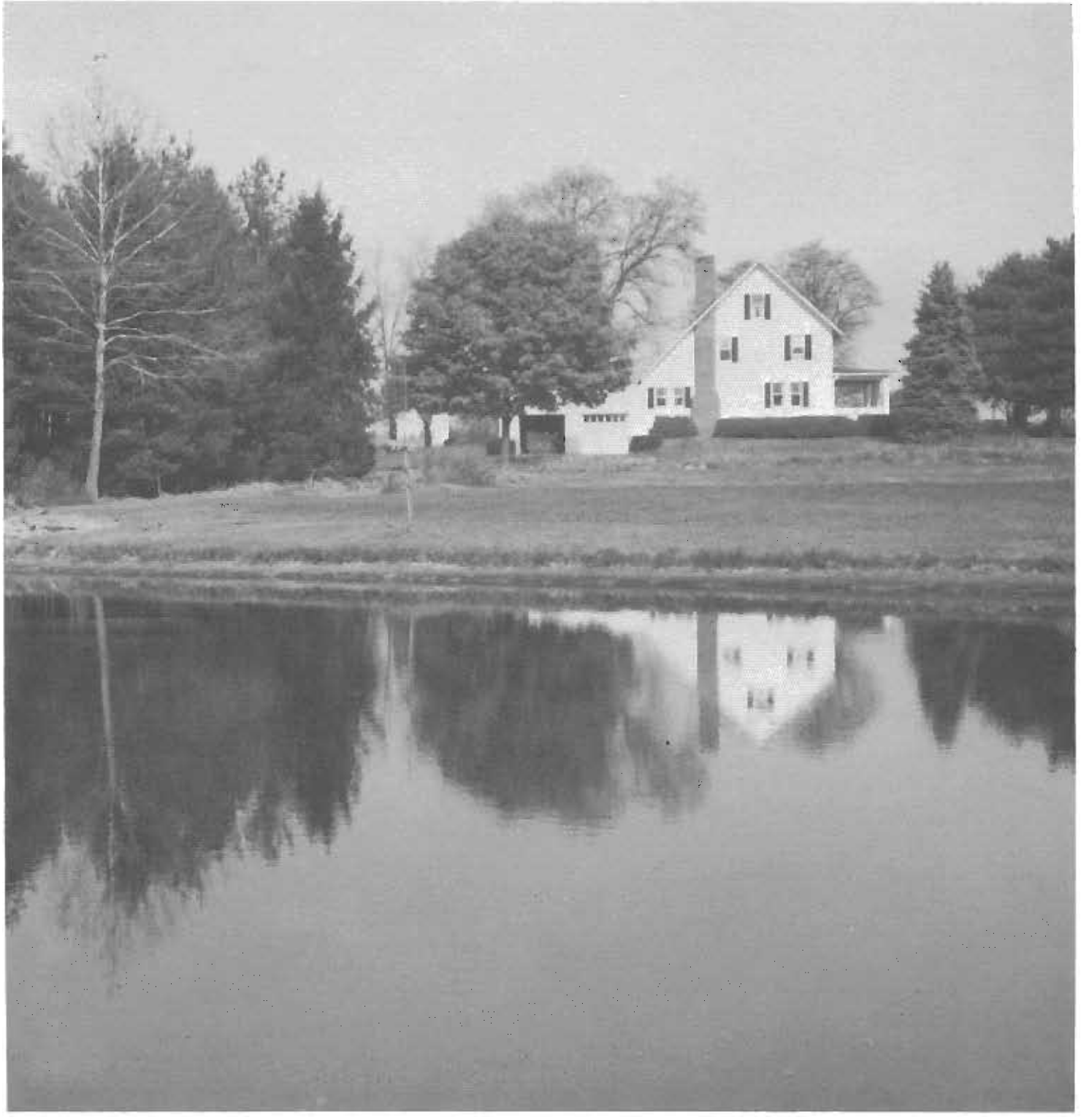
United States
Department of
Agriculture

Soil
Conservation
Service

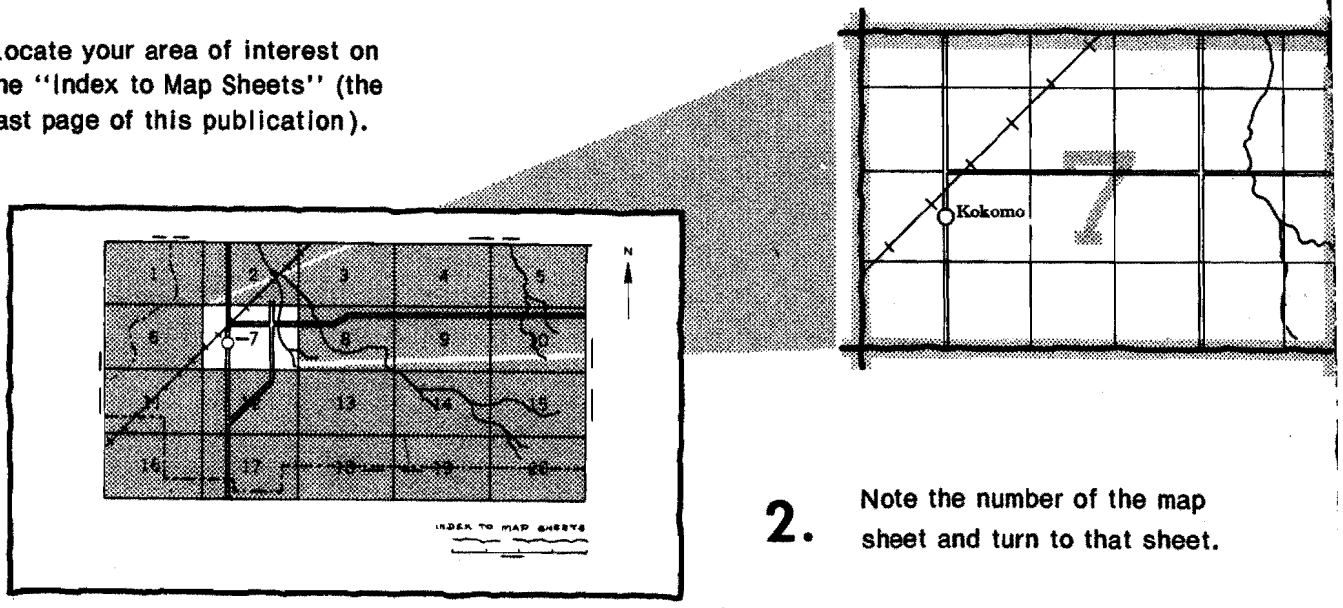
In cooperation with
United States Department
of Agriculture,
Forest Service;
Ohio Department of
