USGS West Liberty quadrangle; Kentucky coordinates 2,270,600/154,000:

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) loam; few fine faint brown (10YR 4/3) mottles; moderate fine and medium granular structure; very friable; common fine roots; 12 percent siltstone channers; neutral; abrupt smooth boundary.

BA—8 to 15 inches; yellowish brown (10YR 5/4) channery loam; few medium faint brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; few fine roots; 20 percent siltstone and sandstone channers; neutral; clear smooth boundary.

Bw1—15 to 26 inches; brown (10YR 5/3) loam; few medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; few fine roots; 5 percent siltstone and sandstone channers; strongly acid; clear smooth boundary.

Bw2—26 to 40 inches; brown (10YR 5/3) loam; weak fine and medium subangular blocky structure; friable; few fine roots; 10 percent siltstone and sandstone channers; moderately acid; gradual smooth boundary.

BC—40 to 50 inches; brown (10YR 5/3) loam; weak fine subangular blocky structure; friable; few fine roots; few fine faint grayish brown (10YR 5/2) iron depletions with diffuse boundaries on faces of peds; 10 percent siltstone and sandstone channers; moderately acid; gradual smooth boundary.

C—50 to 65 inches; brown (10YR 5/3) loam; massive; firm; common medium faint grayish brown (10YR 5/2) iron depletions with diffuse boundaries throughout the matrix; 10 percent sandstone and siltstone channers; strongly acid.

The thickness of the solum ranges from 40 to 65 inches or more. The depth to bedrock is more than 60 inches. The content of rock fragments, mostly siltstone channers and pebbles, ranges from 0 to 30 percent in the solum and from 0 to 60 percent in the substratum. In unlimed areas reaction ranges from very strongly acid to moderately acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The fine-earth fraction is loam. The BA horizon has colors similar to those of the Ap horizon. The fine-earth fraction is loam or silt loam.

The Bw and BC horizons have hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The fine-earth fraction is loam or silt loam. The horizons have common gray or olive iron depletions below a depth of 40 inches in most pedons.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The fine-earth fraction is loam, silt loam, or clay loam.

Shelocta Series

The Shelocta series consists of deep, well drained soils that are moderately permeable. These soils formed in mixed colluvium derived from acid shale, siltstone, and sandstone. They are in coves and on benches, footslopes, and side slopes of hillsides throughout the survey area. Slopes are complex and range from 6 to 65 percent. The soils are fine-loamy, mixed, mesic Typic Hapludults.

Shelocta soils are associated on the landscape with Bethesda, Dekalb, Ezel, Fiveblock, Gilpin, Hazleton, Helechawa, Kaymine, Latham, Lily, Marrowbone, Rayne, Rigley, and Riney soils. Bethesda, Dekalb, Fiveblock, Hazleton, and Kaymine soils are loamy-skeletal. Dekalb, Gilpin, Latham, Lily, and Marrowbone soils are moderately deep and formed in residuum. Ezel and Riney soils formed in alluvium. Helechawa, Marrowbone, and Rigley soils are coarse-loamy. Rayne soils formed in residuum.

Typical pedon of Shelocta loam, in an area of Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony; about 5 miles southeast of Royalton, in Magoffin County; about 1 mile east of the confluence of Puncheon Camp Creek and Pigpen Branch; 2,200 feet west of the Sub Howard Cemetery; 300 feet north of Puncheoncamp Creek, on a narrow bench on an east-facing, wooded hillside; soil map sheet 47; USGS Ivyton quadrangle; Kentucky coordinates 2,811,800/488,100:

Oi—2 inches to 0; partially decomposed hardwood leaf litter.

A—0 to 4 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; common fine and medium roots; 10 percent siltstone channers; strongly acid; clear wavy boundary.

BE—4 to 9 inches; reddish yellow (7.5YR 6/6) loam; weak medium subangular blocky structure; friable; common fine and medium and few coarse roots; few medium tubular pores; 10 percent siltstone channers; very strongly acid; clear smooth boundary.

Bt1—9 to 24 inches; strong brown (7.5YR 5/6) channery loam; moderate medium subangular blocky structure; friable; common fine and medium roots; few medium tubular pores; few distinct brown (7.5YR 4/4) clay films on faces of peds and in pores; 20 percent siltstone channers; very strongly acid; clear smooth boundary.

Bt2—24 to 42 inches; strong brown (7.5YR 5/6) channery silt loam; moderate medium subangular blocky structure; friable; common fine and medium roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; 25 percent sandstone channers; very strongly acid; clear smooth boundary.

Bt3—42 to 51 inches; strong brown (7.5YR 5/6) silty clay loam; many medium prominent grayish brown (10YR 5/2) lithochromic mottles; moderate coarse subangular blocky structure; firm; few fine roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; 5 percent siltstone channers; very strongly acid; clear smooth boundary.

C—51 to 59 inches; yellowish brown (10YR 5/6) very channery silty clay loam; many medium prominent light brownish gray (10YR 6/2) lithochromic mottles; massive; firm; few fine roots; 40 percent siltstone channers; very strongly acid; gradual smooth boundary.

Cr—59 to 70 inches; fractured shale bedrock.

The thickness of the solum and the depth to bedrock range from 40 to 60 inches. The content of rock fragments ranges from 2 to 15 percent in the surface layer, from 5 to 30 percent in the subsoil, and from 15 to 50 percent in the substratum. In unlimed areas reaction ranges from extremely acid to strongly acid. Some pedons have an A or Ap horizon that is moderately acid or slightly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. Cultivated areas have an Ap horizon, which has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The fine-earth fraction is loam or silt loam.

The BE or BA horizon, if it occurs, has hue of 7.5YR or 10YR and value and chroma of 4 to 6. The fine-earth fraction is loam or silt loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. The fine-earth fraction generally is silt loam or silty clay loam. Loam textures occur in some pedons, but they are not throughout the Bt horizon. Lithochromic mottles in shades of brown or gray are common in the lower part of the Bt horizon.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. The fine-earth fraction is loam, silt loam, or silty clay loam. Lithochromic mottles in shades of brown, olive, or gray are common throughout the C horizon. Some pedons have a 2B or 2C horizon below a depth of 40 inches. The 2B or 2C horizon formed from weathered shale or siltstone bedrock. The fine-earth fraction is silty clay or clay.

The bedrock is soft, fractured shale or siltstone.

Udorthents

Udorthents consist of a mixture of soil material and rocks. They have been drastically disturbed and do not have a diagnostic subsurface layer. In most places the soil material has been transported several hundred yards from cut areas to a fill site. Most areas of Udorthents are reconstructed valleys along the Licking River near Salyersville, West Liberty, and the larger communities. Other small areas are along major streams where hillsides have been cut and valleys filled for residential or commercial development. Udorthents are mostly associated on the landscape with Grigsby, Orrville, and Pope soils on flood plains and Rowdy soils on low stream terraces.

A typical pedon is not given because Udorthents vary greatly. The depth to bedrock is 5 to 30 feet or more. The content of rock fragments in these soils ranges from about 5 to 75 percent. It varies greatly with depth. The rock fragments range from a few inches to more than 5 feet in size. They are mostly sandstone, siltstone, or shale that is randomly oriented. In many areas the rock fragments bridge voids as a result of placement. This leaves discontinuous, irregular pores that are larger than texture porosity. The voids vary in size, frequency, and prominence.

The fine-earth fraction of the soil material also varies greatly. Clay content ranges from about 5 to 45 percent, and sand content ranges from about 25 to 80 percent. Reaction ranges from very strongly acid to moderately alkaline.

The range in color depends upon the parent rock and the soil material. Hue generally is 5YR to 5Y. Mottling generally occurs without regard to depth or spacing of material.

Artifacts, including paper, scrap metal, wood, and glass, commonly occur throughout these soils.

Whitley Series

The Whitley series consists of very deep, well drained soils that are moderately permeable. These soils formed in silty alluvium derived from acid sandstone, siltstone, and shale. They are on low stream terraces along the Licking River and a few major streams. Slopes are linear or slightly convex and range from 0 to 3 percent. The soils are fine-silty, mixed, mesic Typic Hapludults.

Whitley soils are associated on the landscape with Allegheny, Knowlton, Morehead, Pope, and Rowdy soils. Allegheny and Rowdy soils are fine-loamy. Pope soils are coarse-loamy. Knowlton soils are poorly drained. Morehead soils are somewhat poorly drained.

Typical pedon of Whitley silt loam, 0 to 3 percent slopes, occasionally flooded; about 0.2 mile northeast of Wonnie, in Magoffin County; 1,000 feet southeast of the confluence of Trace Branch and the Licking River and 600 feet southeast of George Mann Road; 300 feet north of the Licking River in a field on a low terrace; soil map sheet 30; USGS White Oak quadrangle; Kentucky coordinates 2,751,000/548,300:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine and medium granular structure; very friable; few fine roots; moderately acid; clear smooth boundary.

AB—6 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common thin faint brown (10YR 3/3) organic coatings on faces of peds; 2 percent subrounded sandstone channers; moderately acid; abrupt smooth boundary.

Bt1—15 to 22 inches; dark yellowish brown (10YR 4/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; many faint brown (10YR 4/3) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—22 to 29 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; many faint brown (10YR 4/3) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—29 to 35 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; very few very fine roots; many distinct yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt4—35 to 57 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; very few very fine roots; common distinct brown (10YR 5/3) clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt5—57 to 64 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; very few very fine roots; common distinct brown (10YR 5/3) clay films on faces of peds; few fine distinct pale brown (10YR 6/3) iron depletions with diffuse boundaries in the matrix; very strongly acid; gradual smooth boundary.

BC—64 to 80 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; very few very fine roots; common fine distinct pale brown (10YR 6/3) iron depletions with diffuse boundaries in the matrix; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches or more. The depth to bedrock is more than 60 inches. The content of sandstone and siltstone pebbles and subrounded channers ranges from 0 to 6 percent in the upper part of the solum and from 0 to 35 percent below a depth of 40 inches. In unlimed areas reaction is strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The AB horizon has colors similar to those of the Ap horizon. The fine-earth fraction is loam or silt loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. The fine-earth fraction is silt loam, silty clay loam, or loam. The BC horizon has colors and textures similar to those of the lower part of the Bt horizon. Iron depletions in shades of brown or gray are common below a depth of 40 inches.

Some pedons have a C horizon, which has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. The fine-earth fraction is silt loam, silty clay loam, loam, clay loam, sandy loam, or fine sandy loam. The horizon has common iron depletions in shades of brown or gray.

Formation of the Soils

This section describes the geology and geomorphology of the survey area. It also describes the five major factors of soil formation.

Geology

The upland soils of Magoffin and Morgan Counties are underlain by interbedded sandstone, siltstone, shale, and limestone of the Pennsylvanian and Mississippian Systems. The soils on flood plains and stream terraces, such as Allegheny and Pope soils, formed in Quaternary alluvial sediment (McFarlan 1943).

The most extensive geology in the survey area is the level-bedded sedimentary rocks of the Breathitt and Lee Formations. These rocks are of the Lower and Middle Pennsylvanian Systems and are thought to be more than 300 million years old. Major rock strata consist of sandstone, shale, siltstone, and coal interspersed with narrow beds of calcareous shale or limestone. Materials forming sandstone were deposited when streams carried coarse sediment and debris into river deltas. Materials forming shale and siltstone accumulated as clay or mud on flood plains and in backswamps. Materials forming coal accumulated on extensive forested, swampy lowlands. Coal seams in the survey area are generally overlain by marine shale and limestone because of subsidence of the coal-forming forested swamps and the subsequent submersion in seawater. Clay and silt were deposited and calcium carbonates often precipitated as a result of this submersion. As these areas uplifted, coal-forming swamps were reestablished. These long cycles of subsidence and uplift lasted for millions of years. The underclay associated with most coal seams is thought to be an ancient soil on which the coal-forming forests grew (Bates and Sweet 1966).

The Breathitt Formation overlies the Lee Formation and is commonly subdivided into three members (McDowell, Grabowski, and Moore 1981). These subdivisions are generalized since all strata of the Breathitt Formation are discontinuous and may be locally absent because of channel cutting. The upper part of the Breathitt Formation is mostly sandstone, but thin strata of shale and siltstone, as well as significant amounts of coal, are also present. The most extensive area of upper Breathitt geology in this survey is on Bolin Ridge and the associated ridgetops in Morgan County. Small areas also cap some of the ridgetops in the southern part of Magoffin County. The middle part of the Breathitt Formation is sandstone, siltstone, shale, and coal with sandstone becoming more common in the southern and western parts of Magoffin County. The lower part of the Breathitt Formation is mostly shale and siltstone with some strata of argillaceous limestone, siltstone, and calcareous shale (Morse 1931). Dekalb, Gilpin, Hazleton, Helechawa, Latham, Marrowbone, and Shelocta soils formed in material weathered from strata of the Breathitt Formation.

The Lee Formation is the lowest member of the Pennsylvanian System and consists of sandstone and conglomerate that are very resistant to weathering. The upper part of the Lee Formation is quartzitic sandstone, while the lower part is conglomerate. The resistant sandstone caps a few of the ridgetops in the northern part of Morgan County, but it mainly occurs as rock outcrops in the form of jointed cliffs and bluffs, some of which are as much as 80 feet high (fig. 27). In some places the cliffs and bluffs are separated by as many as three narrow erosional benches (Hybert and Philley 1971). Alticrest, Lily, Ramsey, and Rigley soils formed in material weathered from the Lee Formation.

A lower tongue of the Breathitt Formation underlies the Lee Formation in some places. This lower tongue consists of interbedded shale, siltstone, and sandstone. These strata form a footslope that breaks onto a bench weathered from the Pennington Formation of the Mississippian System. This narrow footslope and bench is an unconformity that marks the contact between the Mississippian and Pennsylvanian geologic systems.

The Mississippian System includes the Pennington and Borden Formations and Newman Limestone. These rocks may be more than 320 million years old. They underlie the Pennsylvanian rocks throughout the survey area but are only exposed along the Licking

Figure 27.—The hard sandstone bedrock of the Lee Formation supports valley floors and, when breached, forms cliffs and bluffs that are separated by erosional benches in the western and northern parts of Morgan County and the northeastern part of Magoffin County.

River and other major streams in the northern part of Morgan County. Rock strata consist of limestone, shale, siltstone, and calcareous shale.

The Pennington Formation is thin and discontinuous and is made up of shale and some limestone that rest directly on the Newman Limestone. The Newman Limestone commonly forms ledges of limestone rock outcrop between steplike benches, mainly on southern aspects. Colluvium weathered from both the Pennington Formation and Newman Limestone is highly plastic and commonly slips downslope covering and mixing with residuum weathered from the Borden

Formation. Bledsoe and Donahue soils formed in material weathered from the Newman Limestone and Pennington Formation.

The Bordon Formation is the oldest and stratigraphically lowest geologic formation exposed in the survey area. Dominant rock strata are siltstone, shale, dolomitic limestone, and calcareous shale. The Borden Formation forms steep side slopes, footslopes, and nose slopes along the Licking River and major streams in the northern part of Morgan County. Berks and Cranston soils formed in material weathered from the Borden Formation.

Two major fault systems transverse Magoffin and Morgan Counties. They are the Irving-Paint Creek fault and the Johnson Creek fault. The Irving-Paint Creek fault enters Morgan County at Wilson Creek near Buskirk and transverses Morgan County in a northeasterly direction, crossing Stacey Fork and Caney Creek before dissecting the community of Matthew. The fault then enters Magoffin County at Rockhouse Creek, just south of Logville, and crosses in a more southeasterly direction to the confluence of Big Mine Fork and Lacey Creek, where it enters Johnson County. The Johnson Creek fault is a smaller fault system that begins in Morgan County at Johnson Creek and transverses in a northeasterly direction into Magoffin County, just north of the community of Netty. The fault then crosses Johnson Creek again, north of the community of Kernie. It then crosses the Licking River, just north of Fanning Bend. The fault ends abruptly northeast of Stringtown at State Road Fork near Salyersville (McDowell, Grabowski, and Moore 1981).

Geomorphology

Magoffin and Morgan Counties are on the western edge of the Mountains and Eastern Kentucky Coal Fields physiographic region, also known as the Cumberland Plateau or Cumberland Mountains (University of Kentucky and USDA 1970). The highly dissected region is primarily the result of downcutting of streams. As the streams in the region have deepened their valleys, they have also lengthened them by eroding the upstream ends. Small drainageways have slowly developed into young tributary valleys. The branching pattern of these valleys, known as a dendritic drainage pattern, grows headward at the expense of the original land surface. As material is carried away by the streams, downslope movement of soil and rock sharpens the ridgetops into narrow divides. This process of regional reduction has left few remnants of the original land surface and caused the high relief characteristics common in the southern part of Magoffin County (Bates and Sweet 1966).

The topography changes from steep and very steep hillsides with high, sharp-crested ridgetops in the southern part of the survey area in Magoffin County to lower, less steep and more rounded hills in the northwestern part of the survey area in Morgan County. Throughout most of the survey area, the Licking River and many of its tributaries have downcut through the Breathitt Formation and rest on rock strata of the Lee Formation, which is very resistant to downcutting and other erosional forces. This has caused these watercourses to cut laterally into the less resistant Breathitt Formation. The result is wider, pan-shaped valleys rather than narrow, v-shaped valleys. More extensive areas of terraces and abandoned river and stream channels occur throughout these valleys. Neal Valley and Jones Creek in Morgan County are examples of abandoned river channels (fig. 28). Strath terraces are the highest of these features. They are remnants of old stream channels that have been mostly eroded away, leaving isolated areas of alluvial material high above the valley floors. These areas are underlain by bedrock and have steep, well defined side slopes separating them from the terraces and flood plains below.

As the Licking River has matured, it has widened and the channel has become less deep. At flood stage the river leaves the channel and spreads across wide, level flood plains. Soils near the river have stratified profiles because of the thin strata of alluvium deposited during the repeated flooding.