Natural Resources,
Division of Soil and
Water Conservation; and
Ohio Agricultural
Research and
Development Center

Soil Survey of Athens County Ohio



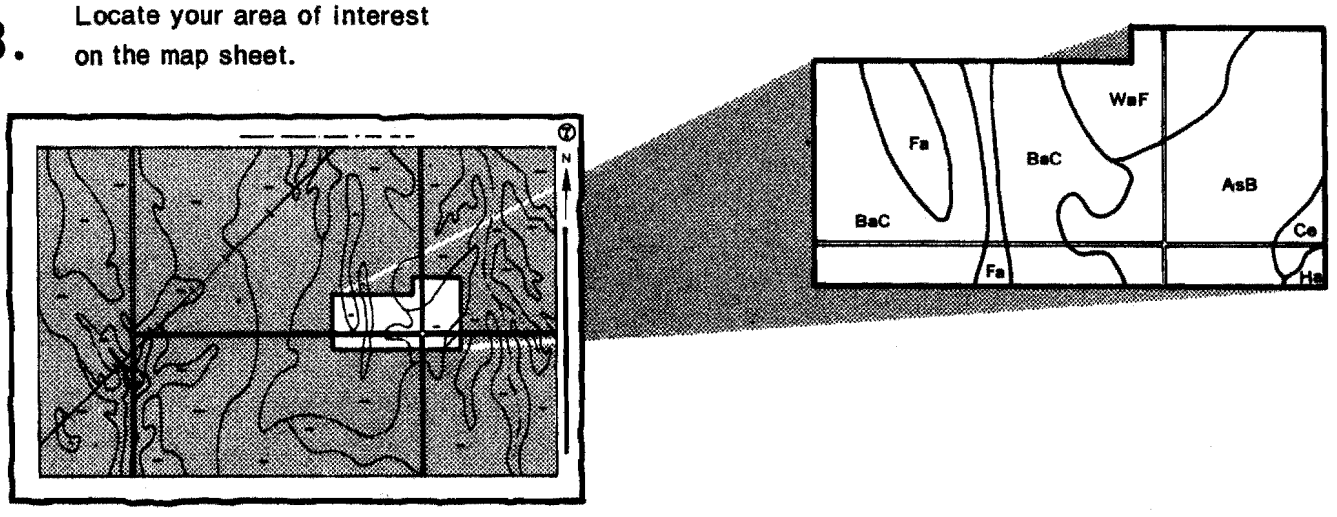
HOW TO US

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).



2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



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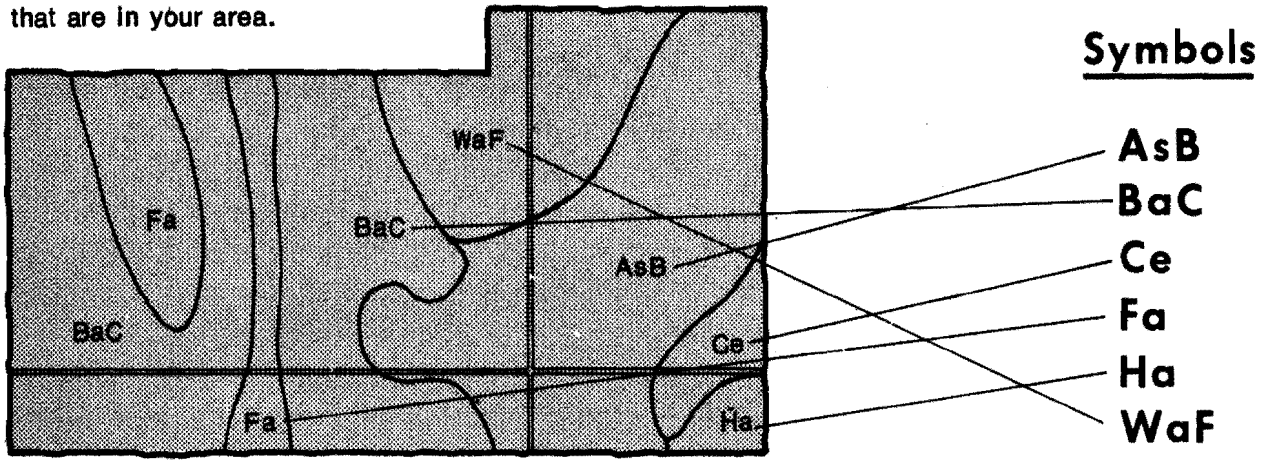
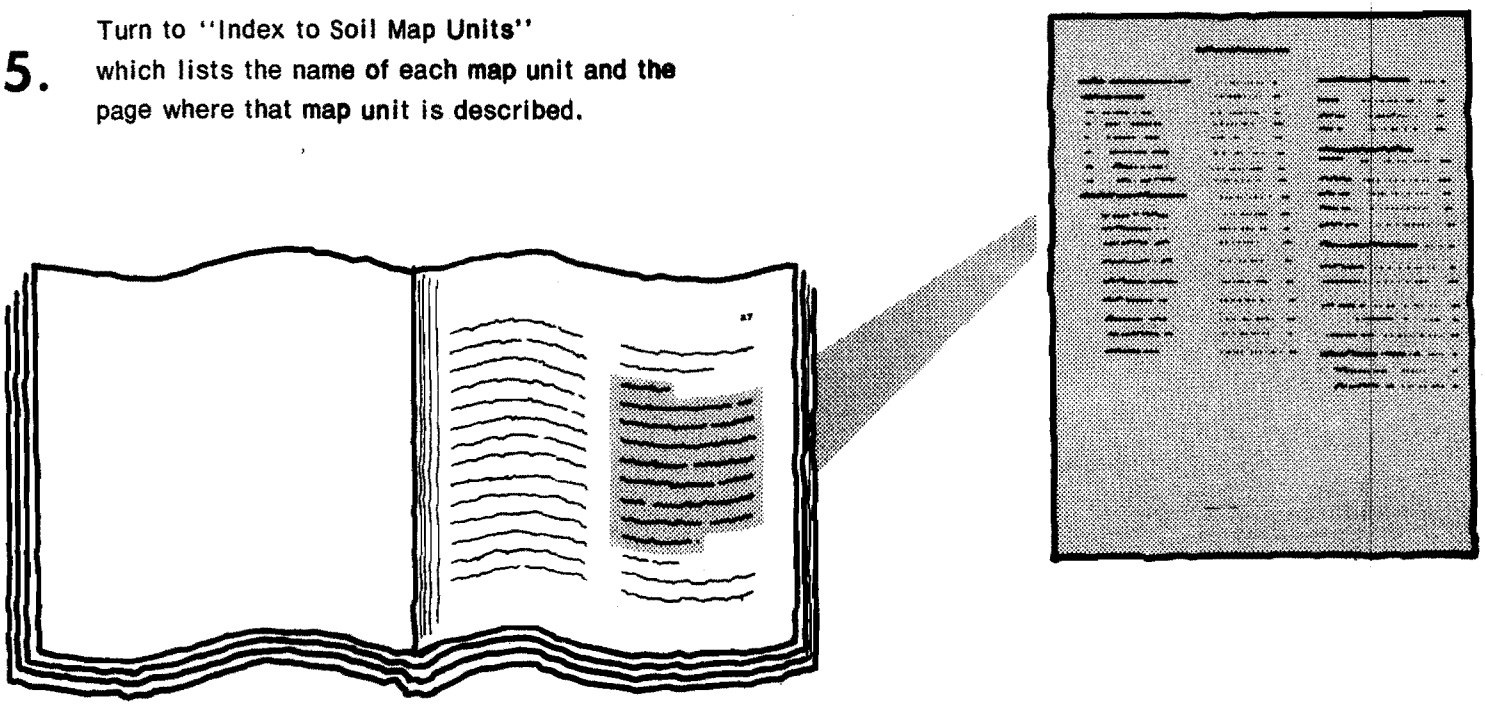
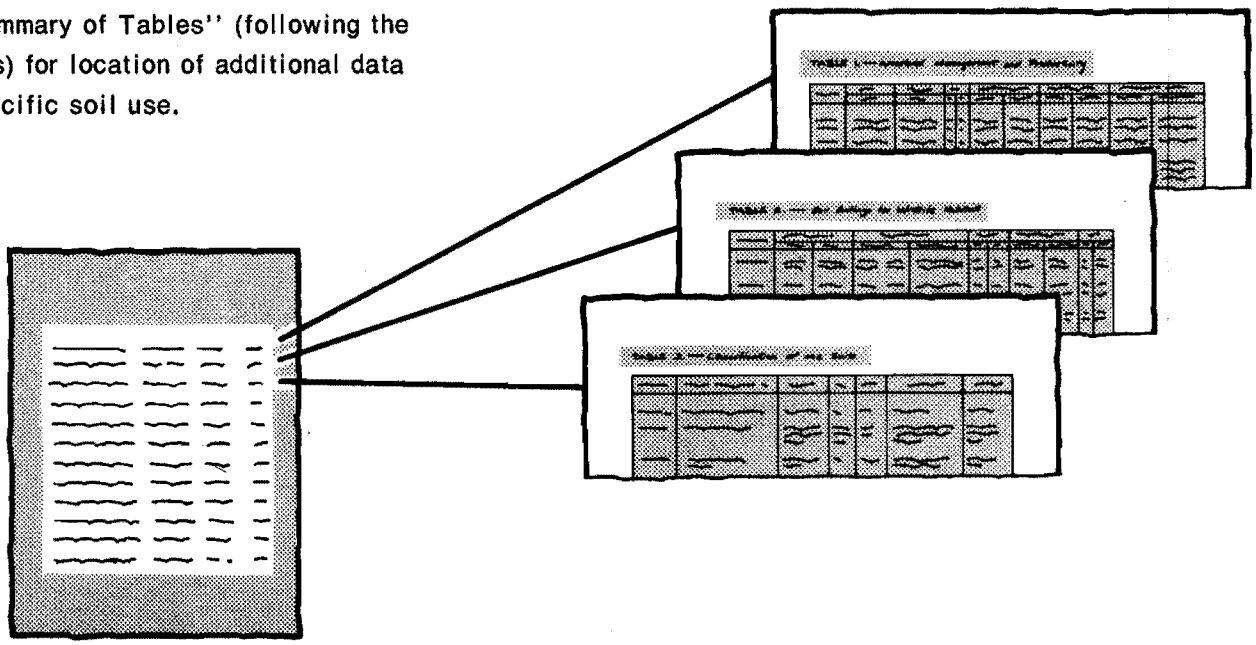