In the northern part of Morgan County, the streams have downcut through the resistant sandstone of the Lee Formation, forming deep, narrow valleys with steep hillsides. Sandstone bedrock escarpments and areas of rubble generally line these steep hillsides (fig. 29). Landforms below the sandstone rock outcrop generally form multiple stepped benches separated by short, steep slopes. Soils on these benches and footslopes are influenced by colluvium and contain rock fragments ranging from quartz pebbles to house-sized boulders. Most of the colluvium from the sandstone rock outcrop rests on a lower tongue of the Breathitt Formation that weathered to form a steep footslope. Below this slope is a bench that weathered from the Pennington Formation at the contact between the Pennsylvanian and Mississippian Systems. Slumping is common on the lower slopes and benches associated with the Pennington Formation, Newman Limestone, and Borden Formation because streams have downcut rapidly and undermined the soils and

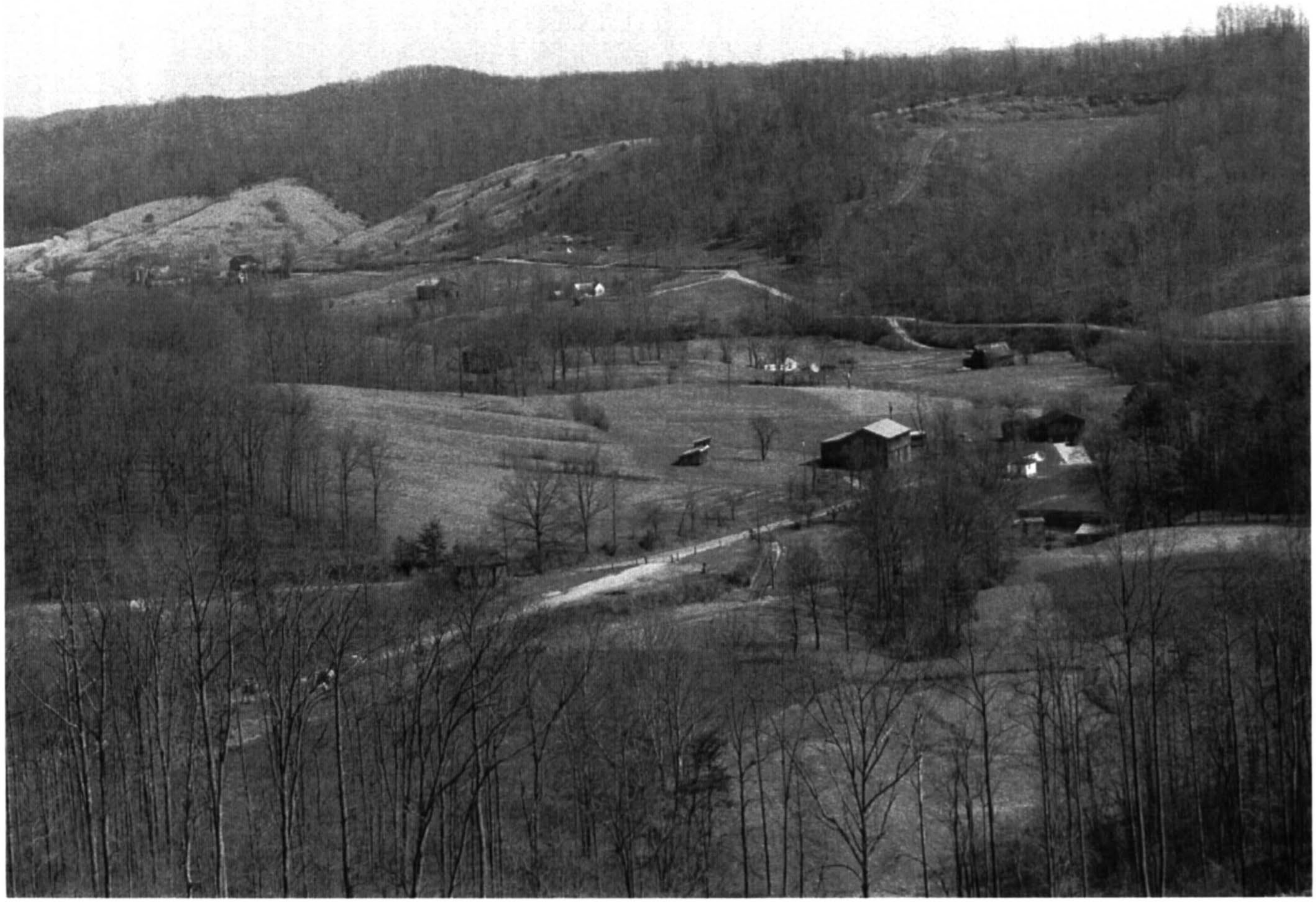


Figure 28.—These terraces along Jones Creek in Morgan County are part of a meander belt that formed when the Licking River abandoned its channel and cut another channel near the community of Cottle. An area of Allegheny loam, 6 to 15 percent slopes, is in the foreground, and an area of Shelocta-Gilpin complex, 25 to 60 percent slopes, is on the hillside in the background.

rocks. This rapid downcutting results in narrow valleys that have a v-shaped cross-profile and valley floors that are occupied almost entirely by streams choked with boulders and rock debris.

Factors of Soil Formation

The characteristics of a soil depend on the physical and chemical composition of the parent material, climate, relief, plant and animal life, and time. Soils form through the interaction of these five factors. The relative importance of each factor differs from one soil to another. In some areas one factor may dominate the development of soil characteristics, and in other areas another factor may dominate. In Magoffin and Morgan Counties, climate and the effect of plant and animal life do not vary greatly, but there are differences in relief and parent material.

Parent Material

Parent material is the raw material acted on by the soil-forming processes. It largely determines soil texture, drainage, and permeability. The physical and chemical composition of parent material has an important effect on the kind of soil that forms.

The soils in Magoffin and Morgan Counties formed from sedimentary layers of sandstone, shale, siltstone, calcareous shale, or limestone. Some soils formed in residuum, which is material weathered in place from bedrock. Gilpin and Latham soils formed in residuum. Other soils formed in colluvium, which is material moved down a hillside by gravity, or in alluvium, which is material deposited by rivers and streams. Shelocta and Bledsoe soils formed in colluvium, and Grigsby and Orrville soils formed in alluvium.

Climate

Climate affects the physical, chemical, and biological relationships in soils. It influences the kind and number of plants and animals on and in the soils, the weathering and decomposition of rocks and minerals, the susceptibility of the soils to erosion, and the rate of soil formation.

The climate of Magoffin and Morgan Counties is humid and temperate. The average annual precipitation is 44.6 inches, and the mean annual air temperature is 40 degrees F. In this environment, alternate periods of freezing and thawing result in physical and chemical weathering of the parent material, accumulation of organic matter, decomposition of minerals, the formation and translocation of clay, and the leaching of soluble compounds. Aspect can affect soil temperature and moisture. South- and west-facing slopes, which receive more direct rays from the sun, are hotter and drier than north- and east-facing slopes. The coolest sites are on the lower slopes that face east to north and in concave draws in coves. The Kimper soils on cool aspects have an A horizon that is thicker and darker than that of the Helechawa and Hazleton soils on warm aspects.

Because of surface mining, the survey area

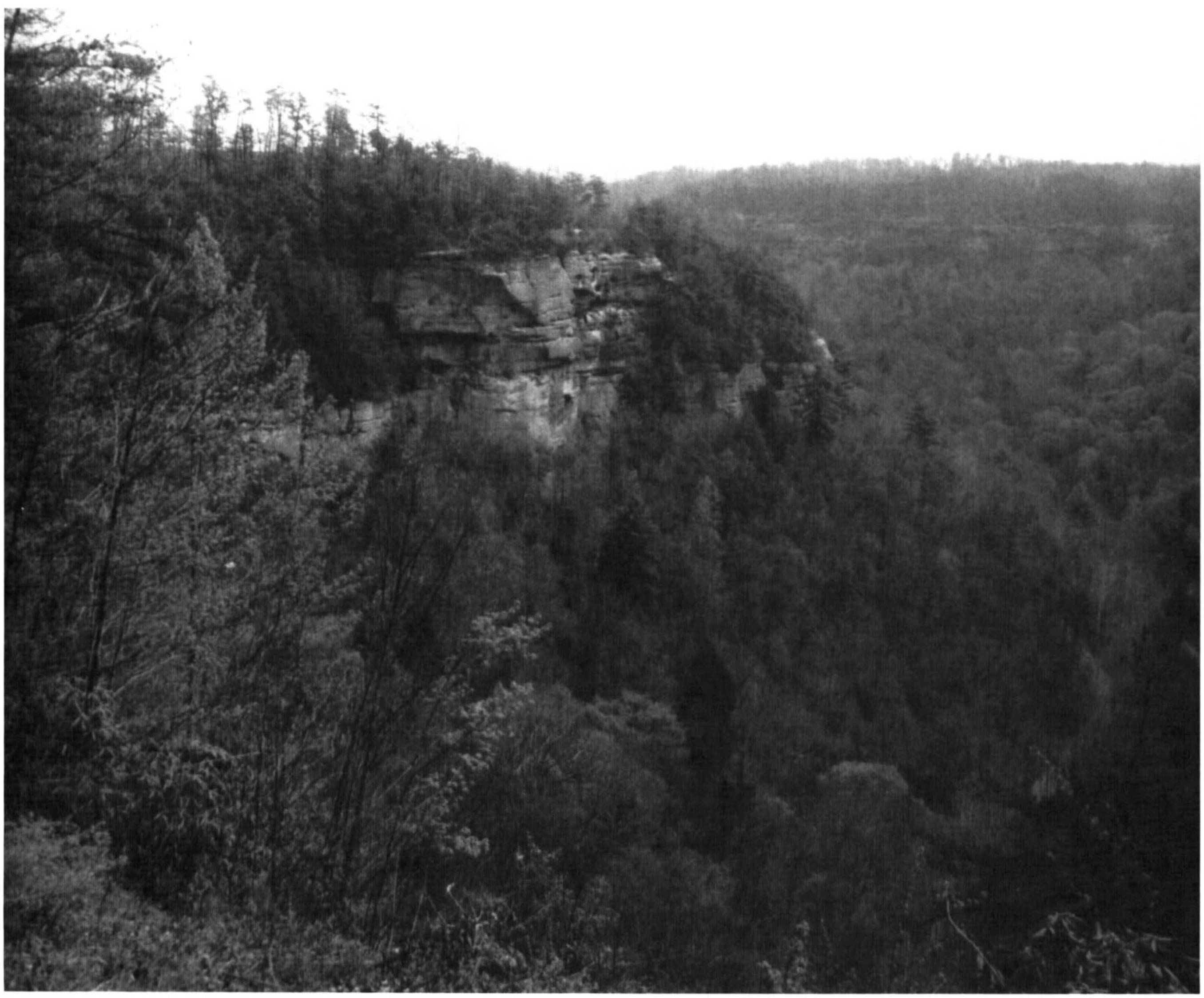


Figure 29.—An area of Rigley-Rock outcrop complex, 25 to 60 percent slopes, on a footslope and bench. Alticrest-Ramsey complex, rocky, 20 to 60 percent slopes, is on the narrow ridgetop above the Rock outcrop.

includes a large acreage of young soils, such as Kaymine soils. Most of these soils formed in unweathered, unleached parent material. Weathering of the surface layer reduces small fragments to fine soil material, generally within a few years. Shale and siltstone are especially susceptible to breakdown by weathering.

Relief

Relief affects soil formation through its effect on drainage, erosion, and exposure to sunlight. Surface runoff can differentiate soils that formed in the same kind of parent material. Water that runs off the higher, more sloping soils can collect in depressions and abandoned stream channels. Allegheny and Knowlton soils both formed in loamy alluvium. The sloping and moderately steep, well drained Allegheny soils are on alluvial terraces that have convex slopes. The nearly level and poorly drained Knowlton soils are on the lower stream terraces, in sloughs, and in abandoned steam channels. Knowlton soils receive runoff from the higher lying, adjacent soils on hillsides, while Allegheny soils receive little or no runoff.

Relief can affect erosion and, as a result, soil depth. Soils on narrow ridgetops and the upper side slopes, such as Dekalb and Marrowbone soils, are generally less than 40 inches deep over bedrock. Soils on the lower mountainsides, such as Shelocta and Hazleton soils, are generally more than 40 inches deep over bedrock. Erosion generally removes soil material from the higher lying soils that formed in residuum. It also removes soil material from the colluvial soils on mountainsides, but the colluvial soils generally continue to receive soil material from higher lying soils.

Aspect of the steep and very steep mountainsides has a pronounced effect on soil development. Soils on steep, north- or east-facing mountainsides and in concave draws in coves receive less exposure to sunlight than soils on south- or west-facing slopes and in coves. These soils have lower soil temperature, which slows down the decomposition of leaf litter and allows organic matter to accumulate. Kimper soils in the southern part of Magoffin County formed in areas that have high relief and cool aspect.

Living Organisms

All living organisms, such as vegetation, bacteria, fungi, and animals, including people, actively affect the formation of soils. Vegetation generally supplies the organic matter that decomposes to give soils a dark surface layer. The decomposed organic matter, or humus, also aids in the formation of soil structure. Larger vegetation, such as trees, transfer and cycle nutrients from the subsoil to the surface layer and act as storehouses for nutrients, such as phosphorus and potassium. Bacteria and fungi decompose the organic matter and release minerals and nutrients, such as carbonates and nitrates, into the soil. Worms, insects, and burrowing animals mix the soil and thus improve soil tilth and porosity.

Most of the soils in the survey area formed under hardwood forest. These soils are characterized by a thin, dark surface layer and a brighter colored subsoil. Local differences in drainage, composition of plant species, parent material, aspect, elevation, and associated ground cover, however, cause variations in soils. Kimper soils have a dark surface layer that is commonly about 7 inches thick and are mostly on north- or east-facing slopes in the southern part of Magoffin County. The cool aspects, lower soil temperatures, and favorable moisture conditions on these slopes slow down the microbial decay of leaf litter and allow accumulation of organic matter in the surface layer. Fedscreek soils, which are mapped in a complex with the Kimper soils in this survey, are an example of soils that formed on somewhat warmer aspects where the soil temperature is higher and greater microbial decay of leaf litter occurs.

The physical properties of soils are also affected by tillage and management practices. Soils can be altered chemically by applications of lime, fertilizer, insecticides, and herbicides. Operating vehicles on the soil surface compacts the soil and can lead to the formation of dense layers, or traffic pans. People have greatly influenced the surface layer and the soil environment by clearing forested areas and plowing. They have mixed the soil layers, moved soil from one place to another, added fertilizers and lime, and introduced new plant species. As a result of accelerated erosion, most of the original surface layer in some places has been removed, exposing the less productive subsoil.

Strip mining and filling flood plains with soil material has resulted in the formation of new soils in the survey area. Heavy equipment was used to remove the native soil and rock and to reshape the soil material. These soils are subject to severe erosion, and their physical, chemical, and mineralogical properties generally vary greatly within a few yards at the surface and within a few inches throughout the profile. Kaymine soils, which formed as a result of surface mining, are extensive in the survey area.

Time

The formation of soil is strongly influenced by the length of time that the parent material has been exposed to the active forces of climate and living organisms.

The soils in the survey area are relatively young. As weathering processes act upon the exposed rocks, mostly on points and ridges, the residue is subjected to the forces of gravity. Weathered soil material and rock fragments are carried downslope and deposited as colluvium.

Where colluvial deposits become thicker, the heavy weight of the colluvium, steep angle of slope, and water seeping along the bedrock tend to move the mass very slowly and irregularly downslope onto the flood plain. Soil is removed from the valleys by the action of the streams. Thus, the valleys slowly become wider, while the mountains and hills become smaller.

Some soils on ridgetops and side slopes in the survey area have only developed structure and a B horizon that is well defined by color. Some soils have little illuvial clay accumulation and are considered to be relatively young. They formed in hard sandstone that is relatively resistant to weathering and contain a limited amount of clay and clay-sized materials. Dekalb and Marrowbone soils are examples of these soils. They are classified as Typic Dystrochrepts.

Some soils on less sloping ridgetops and side slopes have a thick, well defined B horizon that has a significant accumulation of illuvial clay. Examples of these soils are the Gilpin and Shelocta soils, which are classified as Typic Hapludults. These soils formed in shale and siltstone parent material and are not so resistant to weathering. They are considered to be relatively more mature.

Soils in valleys are divided into two categories—those on flood plains and those on stream terraces. Rowdy soils on flood plains formed in recent alluvial deposits along streams. They have some development of structure in the subsoil but no significant accumulation of illuvial clay. Allegheny soils formed in older alluvial deposits on stream terraces that are no longer subject to flooding. They are more highly leached and weathered and have a well developed subsoil that has a significant accumulation of illuvial clays. Rowdy soils are classified as Fluventic Dystrochrepts, and Allegheny soils are classified as Typic Hapludults.

Kaymine and Bethesda soils consist of heterogeneous, geologic material deposited from coal mining activities. These soils show very little alteration other than the breakdown of rock fragments into smaller particles and the accumulation of organic matter in the surface horizon. The C horizon in these soils extends nearly to the surface and is subdivided on the basis of texture, percentage of rock fragments, and reaction. Most of these soils have an A horizon, and many have a thin O horizon at the surface. The action of earthworms and plant roots causes several changes in the soil, including the development of structure in the surface layer and in the subsurface layer and the thickening of the A horizon. Such changes are often observed after the soils have been in place for several years. Kaymine and Bethesda soils are classified as Typic Udorthents.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial (geomorphology). Pertaining to material or processes associated with transportation and deposition by running water.

Alluvial cone. The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvial terrace (geomorphology). See stream terrace.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo. The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium.

Aspect. The direction in which a slope faces. Warm aspects have slopes of more than 15 percent and face an azimuth of 135 to 315 degrees. Cool aspects have slopes of more than 15 percent and face an azimuth of 315 to 135 degrees.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base level (geology). The level below which a stream cannot erode its bed. The ultimate base level for the land surface is sea level, but temporary base levels may exist locally.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench (landform). A relatively flat, horizontal, long and narrow surface, bounded on one side by a steeper, ascending slope and on the other side by a steeper, descending slope.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Break (slopes). An abrupt change or inflection in a slope or profile.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvial fan. A fan-shaped mass of soil and rock at the base of a hill, deposited mainly by the action of gravity.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Constructional. Owing its origin, form, position, or general character to deposition (aggregational) processes, such as the accumulation of sediment to form an alluvial fan or terrace.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cove (landform). The area of rounded, concave slopes at the head of a narrow steep valley, sometimes directly below a head slope, at the end of a drainageway.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crest (landform). The highest line of a ridgetop, from which the surface slopes downward in opposite directions.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; and shallow, less than 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.* These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway (landform). A relatively small, linear depression that, at some time, carries water and either does not have a defined channel or only has a small defined channel.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic).—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated).—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine earth. Portion of the soil finer than a No. 10 (2 millimeter) U.S. standard sieve.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The inclined surface at the base of a hill.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Geomorphology. The science that treats the general configuration of the Earth's surface; specifically, the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying geologic structures and of the history of geologic changes as recorded by these features.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Head-of-hollow fill. A fill structure consisting of any material, other than coal-processing waste and organic material, placed in the uppermost reaches of a hollow where side slopes of the existing hollow measured at the steepest point are more than 20 degrees or the average slope of the profile of the hollow from the toe of the fill to the top is more than 10 degrees.

Head slope (landform). The concave surface at the uppermost end of a drainageway, sometimes directly above or on the upper slopes of a cove, where the flow of all water converges downward.

Highwall. A vertical rock wall, exposed during surface mining for coal, that ranges from a few feet to about 80 feet high.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Hillside (landform). The steeper part of a hill between its ridgetop and any drainageway or stream. Hillside positions include shoulder slopes, side slopes, benches, head slopes, coves, and footslopes. Complex hillsides may include two or more shoulder to foot slope sequences.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Imped (soils). Inside or within a ped, generally refers to pores.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Landform (geomorphology). Any physical, recognizable form or feature on the Earth's surface having a characteristic shape and produced by natural causes.

Landscape (geomorphology). The distinct associations of landforms, especially as modified by geologic forces, that can be seen in a single view.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Limestone (geology). A sedimentary rock consisting chiefly of calcium carbonate (more than 50 percent), primarily in the form of calcite. Limestone is generally formed by a combination of organic and inorganic processes that include chemical and clastic (soluble and insoluble) constituents. Many limestones contain fossils.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Meander belt. The zone within which a stream or river meanders while gradually looping back on its self and leaving abrupt, cutoff segments each time a new channel forms. Landform components within a meander belt include strath terraces, stream terraces, flood plains, sloughs, and abandoned meanders.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope (landform). The projecting slope descending from the crest of a ridgetop where overland flow of water is divergent.

No-till planting (agronomy). Planting a crop in undisturbed soil, with at least 90 percent residue cover left on the surface after planting.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains changes from semisolid to plastic.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Pore linings. Zones of iron or manganese accumulation that may be either coatings on pore surfaces or impregnations of the matrix adjacent to the pore.

Potential native plant community. See Climax plant community.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Regolith. The unconsolidated mantle of weathered

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Ridgetop (landform). A long, narrow, elevation of the land surface, generally sharp crested with steep sides and forming an extended upland between valleys. Ridgetop positions include crests, nose slopes, saddles, and some shoulder slopes and head slopes.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rubble (geology). A loose mass of angular rock fragments, commonly overlying rock outcrop or collecting on a bench or in a drainageway.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saddle (landform). A low point on a ridgetop, commonly at a divide between the heads of streams flowing in opposite directions.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder slope (landform). The position that forms the uppermost inclined surface near the top of a hillside. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope (landform). The part of a hillside between the ridgetop and a drainageway that is generally linear up and down the slope and across the contour.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for slopes are as follows:

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Sloping	6 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 30 percent
Very steep	30 to 70 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slumping. A landslide characterized by a shearing and rotary movement of a generally independent mass of rock or soil along a curved slip surface.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Slough (landform). A sluggish channel of water, such as a side channel of a river or stream, in which water flows slowly through low, swampy ground or a section of an abandoned river channel that may contain stagnant water.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Strath terrace (geomorphology). A type of stream terrace formed as an erosional surface cut on bedrock and thinly mantled with stream deposits.

Stream terrace (geomorphology). One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream and representing the dissected remnants of an abandoned flood plain, stream bed, or valley floor produced during a former stage of deposition and erosion. Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called strath terraces. Remnants of constructional valley floors are called alluvial terraces or stream terraces.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Swale (landform). A slight depression in the midst of generally level land.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy* *loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tributary. A river or stream flowing into a larger river or stream.

Unconformity (geology). An old surface layer that is lower than sea level and has been covered with a new layer of sedimentary rock having markedly differing properties.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley floor (landform). A general term for the nearly level or gently sloping, lowest surface of a valley. Landforms include the flood plain, low stream terraces, and alluvial fans.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the Earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1951-90 at West Liberty, Kentucky)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	42.1	19.5	30.8	70	-12	58	3.27	1.63	4.54	8	3.7
February----	46.7	21.3	34.0	75	-5	70	3.35	1.48	4.53	7	3.9
March-------	56.2	29.2	42.7	83	8	181	4.11	2.21	5.51	8	1.9
April-------	68.2	38.7	53.5	89	20	405	3.90	2.04	5.31	8	.2
May---------	76.6	48.2	62.4	91	29	694	4.39	2.66	5.85	9	.0
June--------	83.7	56.8	70.3	95	40	909	3.69	2.21	4.83	7	.0
July--------	87.1	61.6	74.4	97	48	1,066	5.24	3.10	6.81	8	.0
August------	85.9	59.9	72.9	96	45	1,020	3.69	2.06	5.07	6	.0
September---	80.3	52.3	66.3	95	35	789	3.08	1.35	4.44	5	.0
October-----	69.9	39.2	54.6	88	20	453	2.67	1.14	3.88	5	.0
November----	57.4	30.5	44.0	81	11	163	3.38	1.73	4.76	7	.5
December----	46.0	23.1	34.6	74	-2	88	3.83	1.71	5.32	8	1.7
Yearly:											
Average---	66.7	40.0	53.4	---	---	---	---	---	---	---	---
Extreme---	---	---	---	103	-26	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,896	44.60	37.49	50.35	86	11.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1951-90 at West Liberty, Kentucky)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 2	May 14	June 3
2 years in 10 later than--	Apr. 21	May 2	May 21
5 years in 10 later than--	Apr. 1	Apr. 10	Apr. 27
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 3	Sept. 24	Sept. 6
2 years in 10 earlier than--	Oct. 15	Oct. 6	Sept. 19
5 years in 10 earlier than--	Nov. 6	Oct. 29	Oct. 14

Table 3.--Growing Season

(Recorded in the period 1951-90 at West Liberty, Kentucky)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	193	173	140
8 years in 10	199	180	147
5 years in 10	211	193	161
2 years in 10	225	208	176
1 year in 10	236	220	189

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Magoffin County	Morgan County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
AbB	Allegheny loam, 2 to 6 percent slopes	473	1,313	1,786	0.4
AbC	Allegheny loam, 6 to 15 percent slopes	454	1,345	1,799	0.4
ArF	Alticrest-Ramsey complex, rocky, 20 to 60 percent slopes	0	2,308	2,308	0.5
BcF	Berks-Cranston complex, 40 to 60 percent slopes, very stony	0	1,147	1,147	0.3
BdF	Bledsoe silt loam, 30 to 50 percent slopes, very stony	0	437	437	0.1
BeE	Bledsoe-Donahue-Rock outcrop complex, 15 to 30 percent slopes	0	479	479	0.1
CoB	Cotaco loam, 1 to 4 percent slopes	82	322	404	0.1
DgF	Dekalb-Gilpin-Marrowbone complex, very rocky, 20 to 60 percent slopes	21,467	0	21,467	4.8
Dm	Dumps, coal	45	23	68	*
EgB	Ezel-Gilpin complex, 2 to 6 percent slopes	27	376	403	0.1
EgC	Ezel-Gilpin complex, 6 to 15 percent slopes	215	1,270	1,485	0.3
GlC	Gilpin silt loam, 4 to 12 percent slopes	29	824	853	0.2
GlD	Gilpin silt loam, 12 to 25 percent slopes	36	1,567	1,603	0.4
GnF	Gilpin-Latham-Marrowbone complex, 20 to 60 percent slopes	30,131	37,876	68,007	15.3
Gr	Grigsby sandy loam, 0 to 4 percent slopes, occasionally flooded	7,101	3,921	11,022	2.5
KbD	Kaymine, Bethesda, and Fiveblock soils, 0 to 20 percent slopes, stony	2,327	1,329	3,656	0.8
KbF	Kaymine, Bethesda, and Fiveblock soils, benched, 2 to 70 percent slopes, stony	10,857	5,971	16,828	3.8
KfF	Kimper-Fedscreek complex, 30 to 80 percent slopes, stony	27,182	0	27,182	6.0
Kn	Knowlton silt loam, rarely flooded	153	195	348	0.1
LgD	Latham-Gilpin complex, 4 to 20 percent slopes	72	8,110	8,182	1.8
LsE	Latham-Shelocta-Gilpin complex, 12 to 30 percent slopes	256	22,479	22,735	5.1
LyD	Lily sandy loam, 6 to 20 percent slopes	26	244	270	0.1
MgE	Marrowbone-Gilpin-Latham complex, 15 to 30 percent slopes	0	10,699	10,699	2.4
Mo	Morehead silt loam, rarely flooded	15	450	465	0.1
Or	Orrville loam, frequently flooded	288	154	442	0.1
Oy	Orrville-Grigsby complex, 0 to 3 percent slopes, frequently flooded	646	1,030	1,676	0.4
Pe	Pits, quarries	0	302	302	0.1
Po	Pope loam, frequently flooded	2,341	1,078	3,419	0.8
RgC	Rayne-Gilpin complex, 4 to 12 percent slopes	0	860	860	0.2
RlF	Rigley-Rock outcrop complex, 25 to 60 percent slopes	201	10,956	11,157	2.5
RnD	Riney-Ezel complex, 6 to 20 percent slopes	38	319	357	0.1
RoB	Rowdy loam, 0 to 4 percent slopes, occasionally flooded	608	6,405	7,013	1.6
RyB	Rowdy-Grigsby-Barbourville complex, 0 to 8 percent slopes	2,616	2,218	4,834	1.1
ShC	Shelocta silt loam, 6 to 12 percent slopes	146	679	825	0.2
ShD	Shelocta silt loam, 12 to 20 percent slopes	209	957	1,166	0.3
SlF	Shelocta-Gilpin complex, 25 to 60 percent slopes	82	62,792	62,874	14.2
SpF	Shelocta-Helechawa-Hazleton complex, 30 to 65 percent slopes, stony	89,414	53,168	142,582	32.1
Ur	Udorthents, loamy, 0 to 6 percent slopes	222	178	400	0.1
W	Water	65	1,343	1,408	0.3
WhA	Whitley silt loam, 0 to 3 percent slopes, occasionally flooded	269	418	687	0.2
	Total	198,093	245,542	443,635	100.0

* Less than 0.1 percent.

Table 5.--Land Capability and Yields per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. If the capability subclass of all components in a complex or undifferentiated group is the same, only one subclass is given for the whole unit. If the capability subclass is different, each component's subclass in that unit is given separately)

Soil name and map symbol	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Bu	Lb	Bu	Ton	Ton	AUM*
AbB------------- Allegheny	IIe	120	40	3,000	45	4.5	3.5	7.0
AbC------------- Allegheny	IIIe	110	35	2,750	40	4.0	3.5	7.0
ArF------------- Alticrest-Ramsey	VIIe	---	---	---	---	---	---	---
BcF------------- Berks-Cranston	VIIe	---	---	---	---	---	---	---
BdF------------- Bledsoe	VIIe	---	---	---	---	---	---	---
BeE**:								
Bledsoe---------	VIe	---	---	---	---	---	---	4.0
Donahue---------	VIe	---	---	---	---	---	---	4.0
Rock outcrop---	VIIIs	---	---	---	---	---	---	---
CoB------------- Cotaco	IIw	110	30	2,400	35	4.0	3.0	6.0
DgF------------- Dekalb-Gilpin-Marrowbone	VIIe	---	---	---	---	---	---	---
Dm**------------ Dumps, coal	VIIIs	---	---	---	---	---	---	---
EgB------------- Ezel-Gilpin	IIe	110	40	2,800	44	4.5	3.4	7.0
EgC------------- Ezel-Gilpin	IIIe	100	35	2,400	39	4.0	3.4	7.0
GlC------------- Gilpin	IIIe	85	25	2,000	35	3.5	3.0	7.0
GlD------------- Gilpin	IVe	80	20	1,800	30	3.0	2.5	6.0
GnF------------- Gilpin-Latham-Marrowbone	VIIe	---	---	---	---	---	---	---
Gr-------------- Grigsby	IIw	110	35	2,800	40	4.5	4.0	8.0

See footnotes at end of table.

Table 5.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Bu	Lb	Bu	Ton	Ton	AUM*
KbD------------- Kaymine, Bethesda, and Fiveblock	VIs	---	---	---	---	---	---	5.0
KbF------------- Kaymine, Bethesda, and Fiveblock	VIIs	---	---	---	---	---	---	---
KfF------------- Kimper-Fedscreek	VIIe	---	---	---	---	---	---	---
Kn-------------- Knowlton	IIIw	100	44	---	50	---	4.1	8.2
LgD------------- Latham-Gilpin	IVe	85	25	2,200	30	3.5	3.0	6.0
LsE------------- Latham-Shelocta-Gilpin	VIe	---	---	---	---	---	2.5	4.5
LyD------------- Lily	IVe	70	25	1,900	30	3.5	2.5	5.0
MgE------------- Marrowbone-Gilpin-Latham	VIe	---	---	---	---	---	---	4.0
Mo-------------- Morehead	IIw	110	40	2,800	40	3.5	4.0	8.0
Or-------------- Orrville	IIw	100	32	2,000	30	---	3.0	5.0
Oy-------------- Orrville-Grigsby	IIw	100	35	2,600	35	3.5	3.5	6.0
Pe**------------ Pits, quarries	VIIIs	---	---	---	---	---	---	---
Po-------------- Pope	IIw	105	35	2,200	35	4.0	3.5	7.0
RgC------------- Rayne-Gilpin	IIIe	95	30	2,200	39	4.2	3.3	7.0
RlF:								
Rigley----------	VIIe	---	---	---	---	---	---	---
Rock outcrop----	VIIIs	---	---	---	---	---	---	---
RnD------------- Riney-Ezel	IVe	105	27	2,400	35	4.0	2.7	5.5
RoB------------- Rowdy	IIw	120	40	3,000	45	4.5	3.5	6.5

See footnotes at end of table.

Table 5.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Bu	Lb	Bu	Ton	Ton	AUM*
RyB------------- Rowdy-Grigsby-Barbourville	IIw	115	40	3,000	45	4.5	3.7	7.3
ShC------------- Shelocta	IIIe	100	30	2,300	40	4.0	3.5	8.0
ShD------------- Shelocta	IVe	80	25	2,000	35	3.5	3.0	7.0
SlF------------- Shelocta-Gilpin	VIIe	---	---	---	---	---	---	---
SpF------------- Shelocta-Helechawa-Hazleton	VIIe	---	---	---	---	---	---	---
Ur**------------ Udorthents, loamy	VIs	---	---	---	---	---	---	---
W**. Water								
WhA------------- Whitley	IIw	135	40	3,200	40	5.0	4.0	8.0

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

Table 6.--Capability Classes and Subclasses

(The acreage of water is excluded. Dashes indicate no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I:				
Magoffin County	---	---	---	---
Morgan County	---	---	---	---
II:				
Magoffin County	14,466	500	13,966	---
Morgan County	17,685	1,689	15,996	---
III:				
Magoffin County	997	844	153	---
Morgan County	5,173	4,978	195	---
IV:				
Magoffin County	381	381	---	---
Morgan County	11,197	11,197	---	---
V:				
Magoffin County	---	---	---	---
Morgan County	---	---	---	---
VI:				
Magoffin County	2,805	256	---	2,549
Morgan County	35,092	33,585	---	1,507
VII:				
Magoffin County	179,304	168,447	---	10,857
Morgan County	173,012	167,041	---	5,971
VIII:				
Magoffin County	75	---	---	75
Morgan County	2,040	---	---	2,040

Table 7.--Woodland Management and Productivity

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
AbB, AbC-------- Allegheny	Slight	Slight	Slight	Severe	Shortleaf pine------ Yellow-poplar------- Virginia pine------- Black oak----------- White oak-----------	80 93 72 78 70	130 95 112 60 52	Eastern white pine, black walnut, white oak, white ash, northern red oak.
ArF**:								
Alticrest (cool aspect)-	Severe	Severe	Moderate	Moderate	Virginia pine------- Shortleaf pine------ Chestnut oak-------- Black oak----------- Red maple-----------	60 60 64 70 ---	109 108 47 52 ---	Shortleaf pine, eastern white pine.
Ramsey (cool aspect)-	Severe	Severe	Severe	Slight	Shortleaf pine------ White oak----------- Black oak----------- Chestnut oak-------- Virginia pine-------	59 61 69 67 ---	--- 54 51 49 ---	Eastern white pine, shortleaf pine.
ArF**:								
Alticrest (warm aspect)-	Severe	Severe	Severe	Moderate	Virginia pine------- Shortleaf pine------ Pitch pine---------- Chestnut oak-------- Scarlet oak---------	60 60 --- 54 ---	91 96 --- 38 ---	Shortleaf pine, eastern white pine.
Ramsey (warm aspect)-	Severe	Severe	Severe	Slight	Shortleaf pine------ Virginia pine------- Chestnut oak-------- Scarlet oak--------- Red maple-----------	54 54 60 --- ---	76 77 43 --- ---	Eastern white pine, shortleaf pine.
BcF**:								
Berks (cool aspect)-	Severe	Severe	Moderate	Moderate	Scarlet oak--------- Black oak----------- American beech------ Red maple----------- White oak-----------	75 70 --- --- 70	57 62 --- --- 52	Virginia pine, shortleaf pine, eastern white pine, black oak, white oak, northern red oak.

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
BcF**:								
Cranston								
(cool aspect)	Severe	Severe	Slight	Moderate	Shortleaf pine	75	56	Northern red oak, eastern white pine, shortleaf pine, white oak.
					White oak	80	62	
					Yellow-poplar	---	---	
					Northern red oak	---	---	
					Red maple	---	---	
					Black oak	---	---	
					Hickory	---	---	
BcF**:								
Berks								
(warm aspect)	Severe	Severe	Severe	Moderate	Scarlet oak	60	41	Shortleaf pine, Virginia pine, eastern white pine, white oak, black oak.
					Black oak	71	53	
					Virginia pine	52	73	
					White oak	63	46	
					Red maple	---	---	
					Chestnut oak	---	---	
Cranston								
(warm aspect)	Severe	Severe	Moderate	Moderate	Shortleaf pine	65	51	Shortleaf pine, eastern white pine, black oak, white oak.
					White oak	66	47	
					Scarlet oak	---	---	
					Chestnut oak	---	---	
					Hickory	---	---	
					Black oak	---	---	
BdF Bledsoe (cool aspect)	Severe	Severe	Slight	Severe	Yellow-poplar	104	114	Yellow-poplar, white ash, eastern white pine, white oak, northern red oak.
					Black walnut	---	---	
					White ash	---	---	
					Sugar maple	---	---	
					Black cherry	---	---	
					American beech	---	---	
BdF Bledsoe (warm aspect)	Severe	Severe	Moderate	Moderate	Yellow-poplar	84	79	Northern red oak, white oak, white ash, eastern white pine.
					Pignut hickory	74	---	
					Shagbark hickory	---	---	
					Sassafras	---	---	
					Blackgum	---	---	
					Red maple	---	---	
					White oak	---	---	
BeE**:								
Bledsoe								
(cool aspect)	Moderate	Moderate	Slight	Severe	Yellow-poplar	104	114	White ash, white oak, northern red oak, eastern white pine.
					Black walnut	---	---	
					White ash	---	---	
					Sugar maple	---	---	
					Black cherry	---	---	
					American beech	---	---	
Donahue								
(cool aspect)	Moderate	Moderate	Slight	Moderate	White oak	80	67	White oak, northern red oak, shortleaf pine, eastern white pine.
					Black oak	80	62	
					Yellow-poplar	90	90	
					Northern red oak	---	---	
Rock outcrop.								