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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 Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service and Forest Service; Ohio Department of Natural Resources, Division of Soil and Water Conservation; and Ohio Agricultural Research and Development Center. It was funded in part by the Athens County Commissioners, Ohio University, and the City of Athens. It is part of the technical assistance furnished to the Athens Soil and Water 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: Pond used for recreation and fire protection on Omulga soils.

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Foreword

This soil survey contains information that can be used in land-planning programs in Athens County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, 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 insure 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.

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 water table near the surface 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 Soil Conservation Service or the Cooperative Extension Service.

Robert R. Shaw
State Conservationist
Soil Conservation Service

Soil Survey of
Athens County, Ohio

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United States Department of Agriculture,
Soil Conservation Service,
in cooperation with
United States Department of Agriculture,
Forest Service;
Ohio Department of Natural Resources,
Division of Soil and Water Conservation; and
Ohio Agricultural Research and Development Center

General Nature of the County

Athens County is in southeastern Ohio (fig. 1). It has an area of 322,560 acres, or approximately 504 square miles. According to the Bureau of Census, the preliminary population count in 1980 was 53,311.

Athens, the county seat, has a population of 19,801 and is the largest city. Nelsonville, the second largest city, has a population of 4,571. Smaller incorporated villages are Albany, Amesville, Buchtel, Chauncey, Coolville, Glouster, Jacksonville, and Trimble.

Athens County is part of the unglaciated Allegheny Plateau Region. The landscape is strongly dissected, with the exception of the gently sloping, high, level terraces at Albany and Coolville.