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
BeE**:								
Bledsoe (warm aspect)	Moderate	Moderate	Moderate	Moderate	Yellow-poplar	84	79	Northern red oak, white oak, white ash, eastern white pine.
					Pignut hickory	74	---	
					Shagbark hickory	---	---	
					Sassafras	---	---	
					Blackgum	---	---	
					Red maple	---	---	
					White oak	---	---	
Donahue (warm aspect)	Moderate	Moderate	Moderate	Moderate	Shortleaf pine	70	57	Shortleaf pine, white oak, eastern white pine.
					White oak	70	52	
					Black oak	70	47	
					Scarlet oak	70	47	
					Hickory	---	--	
					Virginia pine	---	--	
Rock outcrop.								
CoB: Cotaco	Slight	Slight	Slight	Severe	Yellow-poplar	95	98	Eastern white pine, yellow-poplar, white oak, northern red oak, sweetgum.
					Black oak	87	69	
					Sweet birch	---	---	
DgF**:								
Dekalb	Severe	Severe	Severe	Moderate	Shortleaf pine	---	---	Eastern white pine, shortleaf pine.
					Chestnut oak	59	42	
					Scarlet oak	67	49	
					Red maple	---	---	
					Hickory	---	---	
					Virginia pine	---	---	
Gilpin	Severe	Severe	Moderate	Moderate	Black oak	70	52	Eastern white pine, black oak, shortleaf pine.
					Scarlet oak	72	54	
					Chestnut oak	68	50	
					Hickory	---	---	
Marrowbone	Severe	Severe	Moderate	Moderate	Shortleaf pine	75	120	Shortleaf pine, black oak.
					Virginia pine	---	---	
					White oak	---	---	
					Black oak	---	---	
					Red maple	---	---	
					Hickory	---	---	
					Chestnut oak	---	---	
					Hickory	---	---	
EgB**, EgC**:								
Ezel	Slight	Slight	Slight	Severe	Shortleaf pine	80	130	Eastern white pine, yellow-poplar, black walnut, white oak, white ash, northern red oak.
					Yellow-poplar	93	95	
					Sugar maple	---	---	
					White ash	---	---	
					Northern red oak	---	---	
					Pignut hickory	---	---	
					Black oak	78	60	
					White oak	70	52	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
EgB**, EgC**:								
Gilpin	Slight	Slight	Slight	Moderate	Northern red oak	80	---	White oak, eastern white pine, northern red oak, yellow-poplar, black oak.
					Yellow-poplar	95	90	
					White oak	---	---	
					Sugar maple	---	---	
					Black oak	80	62	
GlC: Gilpin	Slight	Slight	Slight	Moderate	Northern red oak	80	---	Black oak, eastern white pine, white oak, northern red oak, yellow-poplar.
					Yellow-poplar	90	90	
					White oak	---	---	
					Sugar maple	---	---	
					Black oak	80	62	
GlD: Gilpin	Moderate	Moderate	Slight	Moderate	Northern red oak	80	---	Black oak, eastern white, pine, white oak, northern red oak, yellow-poplar.
					Yellow-poplar	90	90	
					White oak	75	57	
					Hickory	---	---	
					Red maple	---	---	
					Black oak	80	62	
GnF**:								
Gilpin	Severe	Severe	Moderate	Moderate	Scarlet oak	72	54	White oak, black oak, eastern white pine, northern red oak.
					Yellow-poplar	90	90	
					White oak	75	57	
					Black oak	80	62	
					Shortleaf pine	60	88	
					Chestnut oak	80	62	
Latham	Severe	Severe	Severe	Moderate	Scarlet oak	74	56	Northern red oak, eastern white pine, black oak, yellow-poplar, white oak.
					Black oak	72	54	
					Virginia pine	59	88	
					White oak	60	43	
					Shortleaf pine	56	80	
					Pitch pine	55	---	
Marrowbone	Severe	Severe	Moderate	Moderate	Chestnut oak	60	43	Shortleaf pine, black oak.
					Yellow-poplar	100	110	
					Sweet birch	---	---	
					American beech	---	---	
					Northern red oak	---	---	
					Shortleaf pine	75	120	
					Pitch pine	---	---	
					Virginia pine	---	---	
Gr: Grigsby	Slight	Slight	Slight	Severe	Yellow-poplar	110	124	Yellow-poplar, black walnut, eastern white pine, white oak, northern red oak, white ash.
					Northern red oak	85	67	
					White oak	85	67	
					Black walnut	---	---	
					American sycamore	---	---	
					Sweetgum	---	---	
					Red maple	---	---	
					Hickory	---	---	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
KbD**:								
Kaymine	Moderate	Slight	Severe	Moderate	Eastern white pine	94	4	Eastern white pine, loblolly pine, black locust, royal paulownia.
					Black locust	80	12	
					Loblolly pine	82	8	
					Red maple	---	7	
Bethesda	Moderate	Slight	Severe	Moderate	Black locust	75	---	Eastern white pine, loblolly pine, black locust, royal paulownia, white ash.
					Red maple	---	---	
					Loblolly pine	69	91	
					Eastern white pine	85	135	
Fiveblock	Moderate	Slight	Severe	Moderate	Eastern white pine	94	75	Eastern white pine, loblolly pine, black locust, royal paulownia.
					Black locust	---	---	
					Loblolly pine	69	101	
					Red maple	90	---	
KbF**:								
Kaymine	Severe	Severe	Severe	Moderate	Eastern white pine	94	75	Eastern white pine, loblolly pine, black locust, royal paulownia.
					Black locust	---	---	
					Loblolly pine	82	114	
					Red maple	---	---	
Bethesda	Severe	Severe	Severe	Moderate	Black locust	75	---	Eastern white pine, loblolly pine, black locust, royal paulownia.
					Red maple	---	---	
					Loblolly pine	69	101	
					Eastern white pine	85	135	
Fiveblock	Severe	Severe	Severe	Moderate	Eastern white pine	94	---	Eastern white pine, loblolly pine, black locust, royal paulownia.
					Black locust	---	---	
					Loblolly pine	69	101	
					Red maple	---	---	
KfF**:								
Kimper (cool aspect)	Severe	Severe	Slight	Severe	White oak	76	54	Yellow-poplar, white ash, northern red oak, eastern white pine, black walnut.
					Yellow-poplar	112	119	
					Sugar maple	---	---	
					American basswood	---	---	
					American beech	---	---	
					Sweet birch	---	---	
					Northern red oak	75	57	
					White ash	---	---	
					Cucumber tree	---	---	
Fedscreek (cool aspect)	Severe	Severe	Slight	Severe	Yellow-poplar	90	90	Yellow-poplar, northern red oak, white ash, black walnut, eastern white pine.
					White oak	70	52	
					Black oak	75	57	
					American basswood	---	---	
					Black walnut	---	---	
					Northern red oak	---	---	

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
Kn----------------- Knowlton	Slight	Moderate	Moderate	Severe	Sweetgum------------	90	68	Sweetgum, pin oak, green ash, eastern white pine, red maple.
					Pin oak-------------	90	68	
					Red maple-----------	---	---	
					Boxelder------------	---	---	
					American sycamore---	---	---	
					Green ash-----------	---	---	
LgD**:								
Latham---------	Moderate	Severe	Severe	Moderate	Northern red oak----	63	---	Eastern white pine, black oak, white oak, northern red oak.
					Black oak-----------	72	54	
					Shortleaf pine------	56	80	
					White oak-----------	60	43	
					Hickory-------------	---	---	
					Yellow-poplar-------	100	110	
Gilpin---------	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	---	Northern red oak, eastern white pine, white oak, black oak.
					Yellow-poplar-------	95	90	
					White oak-----------	75	57	
					Hickory-------------	---	---	
					Red maple-----------	---	---	
					Black oak-----------	80	62	
LsE**:								
Latham---------	Moderate	Severe	Severe	Moderate	Northern red oak----	68	---	Northern red oak, eastern white pine, black oak, white oak.
					Black oak-----------	72	54	
					White oak-----------	60	43	
					Shortleaf pine------	56	80	
					Hickory-------------	---	---	
					Yellow-poplar-------	100	110	
Shelocta-------	Moderate	Moderate	Slight	Severe	White oak-----------	65	47	Eastern white pine, white oak, northern red oak.
					Yellow-poplar-------	99	110	
					Cucumbertree--------	---	---	
					American beech------	---	---	
					Shortleaf pine------	77	124	
					Red maple-----------	81	---	
					Scarlet oak---------	80	---	
					Northern red oak----	---	---	
					Black oak-----------	70	52	
Gilpin---------	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	---	Northern red oak, eastern white pine, white oak, black oak.
					Yellow-poplar-------	95	---	
					White oak-----------	75	57	
					Hickory-------------	---	---	
					Red maple-----------	---	---	
					Black oak-----------	80	62	
LyD---------------- Lily	Moderate	Moderate	Slight	Moderate	Shortleaf pine------	63	95	Shortleaf pine, white oak, eastern white pine, black oak.
					Virginia pine-------	80	112	
					Black oak-----------	78	62	
					White oak-----------	73	51	
					Chestnut oak--------	73	58	
					Yellow-poplar-------	95	---	
					Northern red oak----	78	---	
					Scarlet oak---------	77	55	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
MgE**:								
Marrowbone	Moderate	Moderate	Moderate	Moderate	Shortleaf pine	75	120	Shortleaf pine, white oak, black oak.
					Virginia pine	---	---	
					White oak	---	---	
					Black oak	---	---	
					Red maple	---	---	
					Hickory	---	---	
Gilpin	Moderate	Moderate	Slight	Moderate	Northern red oak	70	---	Northern red oak, eastern white pine, white oak, black oak, yellow-poplar.
					Yellow-poplar	90	110	
					White oak	75	57	
					Hickory	---	---	
					Red maple	---	---	
					Black oak	70	52	
Latham	Moderate	Severe	Severe	Moderate	Northern red oak	59	---	Northern red oak, eastern white pine, black oak, yellow-poplar, white oak.
					Black oak	72	54	
					White oak	---	---	
					Shortleaf pine	56	80	
					Hickory	---	---	
					Yellow-poplar	100	110	
Mo Morehead	Slight	Moderate	Slight	Severe	Shortleaf pine	84	138	Shortleaf pine, yellow-poplar, sweetgum, pin oak, eastern white pine, green ash.
					Yellow-poplar	82	75	
					White oak	---	--	
					Red maple	---	--	
					Pin oak	---	--	
					Black oak	---	--	
					White ash	---	--	
					River birch	---	--	
Or Orrville	Slight	Slight	Slight	Severe	Pin oak	85	---	Eastern white pine, green ash, pin oak, sweetgum, cherrybark oak.
					Northern red oak	80	---	
					Yellow-poplar	90	90	
					Sugar maple	80	---	
					White oak	---	---	
					Green ash	---	---	
					Sweetgum	---	---	
Oy**:								
Orrville	Slight	Slight	Slight	Severe	Pin oak	85	---	Eastern white pine, green ash, pin oak, sweetgum, cherrybark oak.
					Northern red oak	80	---	
					Yellow-poplar	90	90	
					Sugar maple	80	---	
					White oak	---	---	
					Green ash	---	---	
					Sweetgum	---	---	
Grigsby	Slight	Slight	Slight	Severe	Yellow-poplar	110	124	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white oak, northern red oak, white ash.
					Northern red oak	85	67	
					White oak	85	67	
					Black walnut	---	---	
					American sycamore	---	---	
					Sweetgum	---	---	
					Red maple	---	---	
					Hickory	---	---	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
Po-------------- Pope	Slight	Slight	Slight	Severe	Yellow-poplar-------	96	100	Eastern white pine, yellow-poplar, black walnut, white oak, northern red oak, white ash.
					American beech------	---	---	
					White oak-----------	80	62	
					Blackgum------------	---	---	
					American sycamore---	---	---	
					Northern red oak----	---	---	
					American basswood---	---	---	
					Eastern hemlock-----	---	---	
					Bitternut hickory---	---	---	
RgC**:								
Rayne-----------	Slight	Slight	Slight	Severe	Northern red oak----	80	62	Eastern white pine, black cherry, white oak.
					Yellow-poplar-------	90	90	
					White oak-----------	---	---	
					Black oak-----------	---	---	
Gilpin----------	Slight	Slight	Slight	Moderate	Northern red oak----	80	---	Eastern white pine, black cherry, northern red oak, black oak.
					Yellow-poplar-------	95	90	
					White oak-----------	---	---	
					Sugar maple---------	---	---	
					Black oak-----------	80	62	
RlF**:								
Rigley----------	Severe	Severe	Moderate	Moderate	White oak-----------	65	44	Eastern white pine, black oak, shortleaf pine, white oak.
					Black oak-----------	74	56	
					Hickory-------------	---	---	
					Scarlet oak---------	64	47	
					American beech------	---	---	
					Shortleaf pine------	---	---	
					Eastern hemlock-----	---	---	
Rock outcrop.								
RnD**:								
Riney-----------	Slight	Slight	Slight	Severe	Yellow-poplar-------	93	95	Yellow-poplar, white ash, eastern white pine, black walnut, white oak, northern red oak.
					White oak-----------	78	67	
					Red maple-----------	---	---	
					Black oak-----------	80	62	
Ezel------------	Slight	Slight	Slight	Severe	Shortleaf pine------	80	130	Eastern white pine, yellow-poplar, black walnut, white oak, white ash, northern red oak.
					Yellow-poplar-------	93	95	
					Sugar maple---------	---	---	
					White ash-----------	---	---	
					Northern red oak----	---	---	
					Pignut hickory------	---	---	
					Black oak-----------	78	60	
					White oak-----------	70	52	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
RoB------------- Rowdy	Slight	Slight	Slight	Severe	Yellow-poplar-------	100	107	Yellow-poplar, black walnut, eastern white pine, white ash, white oak, northern red oak.
					American sycamore---	---	---	
					Black walnut--------	---	---	
					River birch---------	---	---	
					White oak-----------	---	---	
					American elm--------	---	---	
					Sweetgum------------	---	---	
					Boxelder------------	---	---	
RyB**:								
Rowdy----------	Slight	Slight	Slight	Severe	Yellow-poplar-------	100	107	Yellow-poplar, black walnut, eastern white pine, white ash, white oak, northern red oak.
					American sycamore---	---	---	
					Black walnut--------	---	---	
					River birch---------	---	---	
					White oak-----------	---	---	
					American elm--------	---	---	
					Sweetgum------------	---	---	
					Boxelder------------	---	---	
Grigsby--------	Slight	Slight	Slight	Severe	Yellow-poplar-------	110	124	Yellow-poplar, black walnut, eastern white pine, white oak, northern red oak, white ash.
					Northern red oak----	85	67	
					White oak-----------	85	67	
					Black walnut--------	---	--	
					American sycamore---	---	--	
					Sweetgum------------	---	--	
					Red maple-----------	---	--	
					Hickory-------------	---	--	
Barbourville---	Slight	Slight	Slight	Severe	Yellow-poplar-------	102	105	Eastern white pine, black walnut, yellow-poplar, white ash, northern red oak, white oak.
					White ash-----------	---	---	
					White oak-----------	---	---	
					Red maple-----------	---	---	
					American sycamore---	---	---	
					Cucumbertree--------	---	---	
ShC------------- Shelocta	Slight	Slight	Slight	Severe	White oak-----------	77	59	Black walnut, eastern white pine, black oak, shortleaf pine, white ash, white oak, northern red oak.
					Yellow-poplar-------	99	105	
					Cucumbertree--------	---	---	
					American beech------	---	---	
					Shortleaf pine------	77	128	
					Red maple-----------	81	---	
					Scarlet oak---------	80	62	
					Black oak-----------	79	61	
					Northern red oak----	---	---	
ShD------------- Shelocta	Moderate	Moderate	Slight	Severe	White oak-----------	77	59	Black walnut, eastern white pine, black oak, shortleaf pine, white ash, white oak, northern red oak.
					Yellow-poplar-------	99	105	
					Cucumbertree--------	---	---	
					American beech------	---	---	
					Shortleaf pine------	77	128	
					Red maple-----------	81	---	
					Scarlet oak---------	80	62	
					Black oak-----------	79	61	
					Northern red oak----	---	---	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
SlF**:								
Shelocta	Severe	Severe	Slight	Severe	White oak	65	47	Eastern white pine, black oak, shortleaf pine, white oak, northern red oak.
					Yellow-poplar	99	110	
					Cucumbertree	---	---	
					American beech	---	---	
					Shortleaf pine	77	124	
					Red maple	81	---	
					Scarlet oak	80	---	
					Northern red oak	---	---	
					Black oak	70	52	
Gilpin	Severe	Severe	Slight	Moderate	Northern red oak	80	---	Eastern white pine, black oak, white oak, yellow-poplar, northern red oak, shortleaf pine.
					Yellow-poplar	95	---	
					White oak	75	57	
					Hickory	---	---	
					Red maple	---	---	
					Black oak	80	62	
SpF**:								
Shelocta (cool aspect)	Severe	Severe	Slight	Severe	White oak	71	61	Shortleaf pine, white oak, eastern white pine, white ash, northern red oak.
					Black oak	79	61	
					Scarlet oak	80	---	
					Yellow-poplar	99	110	
					American beech	---	---	
					Blackgum	---	---	
					Red maple	81	---	
					Northern red oak	---	---	
Helechawa (cool aspect)	Severe	Severe	Moderate	Moderate	Sugar maple	---	---	White oak, eastern white pine, shortleaf pine.
					Chestnut oak	---	---	
					White oak	75	57	
					Virginia pine	75	115	
					Eastern white pine	108	120	
Hazleton (cool aspect)	Severe	Severe	Moderate	Moderate	Northern red oak	87	71	Eastern white pine, black oak, white oak.
					Black oak	85	67	
					White oak	---	---	
					Yellow-poplar	104	114	
					Mockernut hickory	---	---	
SpF**:								
Shelocta (warm aspect)	Severe	Severe	Slight	Severe	White oak	65	47	Eastern white pine, shortleaf pine, white oak.
					Yellow-poplar	90	93	
					Cucumbertree	---	---	
					American beech	---	---	
					Shortleaf pine	77	---	
					Red maple	55	---	
					Scarlet oak	70	50	
					Black oak	73	52	

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
SpF**:								
Helechawa								
(warm aspect)	Severe	Severe	Moderate	Moderate	White oak	65	47	White oak, shortleaf pine.
					Chestnut oak	65	47	
					Virginia pine	65	100	
					Scarlet oak	70	52	
Hazleton								
(warm aspect)	Severe	Severe	Moderate	Moderate	Northern red oak	60	52	Black oak, eastern white pine, white oak.
					Yellow-poplar	80	90	
					Black oak	76	58	
					White oak	72	54	
					Scarlet oak	76	58	
WhA: Whitley	Slight	Slight	Slight	Severe	Shortleaf pine	90	110	Shortleaf pine, eastern white pine, white oak, black walnut, black cherry.
					White oak	---	---	
					American sycamore	---	---	
					Hickory	---	---	
					Yellow-poplar	110	124	
					Box elder	---	---	