Ohio University, located in the city of Athens, is the county's largest employer. Coal mining, although presently a small industry in Athens County, provides employment in the surrounding areas for many county residents.

Nearly 56 percent of the county is in forest, 22 percent in pasture, and 12 percent in cropland. Livestock and livestock products are the leading sources of farm income. The slope and erosion hazard are the main land

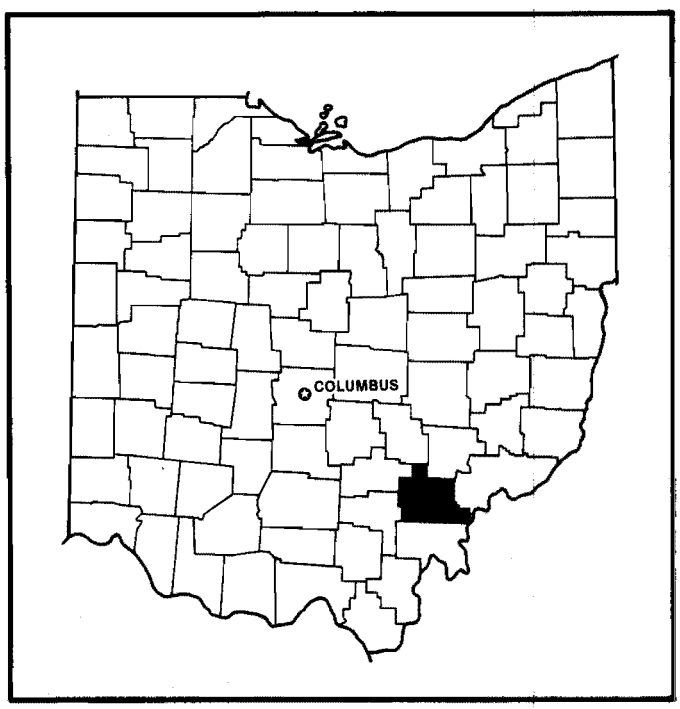

Figure 1.—Location of Athens County in Ohio.

use limitations. Other limitations include hillside slippage, clayey subsoil, seasonal wetness, slow or very slow permeability, high shrink-swell potential, and moderate depth to bedrock.

This survey updates an earlier soil survey of Athens County published in 1938 (*7*). It provides additional information and larger maps that show the soils in greater detail.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Winters are cold and snowy at the higher elevations in Athens County. In the valleys it is also frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on ridgetops and very warm with occasional very hot days in the valleys. Rainfall is evenly distributed during the year, but it is appreciably heavier on the windward, west-facing slopes than in the valleys. Normal annual precipitation is adequate for all crops, although summer temperatures and growing season length, particularly at higher elevations, may be inadequate.

Table 1 gives data on temperature and precipitation for the county as recorded at Athens in the period 1951 to 1978. 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 32 degrees F and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred on January 28, 1963, is minus 27 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 104 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 (50 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 38.6 inches. Of this, 21 inches, or 55 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 18 inches. The heaviest 1-day rainfall during the period of record was 3.65 inches on July 12, 1966. Thunderstorms occur on about 45 days each year, and most occur in summer.

The average seasonal snowfall is 14 inches. The greatest snow depth at any one time during the period of record was 5 inches. On the average, there is no day with an 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 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 8 miles per hour, in spring.

Settlement

Athens County was formed from a tract of land organized as Washington County in 1805. Athens County originally contained not only the present county area, but also three townships that are now in Hocking County, five townships in Meigs County, two townships in Morgan County, seven townships in Vinton County, and a strip of land 10 miles long and a mile wide in Washington County.

The first settlers were New Englanders, mainly veterans of the Revolutionary War. One section of every township was reserved as school land, and all revenue derived from it was used to support the township schools. Another section was reserved for religious institutions. In addition, two complete townships, Athens and Alexander, were set aside to help start Northwestern University, now Ohio University.

A surveyor for the Ohio Land Company, who originally contracted the area, intended that the first settlement should be made on "The Plains." His directions were misunderstood, however, and the first settlement was made at the present site of Athens. The small community of The Plains was settled later.

Physiography, Relief, and Drainage

Athens County is in the unglaciated Allegheny Plateau Region. The area has been extensively dissected by drainageways. Most of the soils are underlain by sedimentary rocks of the Allegheny, Conemaugh, and Monongahela Formations of the Pennsylvanian System and the Washington and Green Formations of the Permian System (*8*). The rocks are shale, siltstone, sandstone, limestone, and coal. They have a northeast-southwest strike, with an average dip of 30 feet per mile toward the southeast. Rocks of the Allegheny and Conemaugh Formations underlie the western part of the county; rocks of the Monongahela Formation underlie the central part of the county; and rocks of the Permian System underlie the eastern part.