* Volume is the yield in cubic feet/acre/year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

Table 8.--Recreational Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AbB: Allegheny	Slight	Slight	Moderate: slope.	Slight	Slight.
AbC: Allegheny	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
ArF*:					
Alticrest	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ramsey	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
BcF*:					
Berks	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Cranston	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
BdF: Bledsoe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
BeE*:					
Bledsoe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Donahue	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Rock outcrop.					
CoB: Cotaco	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
DgF*:					
Dekalb	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Marrowbone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Dm*. Dumps, coal					

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
EgB*:					
Ezel	Slight	Slight	Moderate: slope.	Slight	Slight.
Gilpin	Slight	Slight	Moderate: slope.	Slight	Moderate: depth to rock.
EgC*:					
Ezel	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
GlC Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
GlD Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
GnF*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Latham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Marrowbone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gr Grigsby	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
KbD*:					
Kaymine	Variable	Variable	Variable	Variable	Variable.
Bethesda	Variable	Variable	Variable	Variable	Variable.
Fiveblock	Variable	Variable	Variable	Variable	Variable.
KbF*:					
Kaymine	Variable	Variable	Variable	Variable	Variable.
Bethesda	Variable	Variable	Variable	Variable	Variable.
Fiveblock	Variable	Variable	Variable	Variable	Variable.
KfF*:					
Kimper	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fedscreek	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Kn----------------- Knowlton	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
LgD*:					
Latham--------------	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope, depth to rock.
Gilpin--------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---------	Moderate: slope, depth to rock.
LsE*:					
Latham--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Shelocta------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Gilpin--------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
LyD----------------- Lily	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---------	Moderate: slope, depth to rock.
MgE*:					
Marrowbone----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Gilpin--------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Latham--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Mo------------------ Morehead	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Or------------------ Orrville	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Oy*:					
Orrville------------	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Grigsby-------------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Pe*----------------- Pits, quarries	Variable--------	Variable--------	Variable--------	Variable--------	Variable.
Po------------------ Pope	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Severe: erodes easily.	Severe: flooding.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RgC*:					
Rayne	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Gilpin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
RlF:					
Rigley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
RnD*:					
Riney	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Ezel	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
RoB Rowdy	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
RyB*:					
Rowdy	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
Grigsby	Severe: flooding.	Slight	Moderate: slope, flooding.	Slight	Moderate: flooding.
Barbourville	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight	Slight.
ShC Shelocta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
ShD Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
SlF*:					
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SpF*:					
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Helechawa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hazleton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ur*: Udorthents, loamy	Variable	Variable	Variable	Variable	Variable.
W*. Water					
WhA: Whitley	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 9.--Wildlife Habitat

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
AbB: Allegheny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AbC: Allegheny	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ArF*:										
Alticrest	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ramsey	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
BcF*:										
Berks	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Cranston	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
BdF: Bledsoe	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
BeE*:										
Bledsoe	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Donahue	Poor	Fair	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rock outcrop.										
CoB: Cotaco	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
DgF*:										
Dekalb	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Marrowbone	Very poor.	Poor	Good	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Dm*. Dumps, coal										
EgB*:										
Ezel	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Gilpin	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.

Table 9.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
EgC*:										
Ezel	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
GlC Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
GlD Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GnF*:										
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Latham	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Marrowbone	Very poor.	Poor	Good	Fair	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Gr Grigsby	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
KbD*, KbF*:										
Kaymine	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Bethesda	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Fiveblock	Very poor.	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
KfF*:										
Kimper	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Fedscreek	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Kn Knowlton	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
LgD*:										
Latham	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
LsE*:										
Latham	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Shelocta	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

Table 9.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
LsE*:										
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
LyD Lily	Fair	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.
MgE*:										
Marrowbone	Poor	Fair	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Latham	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Mo Morehead	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Or Orrville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Oy*:										
Orrville	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Grigsby	Fair	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Pe*. Pits, quarries										
Po Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RgC:										
Rayne	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Gilpin	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
RlF*:										
Rigley	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
RnD Riney	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Rob Rowdy	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RyB*:										
Rowdy	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Grigsby	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

Table 9.--Wildlife Habitat--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
RyB*:										
Barbourville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ShC: Shelocta	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ShD: Shelocta	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
SlF*:										
Shelocta	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
SpF*:										
Shelocta	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Helechawa	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Hazleton	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Ur*. Udorthents, loamy										
W*. Water										
WhA: Whitley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 10.--Building Site Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AbB: Allegheny	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
AbC: Allegheny	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
ArF*:						
Alticrest	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ramsey	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
BcF*:						
Berks	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: small stones, slope, depth to rock.
Cranston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BdF: Bledsoe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
BeE*:						
Bledsoe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Donahue	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						
CoB: Cotaco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
DgF*:						
Dekalb	Severe: slope, depth to rock.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Marrowbone	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Dm*. Dumps, coal	Variable	Variable	Variable	Variable	Variable	Variable.
EgB*:						
Ezel	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight	Slight.
Gilpin	Severe: depth to rock.	Slight	Severe: depth to rock.	Moderate: slope.	Moderate: depth to rock.	Moderate: depth to rock.
EgC*:						
Ezel	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Gilpin	Severe: depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Moderate: slope, depth to rock.
GlC Gilpin	Severe: depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Moderate: slope, depth to rock.
GlD Gilpin	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
GnF*:						
Gilpin	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Latham	Severe: wetness, slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: wetness, slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Marrowbone	Severe: slope, depth to rock.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope, depth ro rock.
Gr Grigsby	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
KbD*:						
Kaymine	Variable	Variable	Variable	Variable	Variable	Variable.
Bethesda	Variable	Variable	Variable	Variable	Variable	Variable.
Fiveblock	Variable	Variable	Variable	Variable	Variable	Variable.
KbF*:						
Kaymine	Variable	Variable	Variable	Variable	Variable	Variable.
Bethesda	Variable	Variable	Variable	Variable	Variable	Variable.
Fiveblock	Variable	Variable	Variable	Variable	Variable	Variable.

See footnote at end of table.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
KfF*:						
Kimper	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Fedscreek	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kn: Knowlton	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.
LgD*:						
Latham	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope, thin layer.
Gilpin	Severe: depth to rock.	Moderate: slope.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Moderate: slope, depth to rock.
LsE*:						
Latham	Severe: wetness, slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: wetness, slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
LyD: Lily	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Moderate: slope, depth to rock.
MgE*:						
Marrowbone	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Latham	Severe: wetness, slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: wetness, slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: shrink-swell, low strength, slope.	Severe: slope.
Mo: Morehead	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength.	Moderate: wetness.
Or: Orrville	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Oy*:						
Orrville	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
Grigsby	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Pe*. Pits, quarries						
Po Pope	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
RgC*:						
Rayne	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Gilpin	Severe: depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Moderate: slope, depth to rock.
RlF*:						
Rigley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
RnD*:						
Riney	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Ezel	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
RoB Rowdy	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
RyB*:						
Rowdy	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Grigsby	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Barbourville	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
ShC Shelocta	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
ShD Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

Table 10.--Building Site Development--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SlF*:						
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilpin	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
SpF*:						
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Helechawa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hazleton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ur*. Udorthents, loamy						
W*. Water						
WhA Whitley	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 11.--Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbB----------------- Allegheny	Slight-----------	Moderate: seepage, slope.	Severe: depth to rock.	Slight-----------	Good.
AbC----------------- Allegheny	Moderate: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.	Fair: slope.
ArF*:					
Alticrest----------	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope, thin layer.
Ramsey-------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope, thin layer.
BcF*:					
Berks--------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, small stones, slope, thin layer.
Cranston-----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
BdF----------------- Bledsoe	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
BeE*:					
Bledsoe------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Donahue------------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, slope, thin layer.
Rock outcrop.					
CoB----------------- Cotaco	Severe: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DgF*:					
Dekalb	Severe: depth to rock, poor filter, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: slope, area reclaim, thin layer.
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, area reclaim, thin layer.
Marrowbone	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope, thin layer, area reclaim.
Dm*. Dumps, coal					
EgB*:					
Ezel	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock.
Gilpin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
EgC*:					
Ezel	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: depth to rock, slope.
Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GlC Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
GlD Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, area reclaim, thin layer.
GnF*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, area reclaim, thin layer.
Latham	Severe: thin layer, wetness.	Severe: slope, slippage.	Severe: wetness, slope.	Severe: slope, slippage.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GnF*:					
Marrowbone	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, small stones, slope.
Gr: Grigsby	Severe: flooding.	Severe: flooding, seepage.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Good.
KbD*:					
Kaymine	Variable	Variable	Variable	Variable	Variable.
Bethesda	Variable	Variable	Variable	Variable	Variable.
Fiveblock	Variable	Variable	Variable	Variable	Variable.
KbF*:					
Kaymine	Variable	Variable	Variable	Variable	Variable.
Bethesda	Variable	Variable	Variable	Variable	Variable.
Fiveblock	Variable	Variable	Variable	Variable	Variable.
KfF*:					
Kimper	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: slope.
Fedscreek	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: slope.
Kn: Knowlton	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
LgD*:					
Latham	Severe: thin layer, wetness.	Severe: slope, wetness.	Severe: wetness, too clayey, depth to rock.	Moderate: wetness, slope.	Poor: area reclaim, too clayey, hard to pack.
Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
LsE*:					
Latham	Severe: thin layer, wetness, slope.	Severe: slope, slippage, wetness.	Severe: wetness, slope, too clayey.	Severe: slope, slippage, depth to rock.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LsE*:					
Shelocta	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: slope.	Poor: slope.
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, area reclaim, thin layer.
LyD: Lily	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock, thin layer.
MgE*:					
Marrowbone	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope, thin layer.
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, area reclaim, thin layer.
Latham	Severe: thin layer, wetness.	Severe: slope, slippage, wetness.	Severe: wetness, slope, too clayey.	Severe: slope, slippage, wetness.	Poor: area reclaim, too clayey, hard to pack.
Mo: Morehead	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Or: Orrville	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Oy*:					
Orrville	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Grigsby	Severe: flooding.	Severe: flooding, seepage.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Good.
Pe*. Pits, quarries					
Po: Pope	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RgC*:					
Rayne	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: thin layer, slope, depth to rock.
Gilpin	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer, depth to rock.
RlF*:					
Rigley	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Rock outcrop.					
RnD*:					
Riney	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too clayey, slope.
Ezel	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: depth to rock, slope.
RoB Rowdy	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Good.
RyB*:					
Rowdy	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Good.
Grigsby	Severe: flooding.	Severe: flooding, seepage.	Severe: seepage, wetness, flooding.	Severe: seepage, flooding.	Good.
Barbourville	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: slope.
ShC Shelocta	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, depth to rock.	Moderate: slope, depth to rock.	Fair: depth to rock, slope.
ShD Shelocta	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: slope.	Poor: slope.
SlF*:					
Shelocta	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: slope.	Poor: slope.

See footnote at end of table.

Table 11.--Sanitary Facilities--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SlF*:					
Gilpin-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, area reclaim, thin layer.
SpF*:					
Shelocta-----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: slope.	Poor: slope.
Helechawa----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Hazleton-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Ur*. Udorthents, loamy					
W*. Water					
WhA----------------- Whitley	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 12.--Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AbB------------------ Allegheny	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
AbC------------------ Allegheny	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
ArF*:				
Alticrest-----------	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Ramsey---------------	Poor: depth to rock, slope, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
BcF*:				
Berks----------------	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Cranston-------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
BdF------------------ Bledsoe	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
BeE*:				
Bledsoe--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
Donahue--------------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Rock outcrop.				
CoB------------------ Cotaco	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
DgF*:				
Dekalb---------------	Poor: slope, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope, large stones.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DgF*:				
Gilpin	Poor: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Marrowbone	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Dm*. Dumps, coal				
EgB*:				
Ezel	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
Gilpin	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor.
EgC*:				
Ezel	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Gilpin	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GlC Gilpin	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GlD Gilpin	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
GnF*:				
Gilpin	Poor: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Latham	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Marrowbone	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Gr Grigsby	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
KbD*:				
Kaymine	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Bethesda	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
KbD*:				
Fiveblock	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
KbF*:				
Kaymine	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Bethesda	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Fiveblock	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
KfF*:				
Kimper	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Fedscreek	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Kn Knowlton	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
LgD*:				
Latham	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Gilpin	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
LsE*:				
Latham	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Shelocta	Fair: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Gilpin	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LyD------------------ Lily	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MgE*:				
Marrowbone-----------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Gilpin---------------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Latham---------------	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Mo------------------- Morehead	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Or------------------- Orrville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Oy*:				
Orrville-------------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Grigsby--------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Pe*. Pits, quarries				
Po------------------- Pope	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
RgC*:				
Rayne----------------	Fair: thin layer, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
Gilpin---------------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
RlF*:				
Rigley---------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop.				
RnD*:				
Riney----------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ezel-----------------	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
RoB------------------ Rowdy	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RyB*:				
Rowdy	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Grigsby	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Barbourville	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
ShC: Shelocta	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
ShD: Shelocta	Fair: slope, depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
SlF*:				
Shelocta	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Gilpin	Poor: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
SpF*:				
Shelocta	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Helechawa	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, area reclaim, small stones.
Hazleton	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Ur*. Udorthents, loamy				
W*. Water				
WhA: Whitley	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 13.--Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
AbB: Allegheny	Moderate: seepage, slope.	Severe: piping.	Deep to water	Favorable	Favorable.
AbC: Allegheny	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
ArF*:					
Alticrest	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, droughty.
Ramsey	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
BcF*:					
Berks	Severe: seepage, slope.	Severe: thin layer, large stones, piping.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Cranston	Severe: seepage, slope.	Severe: piping, large stones.	Deep to water	Slope, large stones.	Slope, large stones.
BdF: Bledsoe	Severe: slope.	Severe: hard to pack, large stones.	Deep to water	Slope, large stones, erodes easily.	Slope, large stones, erodes easily.
BeE*:					
Bledsoe	Severe: slope.	Severe: hard to pack, large stones.	Deep to water	Slope, large stones, erodes easily.	Slope, large stones, erodes easily.
Donahue	Severe: slope.	Moderate: thin layer, piping, large stones.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Rock outcrop.					
CoB: Cotaco	Moderate: seepage.	Severe: piping, wetness.	Slope	Erodes easily, wetness.	Erodes easily.
DgF*:					
Dekalb	Severe: seepage, slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, depth to rock.	Slope, large stones, droughty, depth to rock.
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
DgF*:					
Marrowbone	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
Dm*. Dumps, coal					
EgB*:					
Ezel	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Favorable	Favorable.
Gilpin	Moderate: seepage, depth to rock, slope.	Moderate: thin layer.	Deep to water	Depth to rock	Depth to rock.
EgC*:					
Ezel	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
GlC, GlD Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
GnF*:					
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Latham	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly: slope.	Slope, erodes easily.	Slope, erodes easily. depth to rock.
Marrowbone	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
Gr Grigsby	Severe: seepage.	Severe: piping, seepage.	Deep to water	Favorable	Favorable.
KbD*:					
Kaymine	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
Bethesda	Severe: slope.	Severe: seepage, piping.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
Fiveblock	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones.	Large stones, slope, droughty.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
KbF*:					
Kaymine	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
Bethesda	Severe: slope.	Severe: seepage, piping.	Deep to water	Slope, large stones, slippage.	Large stones, slope, droughty.
Fiveblock	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
KfF*:					
Kimper	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope	Slope.
Fedscreek	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope	Slope.
Kn Knowlton	Slight	Severe: wetness.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
LgD*:					
Latham	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
LsE*:					
Latham	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
Shelocta	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope	Slope.
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
LyD Lily	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
MgE*:					
Marrowbone	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
MgE*:					
Latham	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
Mo Morehead	Moderate: seepage.	Severe: piping, wetness.	Favorable	Erodes easily, wetness.	Wetness, erodes easily.
Or Orrville	Moderate: seepage.	Severe: piping, wetness.	Flooding	Erodes easily, wetness.	Wetness, erodes easily.
Oy*:					
Orrville	Moderate: seepage.	Severe: piping, wetness.	Flooding	Erodes easily, wetness.	Wetness, erodes easily.
Grigsby	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Pe*. Pits, quarries					
Po Pope	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
RgC*:					
Rayne	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
Gilpin	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
RlF*:					
Rigley	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope	Slope.
Rock outcrop.					
RnD*:					
Riney	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope	Slope.
Ezel	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
RoB Rowdy	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
RyB*:					
Rowdy	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Grigsby	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Barbourville	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
ShC, ShD---------- Shelocta	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope------------	Slope.
SlF*:					
Shelocta---------	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope------------	Slope.
Gilpin-----------	Severe: slope.	Moderate: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
SpF*:					
Shelocta---------	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope------------	Slope.
Helechawa--------	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope------------	Slope, droughty.
Hazleton---------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water----	Slope, large stones.	Slope, large stones, droughty.
Ur*. Udorthents, loamy					
W*. Water					
WhA--------------- Whitley	Moderate: seepage.	Severe: piping.	Deep to water----	Erodes easily----	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 14.--Engineering Index Properties

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
AbB, AbC--------- Allegheny	0-8	Loam-------------	ML, CL	A-4	0	90-100	80-100	65-100	55-95	<35	NP-10
	8-53	Clay loam, loam, silt loam.	ML, CL,	A-4, A-6	0	90-100	80-100	65-95	35-80	<35	NP-15
	53-62	Clay loam, sandy loam, channery sandy loam.	SM, GC, ML, CL	A-4, A-6, A-2, A-1	0-5	65-100	55-100	35-95	20-75	<35	NP-15
	62	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ArF*: Alticrest-------	0-9	Sandy loam-------	ML, CL-ML, SM, SC-SM	A-4, A-2	0-2	80-100	75-100	55-80	34-65	<20	NP-6
	9-22	Sandy loam, loam, channery sandy loam.	ML, CL-ML, SM, SC-SM	A-4, A-2	0-2	80-100	70-100	55-85	34-70	<23	NP-6
	22-38	Channery sandy loam, channery loam.	SM, SC-SM ML, CL-ML	A-2, A-4, A-1-b	0-5	70-100	65-100	45-75	13-36	<20	NP-5
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ramsey----------	0-4	Channery sandy loam.	SM, CL-ML, ML, SC-SM	A-4, A-2	0-10	85-100	70-85	60-75	30-70	<25	NP-7
	4-18	Loam, sandy loam, channery sandy loam.	SM, CL-ML, ML, SC-SM	A-4, A-2	0-10	75-100	65-95	55-77	30-70	<25	NP-7
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
BcF*: Berks-----------	0-5	Channery silt loam.	GM, ML, GC,	A-2, A-4	0-20	50-80	45-70	40-60	30-55	25-36	5-10
	5-20	Channery silt loam, very channery silt loam, channery loam.	GM, GC,	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	20-33	Channery silt loam, very channery silt loam, extremely channery silt loam.	GM, GM-GC	A-1, A-2	0-40	35-65	25-55	20-40	15-35	24-38	2-10
	33-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
BcF*:											
Cranston--------	0-8	Channery silt loam.	GM, GC, ML,	A-4, A-2, A-1	0-30	50-80	25-80	23-80	18-70	<35	NP-10
	8-50	Channery silt loam, very channery silt loam, extremely channery silt loam.	ML, CL, GM, GC	A-4	0-30	50-80	55-75	50-70	40-65	<35	NP-10
	50-62	Very channery silt loam, extremely channery silt loam, extremely channery silty clay loam.	GM, GC, SM	A-4, A-2, A-1	0-30	50-80	25-75	23-60	18-45	<35	NP-10
BdF-------------- Bledsoe	0-5	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	85-95	80-95	70-90	50-90	20-35	5-15
	5-41	Silty clay, silty clay loam, channery silty clay loam.	CH, CL	A-7, A-6	0-15	65-95	65-95	60-90	50-90	35-60	15-35
	41-80	Channery silty clay loam, silty clay, clay.	CH, CL, GC,	A-7, A-6	0-25	50-100	50-100	40-90	35-90	35-60	15-40
BeE*:											
Bledsoe---------	0-8	Loam------------	CL, CL-ML	A-4, A-6	0-5	85-95	80-95	70-90	50-90	20-35	5-15
	8-28	Silty clay, clay, channery sandy clay loam.	CH, CL, SC	A-7, A-6	0-15	65-95	65-95	60-90	50-90	35-60	15-35
	28-63	Channery silty clay loam, silty clay, clay.	CH, CL, GC, SC	A-7, A-6	0-25	50-100	50-100	40-90	35-90	35-60	15-40
	63	Weathered bedrock	---	---	---	---	---	---	---	---	---
Donahue---------	0-7	Loam------------	CL, ML, CL-ML	A-4, A-2	0-10	80-100	70-100	50-90	25-70	<30	NP-7
	7-13	Clay loam, sandy clay loam, channery clay loam.	SM, SC, ML, CL	A-4, A-6	0-20	80-100	75-100	55-95	40-75	20-40	2-15
	13-33	Silty clay, clay	CH, CL	A-7	0-10	85-100	85-100	75-100	65-95	45-70	20-40
	33-39	Weathered bedrock	---	---	---	---	---	---	---	---	---
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.			---	---	---	---	---	---	---	---	---
CoB-------------- Cotaco	0-11	Loam------------	ML, CL-ML,	A-4	0-5	80-100	75-95	55-85	35-80	<30	NP-7
	11-35	Channery loam, silt loam, loam.	GC, CL, ML, CL-ML	A-2, A-4, A-6, A-1-b	0-10	60-100	50-95	40-90	20-80	<35	NP-15
	35-65	Silt loam, clay loam, loam.	GC, CL, ML, CL-ML, CH, MH	A-2, A-4, A-6, A-1-b, A-7	0-10	60-100	50-95	40-90	20-80	<35	NP-15

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
DgF*:											
Dekalb----------	0-6	Sandy loam-------	SM, GM,	A-2, A-4, A-1	0-30	50-90	45-80	40-75	20-55	10-32	NP-10
	6-29	Channery sandy loam, channery loam, very channery sandy loam.	SM, GM, ML, GM-GC	A-2, A-4, A-1	5-40	50-85	40-80	40-75	20-55	15-32	NP-9
	29-32	Channery sandy loam, very channery sandy loam, very channery loamy sand.	SM, GM, SC, GC	A-2, A-4, A-1	10-50	45-85	25-75	20-65	15-40	15-32	NP-9
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilpin----------	0-5	Channery silt loam.	GC, ML, CL, CL-ML	A-2, A-4, A-6	0-25	50-90	45-85	35-75	30-70	20-40	4-15
	5-18	Channery silt loam, silty clay loam.	GC, SC, CL, CL-ML CH, MH	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	18-30	Channery silt loam, very channery silt loam, silty clay loam.	GC, GM-GC, CL, ML-CL, CH, MH	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Marrowbone------	0-3	Loam------------	SC-SM, SM, SC, GM	A-4	0-5	70-95	65-90	55-85	35-49	16-25	2-10
	3-27	Channery loam, loam, channery fine sandy loam.	SC-SM, SM, SC, GM-GC	A-4, A-2-4	0-15	50-95	50-90	40-85	25-49	16-30	2-10
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Dm*. Dumps, coal											
EgB*, EgC*:											
Ezel------------	0-11	Loam------------	ML, CL	A-4	0	90-100	80-100	80-100	55-95	<35	NP-10
	11-47	Loam, sandy clay loam, silt loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	80-100	55-95	35-80	<35	NP-15
	47-53	Sandy loam, sandy clay loam, loam.	SM, GC, SC, ML, CL	A-4, A-6, A-2, A-1	0-5	65-100	55-100	35-95	20-75	<35	NP-15
	53	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilpin----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-32	Silt loam, channery silt loam, loam.	GC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
GlC, GlD--------- Gilpin	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-32	Silt loam, channery silt loam, loam.	GC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GnF*: Gilpin----------	0-5	Channery silt loam.	GC, ML, CL, CL-ML	A-2, A-4, A-6	0-25	50-90	45-85	35-75	30-70	20-40	4-15
	5-18	Channery silt loam, channery silty clay loam, silty clay loam.	GC, CL, CL-ML, CH, MH	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	18-30	Channery silt loam, very channery silt loam, silty clay loam.	GC, GM-GC CL, ML-CL, CH, MH	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Latham----------	0-7	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	7-38	Silty clay, silty clay loam, channery silty clay.	CH, CL	A-7	0-10	85-100	70-95	65-95	60-90	45-65	25-40
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
Marrowbone------	0-3	Loam-------------	SC-SM, SM, SC, GM	A-4	0-5	70-95	65-90	55-85	35-49	16-25	2-10
	3-38	Channery loam, loam, channery fine sandy loam.	SC-SM, SM, SC, GM-GC	A-4, A-2-4	0-15	50-95	50-90	40-85	25-49	16-30	2-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gr--------------- Grigsby	0-11	Sandy loam-------	SM, SC-SM	A-2, A-4	0-5	80-100	80-100	50-95	25-50	<20	NP-5
	11-30	Loam, sandy loam, silt loam.	ML, SM, SC, CL	A-2, A-4	0-5	80-100	80-100	70-100	30-70	<25	NP-10
	30-60	Sandy loam, loam, gravelly sandy loam.	SM, SC-SM, ML, GM-GC	A-2, A-1, A-4	0-30	40-100	30-100	25-100	20-70	<20	NP-5
	60-80	Sandy loam, gravelly sandy loam, very gravelly sandy loam.	SM, GM, SC, GC	A-2, A-4, A-1	0-60	40-85	25-75	20-65	15-40	15-32	NP-9
KbD*, KbF*: Kaymine---------	0-8	Very channery loam.	GC, GM	A-2, A-4, A-6	15-30	45-60	40-55	30-50	20-40	25-35	7-12
	8-65	Extremely channery loam, very channery silt loam, very channery loam.	GC, GM	A-2, A-4, A-6	5-30	30-55	25-50	20-45	15-40	25-35	7-12

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
KbD*, KbF*:											
Bethesda--------	0-8	Very channery silt loam.	ML, GM, GM-GC, CL-ML	A-4, A-6	15-30	55-70	55-80	50-80	35-75	25-40	4-14
	8-65	Very channery clay loam, very channery silty clay loam, channery clay loam.	GM-GC, ML, CL, GM	A-4, A-6, A-7, A-2	10-30	45-80	25-65	25-65	20-60	24-50	3-23
Fiveblock-------	0-9	Very channery sandy loam.	SM, SC-SM, GM-GC, GM	A-1, A-2	15-30	55-70	50-65	35-50	10-25	15-25	NP-7
	9-65	Extremely channery sandy loam, very stony sandy loam, very channery sandy loam.	SM, SC-SM, GM-GC, GM	A-1, A-2	5-30	45-65	25-50	15-35	10-20	15-25	NP-7
KfF*:											
Kimper----------	0-6	Fine sandy loam	CL-ML, SM, SM-SC	A-4, A-6	0-5	90-100	90-100	30-70	20-65	22-30	4-10
	6-13	Channery fine sandy loam, channery silt loam, very channery loam.	ML, CL-ML, GM, CL, SM, SM-SC, SC	A-2-4, A-4, A-6	5-20	40-85	40-75	30-70	20-65	27-41	6-18
	13-50	Channery loam, channery silt loam, channery fine sandy loam.	ML, CL-ML, GM, CL, GC	A-2-4, A-4, A-1-b, A-6	5-15	40-85	40-75	30-70	20-65	23-30	3-10
	50-80	Channery sandy loam, loam, silt loam.	ML, CL, CL-ML, GM, SC	A-2-4, A-4, A-1-b, A-6	0-15	45-90	40-85	30-70	20-65	23-30	3-10
Fedscreek-------	0-3	Channery loam----	ML, CL-ML	A-4, A-2	0-10	65-90	60-80	45-80	30-65	16-30	2-10
	3-45	Channery sandy loam, sandy loam, very channery sandy loam.	SC-SM, SM, SC, GM-GC	A-1, A-4, A-2-4	5-20	30-80	35-75	25-65	25-40	16-30	2-10
	45-80	Very flaggy sandy loam, channery sandy loam.	GM, GC	A-2-4, A-4, A-1	5-30	30-80	35-75	25-65	25-40	16-30	2-10
Kn--------------- Knowlton	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	75-100	75-100	70-100	25-40	5-15
	8-19	Loam, silt loam	CL	A-6, A-7	0	100	75-100	75-100	70-100	25-40	5-15
	19-65	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	75-100	75-100	75-100	35-50	20-30
LgD*:											
Latham----------	0-7	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	7-38	Silty clay, silty clay loam, channery silty clay.	CH, CL	A-7	0-10	85-100	70-95	65-95	60-90	45-65	25-40
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
LgD*:											
Gilpin----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-32	Silt loam, channery silty clay loam, loam.	CL, CL-ML	A-4, A-6,	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LsE*:											
Latham----------	0-7	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	7-38	Silty clay, silty clay loam, channery silty clay.	CH, CL	A-7	0-10	85-100	70-95	65-95	60-90	45-65	25-40
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
Shelocta--------	0-8	Silt loam--------	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-90	<35	NP-10
	8-43	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	43-59	Channery silt loam, channery silty clay loam, silt loam.	GM, GC, ML, CL ML-CL	A-4, A-6, A-2, A-1-b	0-15	40-85	35-70	25-70	20-65	20-40	3-20
	59	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gilpin----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-32	Channery silt loam, channery silty clay loam, loam.	CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LyD------------- Lily	0-8	Sandy loam-------	SM	A-4, A-2	0-5	90-100	85-100	55-80	25-50	<20	NP-4
	8-22	Channery loam, sandy clay loam, loam.	SM, SC, ML, CL	A-4, A-6	0-10	80-100	70-100	65-95	35-75	<35	3-15
	22-38	Sandy clay loam, channery loam, channery sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6, A-1-b	0-10	65-100	50-100	40-95	20-75	<35	3-15
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MgE*:											
Marrowbone------	0-3	Loam-------------	SC-SM, SM, SC, GM	A-4	0-5	75-95	70-90	60-85	35-49	16-25	2-10
	3-27	Channery loam, loam, channery fine sandy loam.	SC-SM, SM, SC, GM-GC	A-4, A-2-4	0-15	50-95	50-90	40-85	25-49	16-30	2-10
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MgE*:											
Gilpin----------	0-5	Channery silt loam.	CL, CL-ML	A-4, A-6	0-25	50-90	45-85	35-75	30-70	20-40	4-15
	5-18	Silt loam, channery silty clay loam, loam.	GC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	18-30	Channery silt loam, very channery silt loam, silty clay loam.	GC, GM-GC, CL, ML-CL, CH, MH	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Latham----------	0-7	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	7-38	Silty clay, silty clay loam, channery silty clay.	CH, CL	A-7	0-10	85-100	70-95	65-95	60-90	45-65	25-40
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mo--------------- Morehead	0-9	Silt loam--------	ML	A-4	0	95-100	95-100	90-100	80-100	25-35	2-10
	9-30	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	75-100	25-40	5-20
	30-65	Silt loam, loam.	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	70-100	60-95	20-40	2-20
Or--------------- Orrville	0-9	Loam-------------	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	20-35	3-10
	9-48	Silt loam, loam, sandy loam.	CL, CL-ML, ML, SM	A-4, A-6	0-2	95-100	75-100	70-95	50-90	20-40	2-16
	48-65	Stratified sandy loam, silt loam, loam.	ML, CL, SM, SC CL-ML	A-4, A-2, A-1	0-2	95-100	65-100	40-85	15-75	15-35	NP-10
Oy*:											
Orrville--------	0-7	Silt loam--------	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	20-35	3-10
	7-29	Silt loam, loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0-2	95-100	75-100	70-95	50-90	20-40	2-16
	29-65	Stratified sandy loam, silt loam, loam.	ML, CL, SM, SC, CL-ML	A-4, A-2, A-1	0-2	95-100	65-100	40-85	15-75	15-35	NP-10
Grigsby---------	0-11	Sandy loam-------	SM, SC-SM	A-2, A-4	0-5	80-100	80-100	50-95	25-50	<20	NP-5
	11-30	Loam, sandy loam, silt loam.	ML, SM, SC, CL	A-2, A-4	0-5	80-100	80-100	70-100	30-70	<25	NP-10
	30-60	Sandy loam, loam, gravelly sandy loam.	SM, SC-SM, ML, GM-GC	A-2, A-1, A-4	0-30	40-100	30-100	25-100	20-70	<20	NP-5
	60-80	Sandy loam, gravelly sandy loam, very gravelly sandy loam.	SM, GM, SC, GC	A-2, A-4, A-1	0-60	45-85	25-75	20-65	15-40	15-32	NP-9
Pe*. Pits, quarries											

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Po---------------- Pope	0-8	Loam-------------	ML, CL, SM, CL-ML	A-4	0	85-100	80-100	70-100	45-90	<30	NP-10
	8-45	Silt loam, sandy loam, loam.	SM, SC-SM, ML, CL-ML	A-2, A-4	0	95-100	80-100	51-95	25-75	<30	NP-7
	45-65	Sandy loam, loamy sand.	SM, SC-SM, ML, GM	A-2, A-1, A-4	0-20	45-100	35-100	30-95	15-70	<30	NP-7
RgC*: Rayne-----------	0-11	Silt loam--------	ML, CL	A-4	0-5	85-100	80-100	70-85	60-80	---	---
	11-40	Loam, channery silty clay loam, channery silt loam.	GM, ML, GC, CL	A-4, A-6, A-2	0-15	60-95	55-85	40-85	30-60	20-40	2-15
	40-48	Channery loam, channery silt loam, very channery silty clay loam.	SM, ML, GM, GP-GM	A-4, A-2, A-1	0-35	40-90	15-80	15-75	10-60	20-35	NP-10
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilpin----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-32	Channery silt loam, channery silty clay loam, loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32-38	Weathered bedrock									
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RlF*: Rigley----------	0-8	Sandy loam-------	SM, SC-SM	A-2, A-4	0-10	80-95	75-90	55-80	25-65	<30	NP-7
	8-45	Sandy loam, loam	SM, ML, GM, GM-GC ML-CL	A-2, A-4, A-1	0-10	65-95	60-90	40-75	20-60	<30	NP-7
	45-68	Very channery sandy loam, channery loam, channery clay loam.	GM, GC, SM, SC, CL, ML	A-2, A-1, A-4, A-6	0-20	55-80	45-70	30-60	15-50	<35	NP-15
	68	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
RnD*: Riney-----------	0-7	Loam-------------	CL, ML,	A-4	0	90-100	85-100	65-80	35-75	10-30	NP-10
	7-45	Clay loam, sandy clay loam, loam.	ML, CL, SC, SC-SM	A-6, A-2, A-4	0	80-100	70-100	70-85	25-75	20-35	2-15
	45-65	Sandy loam, sandy clay loam, loamy sand.	SC, SM, ML, CL	A-4, A-6, A-2, A-1	0	80-100	70-100	40-80	15-55	0-35	NP-15
Ezel------------	0-11	Loam-------------	ML, CL	A-4	0	90-100	80-100	80-100	55-95	<35	NP-10
	11-47	Loam, sandy clay loam, silt loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	80-100	55-95	35-80	<35	NP-15
	47-53	Sandy loam, sandy clay loam, loam.	SM, GC, ML, CL	A-4, A-6, A-2, A-1	0-5	65-100	55-100	35-95	20-75	<35	NP-15
	53	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
RoB: Rowdy	0-8	Loam	ML, CL, SM	A-4	0	80-100	80-100	70-100	40-75	<30	NP-10
	8-15	Loam, channery loam, silt loam.	ML, CL, GM, ML-CL	A-4, A-6, A-2	0-5	60-100	60-100	50-100	25-75	<30	NP-15
	15-65	Loam, clay loam, silt loam.	ML, CL, ML-CL	A-4, A-2, A-6, A-1-b	0-25	30-100	30-100	25-100	20-75	<30	NP-15
RyB*: Rowdy	0-8	Loam	ML, CL, SM	A-4	0	80-100	80-100	70-100	40-75	<30	NP-10
	8-15	Loam, channery loam, silt loam.	ML, CL, GM, ML-CL	A-4, A-6,	0-5	60-100	60-100	50-100	25-75	<30	NP-15
	15-65	Loam, clay loam, silt loam.	ML, CL, ML-SC	A-4, A-6, A-1-b	0-25	30-100	30-100	25-100	20-75	<30	NP-15
Grigsby	0-11	Sandy loam	SM, SC-SM	A-2, A-4	0-5	80-100	80-100	50-95	25-50	<20	NP-5
	11-30	Loam, sandy loam, silt loam.	ML, SM, SC, CL	A-2, A-4	0-5	80-100	80-100	70-100	30-70	<25	NP-10
	30-80	Sandy loam, loam, gravelly sandy loam.	SM, SC-SM, ML, GM-GC	A-2, A-1, A-4	0-30	40-100	30-100	25-100	20-70	<20	NP-5
Barbourville	0-11	Loam	ML, CL-ML	A-4	0-5	95-100	80-95	75-90	50-85	<30	NP-7
	11-41	Channery loam, channery sandy loam.	SC, CL, SM, ML	A-2, A-4, A-6	0-15	60-95	60-90	45-80	25-70	20-35	2-15
	41-65	Channery sandy loam, loam, channery loam.	ML, CL-ML SC, CL, SM, ML	A-4, A-2, A-6	0-15	60-95	60-90	45-80	25-70	20-35	2-15
ShC, ShD: Shelocta	0-8	Silt loam	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-90	<35	NP-10
	8-20	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	20-59	Channery silt loam, channery silty clay loam, silt loam.	GM, GC, ML, CL, CL-ML	A-4, A-6, A-2, A-1-b	0-15	40-85	35-70	25-70	20-65	20-40	3-20
	59	Weathered bedrock	---	---	---	---	---	---	---	---	---
SlF*: Shelocta	0-8	Silt loam	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-90	<35	NP-10
	8-20	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	20-59	Channery silt loam, channery silty clay loam, clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-b	0-15	40-85	35-70	25-70	20-65	20-40	3-20
	59	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gilpin	0-6	Silt loam	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-32	Channery loam, channery silty clay loam, loam.	GC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
SpF*:											
Shelocta--------	0-9	Loam-------------	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-90	<35	NP-10
	9-42	Silt loam, channery silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	42-59	Channery loam, channery silty clay loam, very channery clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-b	0-15	40-85	35-70	25-70	20-65	20-40	3-20
	59	Weathered bedrock	---	---	---	---	---	---	---	---	---
Helechawa-------	0-4	Sandy loam-------	SM, SC-SM, SC	A-2, A-4	0-10	85-100	85-100	70-90	25-45	<20	NP-10
	4-31	Sandy loam, channery sandy loam, silt loam.	SM, SC-SM, SC, ML, CL	A-2, A-4	0-5	85-100	85-100	70-90	25-45	<30	NP-10
	31-65	Very channery sandy loam, channery sandy loam, very channery loam.	SM, SC-SM, SC	A-2	0-10	85-100	70-95	70-90	15-30	<20	NP-10
Hazleton--------	0-9	Loam-------------	ML	A-4	0-5	90-100	90-100	75-90	65-70	---	---
	9-31	Channery sandy loam, channery loam, very channery loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	31-48	Very channery loam, very channery sandy loam, extremely channery loam.	GM, SM, SC, GC	A-2, A-1, A-4	0-60	55-80	35-75	25-65	15-50	<30	NP-8
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ur*. Udorthents, loamy											
W*. Water											
WhA-------------- Whitley	0-6	Silt loam--------	ML, CL	A-4	0	95-100	90-100	75-100	60-95	<35	NP-10
	6-15	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	95-100	90-100	85-100	70-100	20-40	5-20
	15-57	Silt loam, silty clay loam, loam.	ML, CL, ML-CL	A-6, A-4	0	75-100	50-100	45-95	36-90	20-40	2-20
	57-80	Silty clay loam, silt loam, loam.	CL, ML, ML-CL, CH, MH	A-4, A-1-b, A-6, A-7	0-25	45-100	35-100	30-95	15-80	<30	NP-15