The landscape is one of hills, narrow ridgetops, and stream valleys. Mt. Nebo, near Chauncey, is the highest point, with an elevation of 1,055 feet. The northern part of the county is rugged, with steep and very steep slopes. The southern part of the county has more rolling topography, wider ridgetops, and fewer steep hillsides.

Near Albany and Coolville, there are extensive preglacial terraces, which are remnants of the preglacial Teays River drainage system. The Teays River had a

complex drainage system that originated in the Carolinas and flowed generally northwest and terminated near Wisconsin (*5*). With the advance of glacial ice, the Teays River was dammed, forming an extensive lake system. Eventually, the Hocking River and its drainage system were formed and these lakes were drained. The former valleys are at elevations of 700 to 820 feet and are characteristically gently sloping.

Illinoian age outwash terraces are at The Plains and near Stewart. Wisconsin age lake terraces are scattered throughout the county, with the largest areas in Athens and Buchtel. These terraces range from 640 to 700 feet in elevation.

The Hocking River and its tributaries drain most of the county. This river enters the Ohio River at Hockingport. Monday, Sunday, Federal, and Margaret Creeks are major tributaries of the Hocking River in Athens County. Monday, Sunday, and Federal Creeks drain the northern part of the county, and Margaret Creek drains the southwestern part. The Shade River drains the south-central part of the county and flows into Meigs County. Tributaries of Raccoon Creek drain the west-central part.

Natural Resources

There is countywide production of oil and gas from several rock layers. The Middle Kittaning and number 6 coal has been surface or shaft mined in the past, especially in the northwestern part of the county. Pittsburgh number 8 coal has been surface mined near Amesville. Limestone is quarried near Albany. Sand and gravel are excavated along the Hocking River, northwest of Athens and at Stewart.

Water Supply

The principal sources of ground water are the sand and gravel in the Hocking River Valley and the sandstone underlying the uplands. Some rural water districts obtain water from lakes or wells. Areas not served by water district systems or municipal systems depend on dug or drilled wells, farm ponds, cisterns, or springs.

Farming

About 34 percent of Athens County was used for crops and pasture in 1967 according to the Conservation Needs Inventory (*6*). The leading source of farm income is livestock and livestock products, mainly dairy products, cattle and calves, hogs, and poultry. The major beef and dairy operations are in the southern and eastern parts of the county. Grain and vegetable crops are also a source of income.

The principal crops are corn, soybeans, wheat, oats, and hay. These crops are grown primarily in the Albany, Coolville, and Stewart areas and on the wider flood plains and terraces throughout the county. Tomatoes are grown in the Ohio and Hocking Valleys near Hockingport.

Transportation

The Ohio River provides the county with access to commercial barge traffic, but there are no loading facilities in the county. U.S. Route 50 crosses the county from east to west, and U.S. Route 33 crosses from northwest to southeast. Passenger rail service is provided between Washington D.C. and Cincinnati. Small aircraft service and commuter service between Cincinnati and Pittsburgh are available at the Ohio University Airport.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; 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 biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil 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-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, 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. 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.

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 interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were 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 were 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 state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure 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.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. 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 soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns 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 (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

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

General Soil Map Units

The general soil map at the back of this publication shows broad areas called associations that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association 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 association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Westmoreland-Guernsey-Upshur Association

Deep, dominantly strongly sloping to very steep, well drained and moderately well drained soils formed in residuum and colluvium from sandstone, siltstone, shale, and limestone; on uplands

This association consists of high hills and ridges. The hills generally have long, smooth slopes, but some slopes are benched and others are dissected, especially near small drainageways. The ridges generally are somewhat linear and uniform in elevation. Most areas of this association are drained by small drainageways. Slopes are dominantly 15 to 40 percent but range from 8 to 70 percent.

This association covers about 37 percent of the county. It is about 30 percent Westmoreland soils, 20 percent Guernsey soils, 20 percent Upshur soils, and 30 percent soils of minor extent.

Westmoreland soils are deep, well drained, moderately steep to very steep soils on hillsides and ridgetops. Permeability is moderate. Guernsey soils are deep, moderately well drained, strongly sloping to steep soils on hillsides and ridgetops. Permeability is moderately slow or slow. Guernsey soils have a high shrink-swell potential in the middle and lower parts of the subsoil and are subject to hillside slippage. These soils have a seasonal high water table between depths of 24 and 42 inches. Upshur soils are deep, well drained, moderately steep and steep soils on hillsides and ridgetops. Permeability is slow. Upshur soils have a high shrink-swell potential in the subsoil and are subject to hillside slippage.