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 15.--Physical and Chemical Properties of the Soils

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
AbB, AbC---------Allegheny	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.22	3.6-5.5	Low----------	0.32	5	2-4
	8-53	18-35	1.20-1.50	0.6-2.0	0.13-0.18	3.6-5.5	Low----------	0.28		
	53-62	10-35	1.20-1.40	0.6-2.0	0.08-0.17	3.6-5.5	Low----------	0.28		
	62	---	---	---	---	---	-------------	----		
ArF*:										
Alticrest--------	0-9	8-18	1.40-1.55	2.0-6.0	0.12-0.18	4.5-5.5	Low----------	0.24	2	1-2
	9-22	8-18	1.40-1.55	2.0-6.0	0.10-0.16	4.5-5.5	Low----------	0.20		
	22-38	3-10	1.40-1.60	2.0-6.0	0.04-0.10	4.5-5.5	Low----------	0.20		
	38	---	---	---	---	---	-------------	----		
Ramsey----------	0-4	8-25	1.25-1.50	2.0-6.0	0.09-0.12	4.5-5.5	Low----------	0.20	1	1-2
	4-18	8-25	1.20-1.40	2.0-6.0	0.09-0.12	4.5-5.5	Low----------	0.17		
	18	---	---	---	---	---	-------------	----		
BcF*:										
Berks-----------	0-5	5-23	1.20-1.50	0.6-6.0	0.08-0.12	3.6-6.5	Low----------	0.17	3-2	.5-2
	5-20	5-32	1.20-1.60	2.0-6.0	0.04-0.10	3.6-6.5	Low----------	0.17		
	20-33	5-20	1.20-1.60	2.0-6.0	0.04-0.10	3.6-6.5	Low----------	0.17		
	33-38	---	---	---	---	---	-------------	----		
	38	---	---	---	---	---	-------------	----		
Cranston--------	0-8	12-18	1.20-1.40	2.0-6.0	0.12-0.20	3.6-7.3	Low----------	0.28	4	.5-2
	8-50	12-18	1.20-1.40	2.0-6.0	0.14-0.19	3.6-5.5	Low----------	0.28		
	50-62	12-18	1.30-1.50	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28		
BdF--------------Bledsoe	0-5	15-30	1.20-1.50	0.6-2.0	0.16-0.21	5.6-7.8	Low----------	0.37	5	2-4
	5-41	35-50	1.30-1.60	0.2-0.6	0.12-0.19	5.6-7.8	Moderate-----	0.32		
	41-80	30-60	1.35-1.60	0.06-0.6	0.12-0.19	5.6-7.8	Moderate-----	0.32		
BeE*:										
Bledsoe---------	0-8	15-30	1.20-1.50	0.6-2.0	0.16-0.21	5.6-7.8	Low----------	0.37	5	2-4
	8-28	35-50	1.30-1.60	0.2-0.6	0.12-0.19	5.6-7.8	Moderate-----	0.32		
	28-63	30-60	1.35-1.60	0.06-0.6	0.12-0.19	5.6-7.8	Moderate-----	0.32		
	63	---	---	---	---	---	-------------	----		
Donahue---------	0-7	7-20	1.20-1.40	2.0-6.0	0.10-0.16	4.5-5.5	Low----------	0.32	2	.5-2
	7-13	20-40	1.20-1.40	0.2-0.6	0.10-0.16	4.5-5.5	Low----------	0.28		
	13-33	35-60	1.30-1.55	0.2-0.6	0.12-0.17	5.1-7.8	Moderate-----	0.28		
	33-39	---	---	---	---	---	-------------	----		
	39	---	---	---	---	---	-------------	----		
Rock outcrop.										
CoB--------------Cotaco	0-11	7-27	1.20-1.40	0.6-6.0	0.12-0.20	3.6-5.5	Low----------	0.37	3	2-4
	11-35	18-35	1.20-1.50	0.6-2.0	0.07-0.15	3.6-5.5	Low----------	0.28		
	35-65	18-35	1.20-1.50	0.6-2.0	0.07-0.15	3.6-5.5	Low----------	0.28		
DgF*:										
Dekalb----------	0-6	10-20	1.20-1.50	6.0-20	0.08-0.12	3.6-6.5	Low----------	0.17	2	.5-2
	6-29	7-18	1.20-1.50	6.0-20	0.06-0.12	3.6-5.5	Low----------	0.17		
	29-32	5-15	1.20-1.50	>6.0	0.05-0.10	3.6-5.5	Low----------	0.17		
	32	---	---	---	---	---	-------------	----		

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
DgF*:										
Gilpin----------	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3-2	2-4
	5-18	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	18-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	30	---	---	---	---	---	-------------	----		
Marrowbone------	0-3	5-18	1.20-1.60	2.0-6.0	0.10-0.18	3.6-6.5	Low----------	0.24	2	.5-2
	3-27	5-27	1.20-1.70	2.0-6.0	0.08-0.16	3.6-6.0	Low----------	0.17		
	27	---	---	---	---	---	-------------	----		
Dm.										
Dumps, coal										
EgB*, EgC*:										
Ezel------------	0-11	15-27	1.20-1.40	0.6-2.0	0.12-0.22	5.1-7.3	Low----------	0.32	3	2-4
	11-47	18-35	1.20-1.50	0.6-2.0	0.13-0.18	3.5-5.5	Low----------	0.28		
	47-53	10-35	1.20-1.40	0.6-2.0	0.08-0.17	3.5-5.5	Low----------	0.28		
	53	---	---	---	---	---	-------------	----		
Gilpin----------	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3-2	2-4
	6-32	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	32-38	---	---	---	---	---	-------------	----		
	38	---	---	---	---	---	-------------	----		
GlC, GlD--------- Gilpin	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3-2	2-4
	6-32	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	32-38	---	---	---	---	---	-------------	----		
	38	---	---	---	---	---	-------------	----		
Gnf*:										
Gilpin----------	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3-2	2-4
	5-18	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	18-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	30	---	---	---	---	---	-------------	----		
Latham----------	0-7	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-2
	7-38	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	38	---	---	---	---	---	-------------	----		
Marrowbone------	0-3	5-18	1.20-1.60	2.0-6.0	0.10-0.18	3.6-6.5	Low----------	0.24	2	.5-2
	3-38	5-27	1.20-1.70	2.0-6.0	0.08-0.16	3.6-6.0	Low----------	0.17		
	38	---	---	---	---	---	-------------	----		
Gr-------------- Grigsby	0-11	5-10	1.20-1.50	2.0-6.0	0.08-0.14	5.6-7.3	Low----------	0.28	5	2-4
	11-30	5-18	1.20-1.50	2.0-6.0	0.10-0.20	5.6-7.3	Low----------	0.28		
	30-60	5-10	1.20-1.50	2.0-6.0	0.03-0.16	5.1-7.3	Low----------	0.28		
	60-80	5-10	1.20-1.50	2.0-6.0	0.03-0.16	5.1-7.3	Low----------	0.28		
KbD*, KbF*:										
Kaymine---------	0-8	18-27	1.35-1.65	0.6-2.0	0.07-0.16	5.6-7.8	Low----------	0.32	5	<.5
	8-65	18-27	1.35-1.65	0.6-2.0	0.07-0.16	5.6-7.8	Low----------	0.32		
Bethesda--------	0-8	18-27	1.40-1.55	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.28	5	<.5
	8-65	18-35	1.60-1.90	0.2-0.6	0.04-0.10	3.6-5.5	Low----------	0.32		
Fiveblock-------	0-9	5-18	1.35-1.65	2.0-6.0	0.05-0.12	5.6-7.8	Low----------	0.32	5	<.5
	9-65	5-18	1.35-1.65	2.0-6.0	0.05-0.12	5.6-7.8	Low----------	0.32		

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
KfF*:										
Kimper----------	0-6	12-27	1.15-1.30	2.0-6.0	0.15-0.22	4.1-7.3	Low----------	0.32	3	4-15
	6-13	18-30	1.20-1.70	2.0-6.0	0.13-0.20	4.5-6.0	Low----------	0.17		
	13-50	12-20	1.20-1.70	2.0-6.0	0.10-0.16	4.5-6.0	Low----------	0.17		
	50-80	12-30	1.20-1.70	2.0-6.0	0.10-0.16	4.5-6.0	Low----------	0.17		
Fedscreek-------	0-3	5-18	1.00-1.60	2.0-6.0	0.12-0.22	4.5-6.5	Low----------	0.24	3	2-4
	3-45	5-27	1.20-1.70	2.0-6.0	0.10-0.18	4.5-6.0	Low----------	0.17		
	45-80	5-27	1.20-1.70	0.6-6.0	0.10-0.18	4.5-6.0	Low----------	0.17		
Kn--------------- Knowlton	0-8	10-26	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.43	5	1-2
	8-19	10-26	1.30-1.45	0.6-2.0	0.20-0.24	4.5-6.0	Low----------	0.43		
	19-65	18-34	1.40-1.60	0.06-0.2	0.18-0.20	4.5-6.0	Moderate-----	0.43		
LgD*:										
Latham----------	0-7	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-2
	7-38	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	38	---	---	---	---	---	-------------	----		
Gilpin----------	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3-2	2-4
	6-32	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	32-38	---	---	---	---	---	-------------	----		
	38	---	---	---	---	---	-------------	----		
LsE*:										
Latham----------	0-7	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-2
	7-38	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	38	---	---	---	---	---	-------------	----		
Shelocta--------	0-8	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low----------	0.32	3	2-4
	8-43	18-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	43-59	15-34	1.30-1.55	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.17		
	59	---	---	---	---	---	-------------	----		
Gilpin----------	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3-2	2-4
	6-32	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	32-38	---	---	---	---	---	-------------	----		
	38	---	---	---	---	---	-------------	----		
LyD-------------- Lily	0-8	5-20	1.20-1.40	2.0-6.0	0.09-0.16	3.6-5.5	Low----------	0.28	2	2-4
	8-22	18-35	1.25-1.35	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28		
	22-38	20-35	1.25-1.35	2.0-6.0	0.08-0.17	3.6-5.5	Low----------	0.17		
	38	---	---	---	---	---	-------------	----		
MgE*:										
Marrowbone------	0-3	5-18	1.20-1.60	2.0-6.0	0.10-0.18	3.6-6.5	Low----------	0.24	2	.5-2
	3-27	5-27	1.20-1.70	2.0-6.0	0.08-0.16	3.6-6.0	Low----------	0.17		
	27	---	---	---	---	---	-------------	----		
Gilpin----------	0-5	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3-2	2-4
	5-18	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	18-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	3.6-5.5	Low----------	0.24		
	30	---	---	---	---	---	-------------	----		
Latham----------	0-7	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-2
	7-38	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	38	---	---	---	---	---	-------------	----		
Mo--------------- Morehead	0-9	12-27	1.20-1.50	0.6-2.0	0.19-0.23	4.5-5.5	Low----------	0.37	4	2-4
	9-30	18-35	1.20-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.43		
	30-65	7-40	1.20-1.50	0.6-2.0	0.15-0.22	4.5-5.5	Low----------	0.43		

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
Or----------------	0-9	12-27	1.25-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.37	5	2-4
Orrville	9-48	18-30	1.30-1.50	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.37		
	48-65	10-25	1.20-1.40	0.6-6.0	0.08-0.15	5.1-7.3	Low----------	0.37		
Oy*:										
Orrville--------	0-7	12-27	1.25-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.37	5	2-4
	7-29	18-30	1.30-1.50	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.37		
	29-65	10-25	1.20-1.40	0.6-6.0	0.08-0.15	5.1-7.3	Low----------	0.37		
Grigsby---------	0-11	5-10	1.20-1.50	2.0-6.0	0.08-0.14	5.6-7.3	Low----------	0.28	5	2-4
	11-30	5-18	1.20-1.50	2.0-6.0	0.10-0.20	5.6-7.3	Low----------	0.28		
	30-60	5-10	1.20-1.50	2.0-6.0	0.03-0.16	5.1-7.3	Low----------	0.28		
	60-80	5-10	1.20-1.50	6.0-20	0.03-0.16	5.1-7.3	Low----------	0.28		
Pe*.										
Pits, quarries										
Po---------------	0-8	5-15	1.20-1.40	2.0-6.0	0.14-0.23	3.6-5.5	Low----------	0.37	5	2-4
Pope	8-45	5-18	1.30-1.60	2.0-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
	45-65	5-20	1.30-1.60	2.0-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
RgC*:										
Rayne-----------	0-11	10-27	1.20-1.40	0.6-2.0	0.14-0.18	4.5-5.5	Low----------	0.28	4-3	2-4
	11-40	18-35	1.40-1.60	0.6-2.0	0.12-0.16	4.5-5.5	Low----------	0.20		
	40-48	10-30	1.40-1.60	0.6-2.0	0.10-0.16	4.5-5.5	Low----------	0.20		
	48	---	---	---	---	---	-------------	----		
Gilpin----------	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.32	3-2	2-4
	6-32	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	32-38	---	---	---	---	---	-------------	----		
	38	---	---	---	---	---	-------------	----		
RlF*:										
Rigley----------	0-8	7-18	1.20-1.40	2.0-6.0	0.09-0.15	4.5-7.3	Low----------	0.24	4	2-4
	8-45	7-18	1.30-1.60	2.0-6.0	0.09-0.15	3.6-5.5	Low----------	0.17		
	45-68	7-40	1.30-1.60	2.0-6.0	0.07-0.15	3.6-5.5	Low----------	0.17		
	68	---	---	---	---	---	-------------	----		
Rock outcrop.										
RnD*:										
Riney-----------	0-7	10-25	1.20-1.40	2.0-6.0	0.12-0.18	4.5-7.3	Low----------	0.28	4-3	.5-2
	7-45	20-35	1.20-1.50	2.0-6.0	0.13-0.17	4.5-5.5	Low----------	0.28		
	45-65	10-35	1.20-1.50	2.0-6.0	0.05-0.14	4.5-5.5	Low----------	0.28		
Ezel------------	0-11	15-27	1.20-1.40	0.6-2.0	0.12-0.22	5.1-7.3	Low----------	0.32	3	2-4
	11-47	18-35	1.20-1.50	0.6-2.0	0.13-0.18	3.5-5.5	Low----------	0.28		
	47-53	10-35	1.20-1.40	0.6-2.0	0.08-0.17	3.5-5.5	Low----------	0.28		
	53	---	---	---	---	---	-------------	----		
RoB-------------	0-8	10-25	1.20-1.40	0.6-2.0	0.11-0.21	4.5-7.3	Low----------	0.32	5	2-4
Rowdy	8-15	18-30	1.20-1.50	0.6-2.0	0.09-0.21	4.5-6.0	Low----------	0.28		
	15-65	10-30	1.20-1.50	0.6-2.0	0.07-0.18	4.5-6.0	Low----------	0.28		
RyB*:										
Rowdy-----------	0-8	10-25	1.20-1.40	0.6-2.0	0.11-0.21	4.5-7.3	Low----------	0.32	5	2-4
	8-15	18-30	1.20-1.50	0.6-2.0	0.09-0.21	4.5-6.0	Low----------	0.28		
	15-65	10-30	1.20-1.50	0.6-2.0	0.07-0.18	4.5-6.0	Low----------	0.28		

See footnote at end of table.