Some of the minor soils in this association are the well drained Berks, Dekalb, and Steinsburg soils on upper parts of side slopes and the well drained Vandalia soils and moderately well drained Brookside soils on foot slopes. The well drained Nolin soils and the somewhat poorly drained Newark soils are on narrow flood plains.

Most areas of the strongly sloping to steep soils were once cleared and farmed, but most of these areas have reverted to brush and woodland. The very steep soils are in woodland. The strongly sloping and moderately steep soils are moderately well suited to a cropping system of corn, small grain, and hay and are moderately well suited or well suited to pasture. The steep and very steep soils are generally unsuited to most of these uses but are well suited or moderately well suited to woodland. The ridgetops provide the best sites for buildings and sanitary facilities.

Slope and the hazard of erosion are the major concerns of management. Slow or moderately slow permeability and susceptibility to hillside slippage are also limitations. Erosion can be reduced by using conservation tillage that leaves crop residue on the soil surface, no-till farming, contour stripcropping, and cover crops. North- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the prevailing winds and the sun. Due to their moderate permeability and low shrink-swell potential, the Westmoreland soils are better suited as sites for buildings and septic tank absorption fields than the Guernsey and Upshur soils.

2. Westmoreland-Guernsey-Dekalb Association

Deep and moderately deep, dominantly steep and very steep, well drained and moderately well drained soils formed in residuum and colluvium from sandstone, siltstone, shale, and limestone; on uplands

This association consists of soils on hillsides. The side slopes are occasionally broken by narrow benches. Slopes are uneven and range from 25 to 70 percent,

except on less sloping ridgetops and benches. Streams are small with relatively narrow valleys.

This association covers about 26 percent of the county. It is about 25 percent Westmoreland soils, 20 percent Guernsey soils, 15 percent Dekalb soils, and 40 percent soils of minor extent.

Westmoreland soils are deep, well drained, steep and very steep soils on side slopes. Permeability is moderate. Guernsey soils are deep, moderately well drained, steep and very steep soils on side slopes and less sloping benches and ridgetops. Permeability is moderately slow or slow. Guernsey soils have a seasonal high water table between depths of 24 and 42 inches. They have a high shrink-swell potential in the middle and lower parts of the subsoil and are subject to hillside slippage. Dekalb soils are moderately deep, well drained, steep and very steep soils on side slopes. Permeability is moderately rapid or rapid.

Some of the minor soils in this association are the well drained Wellston and Westmore soils on ridgetops, the Berks soils on side slopes, and the Richland soils on foot slopes. Also of minor extent are the well drained Chagrin and Nolin soils and the very poorly drained Melvin soils on narrow flood plains.

Most areas of this association are in woodland. Buildings and roads are generally in the narrow stream valleys and on the benches. The soils are generally unsuited to row crops, small grain, hay, and most urban uses. They are well suited or moderately well suited to woodland and poorly suited to generally unsuited to pasture.

Major limitations for most land uses are the steep and very steep slopes, erosion hazard, bedrock between depths of 20 and 40 inches in the Dekalb soils, slow or moderately slow permeability of the Guernsey soils, and the high shrink-swell potential and susceptibility of the Guernsey soils to hillside slippage. Placing logging roads and skid trails on the contour wherever possible will reduce soil loss by erosion. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

3. Brookside-Westmoreland-Vandalia Association

Deep, dominantly moderately steep to very steep, moderately well drained and well drained soils formed in colluvium and residuum from sandstone, siltstone, shale, and limestone; on uplands

This association consists of soils on long, narrow ridges; side slopes; and broad, uneven foot slopes. The side slopes are commonly benched or broken. Slopes range from 15 to 70 percent. Streams and drainageways in the association are typically small, and the valleys are relatively narrow.

This association covers about 8 percent of the county. It is about 40 percent Brookside soils, 20 percent Westmoreland soils, 15 percent Vandalia soils, and 25 percent soils of minor extent.

Brookside soils are deep, moderately well drained, moderately steep to very steep soils on side slopes and foot slopes. Permeability is moderately slow. A seasonal high water table is between depths of 30 and 48 inches. Brookside soils have a high shrink-swell potential and are subject to hillside slippage. Westmoreland soils are deep, well drained, steep and very steep soils on side slopes and ridgetops. Permeability is moderate. Vandalia soils are deep, well drained, moderately steep and steep soils on foot slopes. Permeability is moderately slow or slow. A seasonal high water table is between depths of 48 and 72 inches. Vandalia soils have a high shrink-swell potential and are subject to hillside slippage.

Some of the minor soils in this association are the well drained Elba and Berks soils on side slopes and the well drained Upshur soils and moderately well drained Guernsey soils on side slopes and ridgetops. The well drained Nolin soils are on narrow flood plains, and the moderately well drained Licking soils are on narrow terraces.