Table 15.--Physical and Chemical Properties of the Soils--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
RyB*:										
Grigsby	0-11	5-10	1.20-1.50	2.0-6.0	0.08-0.14	5.6-7.3	Low	0.28	5	2-4
	11-30	5-18	1.20-1.50	2.0-6.0	0.10-0.20	5.6-7.3	Low	0.28		
	30-80	5-10	1.20-1.50	2.0-6.0	0.03-0.16	5.1-7.3	Low	0.28		
Barbourville	0-11	10-27	1.20-1.40	2.0-6.0	0.10-0.18	4.5-7.3	Low	0.28	4	4-6
	11-41	10-20	1.40-1.60	2.0-6.0	0.10-0.18	4.5-6.0	Low	0.17		
	41-65	10-20	1.40-1.60	2.0-6.0	0.10-0.18	4.5-6.0	Low	0.17		
ShC, ShD Shelocta	0-8	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low	0.32	3	2-4
	8-20	18-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low	0.28		
	20-59	15-34	1.30-1.55	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17		
	59	---	---	---	---	---	---	----		
SlF*:										
Shelocta	0-8	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low	0.32	3	2-4
	8-20	18-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low	0.28		
	20-59	15-34	1.30-1.55	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17		
	59	---	---	---	---	---	---	----		
Gilpin	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3-2	2-4
	6-32	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low	0.24		
	32-38	---	---	---	---	---	---	----		
	38	---	---	---	---	---	---	----		
SpF*:										
Shelocta	0-9	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low	0.32	3	2-4
	9-42	18-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low	0.28		
	42-59	15-34	1.30-1.55	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17		
	59	---	---	---	---	---	---	----		
Helechawa	0-4	4-15	1.10-1.40	2.0-6.0	0.10-0.18	3.6-6.5	Low	0.15	3	2-4
	4-31	7-18	1.35-1.70	2.0-6.0	0.08-0.14	3.6-5.5	Low	----		
	31-65	5-15	1.50-1.70	2.0-6.0	0.08-0.13	3.6-5.5	Low	----		
Hazleton	0-9	7-18	1.20-1.40	2.0-6.0	0.12-0.16	3.6-5.5	Low	0.17	5	2-4
	9-31	7-18	1.20-1.40	2.0-6.0	0.08-0.12	3.6-5.5	Low	0.15		
	31-48	5-15	1.20-1.40	2.0-6.0	0.06-0.12	3.6-5.5	Low	0.15		
	48	---	---	---	---	---	---	----		
Ur*. Udorthents, loamy										
W*. Water										
WhA Whitley	0-6	7-27	1.20-1.40	0.6-2.0	0.16-0.23	4.5-5.5	Low	0.37	4	4-6
	6-15	18-35	1.30-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.37		
	15-57	12-35	1.30-1.50	0.6-2.0	0.10-0.18	4.5-5.5	Low	0.32		
	57-80	5-30	1.30-1.50	0.6-2.0	0.05-0.18	4.5-5.5	Low	0.28		

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 16.--Soil and Water Features

("Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
AbB, AbC----------- Allegheny	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
ArF*:											
Alticrest--------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High.
Ramsey-----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
BcF*:											
Berks------------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High.
Cranston---------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
BdF--------------- Bledsoe	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
BeE*:											
Bledsoe----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Donahue----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	High.
Rock outcrop.											
CoB--------------- Cotaco	C	None--------	---	---	1.5-2.5	Apparent	Nov-May	>60	---	Moderate	High.
DgF*:											
Dekalb-----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High.
Gilpin-----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High.
Marrowbone-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Moderate.
Dm*. Dumps, coal											
EgB*, EgC*:											
Ezel-------------	B	None--------	---	---	>6.0	---	---	40-60	Hard	Low------	High.
Gilpin-----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High.
GlC, GlD---------- Gilpin	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High.
GnF*:											
Gilpin-----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High.
Latham-----------	D	None--------	---	---	1.5-3.0	Apparent	Jan-Apr	20-40	Soft	High-----	High.
Marrowbone-------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	Moderate.
Gr---------------- Grigsby	B	Occasional	Very brief or brief.	Dec-May	3.5-6.0	Apparent	Jan-Apr	>60	---	Low------	Low.

See footnote at end of table.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hard-ness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
KbD*, KbF*:											
Kaymine	C	None	---	---	>6.0	---	---	>60	---	Low	Low.
Bethesda	C	None	---	---	>6.0	---	---	>60	---	Moderate	High.
Fiveblock	C	None	---	---	>6.0	---	---	>60	---	Low	Low.
KfF*:											
Kimper	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
Fedscreek	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
Kn Knowlton	C	Rare	---	---	0-1.0	Apparent	Dec-May	>60	---	High	High.
LgD*:											
Latham	D	None	---	---	1.5-3.0	Apparent	Jan-Apr	20-40	Soft	High	High.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High.
LsE*:											
Latham	D	None	---	---	1.5-3.0	Apparent	Jan-Apr	20-40	Soft	High	High.
Shelocta	B	None	---	---	>6.0	---	---	40-60	Soft	Low	High.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High.
LyD Lily	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High.
MgE*:											
Marrowbone	C	None	---	---	>6.0	---	---	20-40	Hard	Low	Moderate.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High.
Latham	D	None	---	---	1.5-3.0	Apparent	Jan-Apr	20-40	Soft	High	High.
Mo Morehead	C	Rare	---	---	1.0-2.0	Apparent	Dec-Apr	>60	---	Moderate	High.
Or Orrville	C	Frequent	Very brief or brief.	Nov-May	1.0-2.0	Apparent	Nov-Jun	>60	---	High	Moderate.
Oy*:											
Orrville	C	Frequent	Very brief or brief.	Nov-May	1.0-2.0	Apparent	Nov-Jun	>60	---	High	Moderate.
Grigsby	B	Frequent	Very brief or brief.	Dec-May	3.5-6.0	Apparent	Jan-Apr	>60	---	Low	Low.
Pe*. Pits, quarries											
Po Pope	B	Frequent	Very brief or brief.	Nov-Apr	>6.0	---	---	>60	---	Low	High.
RgC*:											
Rayne	B	None	---	---	>6.0	---	---	40-60	Soft	Low	High.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High.

See footnote at end of table.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
RlF*:											
Rigley-----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
Rock outcrop.											
RnD*:											
Riney-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
Ezel------------	B	None--------	---	---	>6.0	---	---	40-60	Hard	Low------	High.
RoB--------------- Rowdy	B	Occasional	Brief-----	Jan-Apr	3.5-6.0	Apparent	Jan-Apr	>60	---	Moderate	Moderate.
RyB*:											
Rowdy-----------	B	Occasional	Brief-----	Jan-Apr	3.5-6.0	Apparent	Jan-Apr	>60	---	Moderate	Moderate.
Grigsby----------	B	Occasional	Very brief or brief.	Dec-May	3.5-6.0	Apparent	Jan-Apr	>60	---	Low------	Low.
Barbourville-----	B	Rare--------	---	---	>6.0	---	---	>40	Soft	Low------	Moderate.
ShC, ShD---------- Shelocta	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	High.
SlF*:											
Shelocta---------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	High.
Gilpin-----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High.
SpF*:											
Shelocta---------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	High.
Helechawa--------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
Hazleton---------	B	None--------	---	---	>6.0	---	---	40-60	Hard	Low------	High.
Ur*. Udorthents, loamy											
W*. Water											
WhA--------------- Whitley	B	Occasional	Brief-----	Jan-Apr	>6.0	---	---	>60	---	Moderate	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 17.--Physical Analyses of Selected Soils

(The symbol < means less than; > means more than. The pedons for the soils listed are typical of the series as they occur in the survey area. For the location of the pedons, see "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station, Lexington, Kentucky)

Soil name, sample number, horizon, and depth in inches	Total			Particle size distribution					
				Sand					
	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Textural class*
	Pct <2mm								
Barbourville loam**: 91-KY-175-14									
Ap ------ 0-11	42.7	35.9	21.4	4.4	3.6	8.3	16.1	10.3	l
Bw1 ----- 11-19	55.4	27.9	16.7	5.7	4.9	12.9	21.7	10.2	sl
Bw2 ----- 19-30	47.1	35.5	17.4	2.2	3.5	10.4	19.9	11.1	l
BC ------ 30-41	51.7	32.1	16.2	2.1	2.9	10.1	22.5	14.1	l
C ------- 41-65	54.3	29.5	16.2	4.3	4.6	13.0	21.1	11.3	sl
Helechawa sandy loam: 91-KY-175-12									
A ------- 0-4	64.5	21.6	13.9	1.5	7.9	29.4	19.0	6.7	sl
BA ------ 4-8	61.4	23.2	15.4	1.2	5.5	28.2	19.1	7.4	sl
Bw1 ----- 8-20	58.8	25.1	16.1	1.2	5.9	27.1	17.6	7.0	sl
Bw2 ----- 20-31	58.7	24.4	16.9	1.7	6.5	26.2	17.3	7.0	sl
Bw3 ----- 31-46	63.3	21.1	15.6	4.2	8.3	27.2	17.0	6.6	sl
BC ------ 46-65	70.2	17.2	12.6	4.8	8.7	27.5	20.8	8.4	sl
Kimper fine sandy loam**: 91-KY-153-7									
A ------- 0-6	63.9	24.0	12.1	1.6	4.3	21.0	27.4	9.6	fsl
BA ------ 6-13	58.9	28.4	12.7	1.0	4.1	20.6	24.4	8.8	fsl
Bt1 ----- 13-25	54.6	28.7	16.7	2.7	5.8	18.4	20.2	7.5	fsl
Bt2 ----- 25-42	50.7	34.0	15.3	2.4	6.2	17.6	17.4	7.1	l
Bt3 ----- 42-50	54.1	31.6	14.3	3.4	7.4	18.8	17.4	7.1	fsl
BC ------ 50-80	63.4	20.7	15.9	2.7	9.7	28.1	16.3	6.6	sl
Shelocta loam: 91-KY-153-9									
A ------- 0-4	50.0	37.7	12.3	6.6	9.9	15.8	11.3	6.4	l
Bt1 ----- 9-15	36.7	44.3	19.0	5.3	6.1	12.1	8.7	4.5	l
Bt1 ----- 15-24	30.3	46.5	23.5	3.9	5.3	8.7	6.9	5.2	l

* The letters sl mean sandy loam; fsl, fine sandy loam; and l, loam.

** This pedon is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

Table 18.--Chemical Analyses of Selected Soils

(The pedons for the soils listed are typical of the series as they occur in the survey area. For the location of the pedons, see the section "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station, Lexington, Kentucky)

Soil name, sample number, horizon, and depth in inches	Soil reaction (H_2O 1:1)	Extractable cations					Cation-exchange capacity		Extractable acidity	Base saturation		Organic matter	Calcium carbonate equivalent	Phosphorus	Potassium
		Ca	Mg	K	Na	Total (TEC)	Ammonium acetate	Sum of cations		Ammonium acetate	Sum of cations				
	pH	--------Milliequivalents per 100 grams of soil---------								Pct	Pct	Pct	Pct	pp/m	pp/m
Barbourville loam*:															
91-KY-175-14															
Ap ----- 0 to 11	5.89	5.33	0.16	0.11	0.02	5.62	9.56	10.90	5.28	59	51	3.99	0.11	48.5	52.5
Bw1 ---- 11 to 19	5.91	2.68	0.23	0.08	0.02	3.01	4.67	5.51	2.50	64	55	1.34	0.06	37.0	3.5
Bw2 ---- 19 to 30	5.49	2.02	0.27	0.08	0.03	2.40	4.98	6.61	4.21	48	36	1.31	0.06	39.5	2.0
BC ----- 30 to 41	5.06	1.12	0.39	0.08	0.03	1.62	4.46	6.33	4.71	36	26	0.91	0.18	35.0	2.0
C ------ 41 to 65	5.22	1.27	0.70	0.09	0.03	2.09	5.34	6.16	4.07	39	34	0.92	0.04	45.0	1.5
Helechawa sandy loam:															
91-KY-175-12															
A ------ 0 to 4	4.96	0.67	0.31	0.24	0.01	1.23	6.81	9.76	8.53	18	13	4.68	0.09	76.5	5.6
BA ----- 4 to 8	4.77	0.12	0.03	0.12	0.02	0.29	3.55	4.61	4.32	8	6	2.03	0.14	47.0	2.5
Bw1 ---- 8 to 20	4.63	0.06	0.06	0.09	0.01	0.22	3.00	4.88	4.71	6	3	0.78	0.05	40.5	2.0
Bw2 ---- 20 to 31	4.50	0.07	0.07	0.09	0.02	0.25	3.30	4.91	4.71	6	4	1.00	0.11	41.0	1.5
Bw3 ---- 31 to 46	4.61	0.12	0.12	0.08	0.01	0.33	3.05	3.09	2.78	10	10	0.78	0.05	37.0	1.0
BC ----- 46 to 65	5.01	0.18	0.18	0.05	0.01	0.42	2.22	1.36	0.82	24	40	0.60	0.12	28.5	1.0
Kimper fine sandy loam*:															
91-KY-153-7															
A ------ 0 to 6	5.12	1.08	0.36	0.27	0.03	1.74	12.16	8.42	10.42	21	14	5.56	0.09	3.5	91.0
BA ----- 6 to 13	5.07	0.37	0.17	0.14	0.01	0.69	7.61	4.58	6.92	15	9	2.03	0.03	0.5	56.0
Bt1 ---- 13 to 25	5.40	0.87	0.29	0.10	0.02	1.28	5.38	3.65	4.10	35	24	0.82	0.06	0.5	43.0
Bt2 ---- 25 to 42	5.50	0.75	0.81	0.12	0.02	1.70	5.31	4.69	3.61	36	32	0.42	0.04	0.5	60.0
Bt3 ---- 42 to 50	5.20	0.33	0.76	0.12	0.01	1.22	6.79	4.46	5.57	27	18	0.49	0.03	1.5	55.0
BC ----- 50 to 80	5.16	0.30	0.66	0.11	0.01	1.08	5.40	3.99	4.32	27	20	0.35	0.03	1.0	50.0
Shelocta loam:															
91-KY-153-9															
A ------ 0 to 4	6.90	7.42	2.06	0.79	0.02	10.29	17.00	13.92	6.71	74	60	8.90	0.11	20.5	222.0
Bt1 ---- 9 to 15	5.52	1.75	0.71	0.53	0.01	3.00	7.71	5.82	4.71	51	39	1.37	0.06	25.0	210.0
Bt1 ---- 15 to 24	4.84	0.50	0.34	0.33	0.02	1.19	9.04	1.24	7.85	19	13	0.67	0.06	3.0	140.0

* This pedon is a taxadjunct to the series.

Table 19.--Mineralogy of Selected Soils

(The determinations were made by x-ray diffraction (XRD) analysis on soil material smaller than 2 millimeters in diameter. Dashes indicate that the mineral was not detected. The pedons for the soils listed are typical of the series as they occur in the survey area. For the location of the pedons, see the section "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station, Lexington, Kentucky)

Soil name, sample number, horizon, and depth in inches	Resistant minerals			Weatherable minerals		
	Quartz	Kaolinite	Total	Potassium feldspar	Mica	Total
	Pct			Pct		
Barbourville loam*:						
91-KY-175-14						
Bw1 ---- 11 to 19	86	1	87	11	2	13
Bw2 ---- 19 to 30	86	3	89	5	6	11
BC ----- 30 to 41	87	4	91	6	3	9
Helechawa sandy loam:						
91-KY-175-12						
BA ----- 4 to 8	98	---	98	2	---	2
Bw1 ---- 8 to 20	96	---	96	4	---	4
Bw2 ---- 20 to 31	93	4	97	1	2	3
BC ----- 31 to 46	96	---	96	4	---	4
Kimper fine sandy loam*:						
91-KY-153-7						
BA ----- 6 to 13	76	---	76	24	---	24
Bt1 ---- 13 to 25	70	3	73	25	2	27
Bt2 ---- 25 to 42	70	12	82	7	11	18
Shelocta loam:						
91-KY-153-9						
Bt1 ---- 9 to 15	81	5	86	---	14	14
Bt1 ---- 15 to 24	70	6	76	3	21	24

* This pedon is a taxadjunct to the series.

Table 20.--Engineering Index Test Data

(The pedons for the soils listed are typical of the series as they occur in the survey area. For the location of the pedons, see "Soil Series and Their Morphology." Soil samples were tested by the Natural Resources Conservation Service, Soil Mechanics Laboratory, Fort Worth, Texas)

Soil name, sample number, horizon, and depth in inches	Classification		Grain-size distribution										Liquid limit	Plasticity index	Moisture density		Specific gravity
			Percentage passing sieve--							Percentage smaller than--							
	AASHTO	Unified	3 in.	1.5 in.	3/4 inch	3/8 inch	No. 4	No. 10	No. 200	.02 mm	.005 mm	.002 mm			Maximum dry density	Optimum moisture	
													Pct		Lb/ cu ft	Pct	
Barbourville loam*:																	
91-KY-175-14																	
Bw1, Bw2 -- 11-30	A-6	CL	100	100	99	96	92	85	51	34	22	13	26	11	144.0	14.0	2.70
Helechawa sandy loam:																	
91-KY-175-12																	
Bw1, Bw2 -- 8-31	A-2-4	SC	83	76	68	65	64	63	25	34	11	8	22	8	110.5	11.5	2.65
Kimper fine sandy loam* **:																	
91-KY-153-7																	
Bt1, Bt2 -- 13-42	A-6	CL	100	96	96	95	93	89	51	36	22	13	25	11	113.0	14.5	2.67

* This pedon is a taxadjunct to the series.

** AASHTO group index A-6 is outside the range in characteristics for the Kimper series; this result indicates the possibility of high volume change between wet and dry states in this soil.

Table 21.--Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Allegheny	Fine-loamy, mixed, mesic Typic Hapludults
Alticrest	Coarse-loamy, siliceous, mesic Typic Dystrochrepts
*Barbourville	Fine-loamy, mixed, mesic Typic Haplumbrepts
Berks	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Bethesda	Loamy-skeletal, mixed, acid, mesic Typic Udorthents
Bledsoe	Fine, mixed, mesic Typic Hapludalfs
Cotaco	Fine-loamy, mixed, mesic Aquic Hapludults
*Cranston	Coarse-loamy, mixed, mesic Ultic Hapludalfs
Dekalb	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Donahue	Fine, mixed, mesic Typic Hapludalfs
Ezel	Fine-loamy, mixed, mesic Typic Hapludults
Fedscreek	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Fiveblock	Loamy-skeletal, mixed, nonacid, mesic Typic Udorthents
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Grigsby	Coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Hazleton	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Helechawa	Coarse-loamy, siliceous, mesic Typic Dystrochrepts
Kaymine	Loamy-skeletal, mixed, nonacid, mesic Typic Udorthents
*Kimper	Fine-loamy, mixed, mesic Umbric Dystrochrepts
*Knowlton	Fine-silty, mixed, mesic Typic Ochraquults
Latham	Clayey, mixed, mesic Aquic Hapludults
Lily	Fine-loamy, siliceous, mesic Typic Hapludults
Marrowbone	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Morehead	Fine-silty, mixed, mesic Aquic Hapludults
Orrville	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Ramsey	Loamy, siliceous, mesic Lithic Dystrochrepts
Rayne	Fine-loamy, mixed, mesic Typic Hapludults
Rigley	Coarse-loamy, mixed, mesic Typic Hapludults
Riney	Fine-loamy, siliceous, mesic Typic Hapludults
Rowdy	Fine-loamy, mixed, mesic Fluventic Dystrochrepts
Shelocta	Fine-loamy, mixed, mesic Typic Hapludults
Udorthents	Udorthents
Whitley	Fine-silty, mixed, mesic Typic Hapludults

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