Most of the steep and very steep soils on side slopes are in woodland. Many of the moderately steep soils on foot slopes were once cleared but are now reverting to brush and woodland. The soils on ridgetops are used for hay, pasture, and woodland. The moderately steep soils are moderately well suited to hay and pasture and an occasional row crop in a crop rotation. The steep and very steep soils are generally unsuited to these uses but are well suited to woodland. The Westmoreland soils on ridgetops provide the best sites in the association for buildings.

Major land use limitations include the moderately steep to very steep slopes, erosion hazard, moderately slow or slow permeability, seasonal wetness, high shrink-swell potential, and susceptibility of the Brookside and Vandalia soils to hillside slippage. The unevenness and steepness of the hillsides and foot slopes make pasture improvement difficult. Seeding by the no-till method reduces erosion. Logging roads and skid trails should be placed on the contour wherever possible to reduce erosion.

4. Steinsburg-Westmoreland-Vandalia Association

Moderately deep and deep, dominantly steep and very steep, well drained soils formed in residuum and colluvium from sandstone, siltstone, shale, and limestone; on uplands

This association consists of ridgetops and side slopes that are occasionally broken by narrow benches. Slopes are uneven and range from 25 to 70 percent, except on some less sloping ridgetops, benches, and foot slopes. Streams are small with relatively narrow valleys.

This association covers about 10 percent of the county. It is about 30 percent Steinsburg soils, 20

percent Westmoreland soils, 15 percent Vandalia soils, and 35 percent soils of minor extent.

Steinsburg and Westmoreland soils are on the upper part of steep and very steep side slopes and Vandalia soils are on the foot slopes. Steinsburg soils are moderately deep and well drained. They have moderately rapid permeability. Westmoreland soils are deep, well drained, moderately permeable soils. Vandalia soils are deep, well drained, steep soils. Permeability is moderately slow or slow. A seasonal high water table is between depths of 48 and 72 inches. These soils have a high shrink-swell potential and are subject to hillside slippage.

Some of the minor soils in this association are the well drained Clymer soils and the moderately well drained Guernsey soils on ridgetops. Guernsey soils are also on the less sloping portions of side slopes. The well drained Richland soils are on foot slopes and toe slopes. The well drained Chagrin soils are on flood plains along small streams.

Most areas of this association are in woodland. Buildings and roads are in the narrow stream valleys and on benches on the upper part of side slopes. These soils are generally unsuited to row crops, small grain, hay, and most urban uses. They are well suited or moderately well suited to woodland and poorly suited to generally unsuited to pasture. Some areas are scenic and have potential for hiking trails and related recreational uses.

Major limitations for most land uses are the steep and very steep slopes, erosion hazard, bedrock between depths of 24 and 42 inches in the Steinburg soils, moderately slow or slow permeability of the Vandalia soils, and high shrink-swell potential and susceptibility of the Vandalia soils to hillside slippage. Placing logging roads and skid trails on the contour wherever possible will reduce soil loss by erosion. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. These slopes are less exposed to the drying effects of the prevailing winds and the sun.

5. Westmoreland-Guernsey-Wellston Association

Deep, dominantly gently sloping to steep, well drained and moderately well drained soils formed in residuum and colluvium from sandstone, siltstone, shale, and limestone; on uplands

This association consists of soils on hillsides and ridges. The side slopes are broken by narrow, moderately steep benches. The ridgetops are generally wide and undulating. Slopes are dominantly 8 to 40 percent but range from 3 to 40 percent.

This association covers about 3 percent of the county. It is about 35 percent Westmoreland soils, 30 percent Guernsey soils, 25 percent Wellston soils, and 10 percent soils of minor extent.

Westmoreland soils are deep, well drained, strongly sloping or steep soils on side slopes and ridgetops. Permeability is moderate. Guernsey soils are deep, moderately well drained, gently sloping to steep soils on side slopes and ridgetops. Permeability is moderately slow or slow. Guernsey soils have a seasonal high water table between depths of 24 and 42 inches. They have a high shrink-swell potential in the middle and lower parts of the subsoil and are subject to hillside slippage. Wellston soils are deep, well drained, gently sloping and strongly sloping soils on ridgetops. Permeability is moderate.

Some of the minor soils in this association are the well drained Berks and Dekalb soils on the upper parts of side slopes, the well drained Richland soils and moderately well drained Brookside soils on foot slopes and toe slopes, the well drained Newark and Nolin soils on flood plains, and the well drained Westmore soils on ridgetops.

This association is used mainly for farming. The steeper areas are in woodland. Soils on the ridgetops are well suited or moderately well suited to corn, small grain, hay, and pasture; soils on the side slopes are generally unsuited or poorly suited to these uses. The soils in this association are well suited to woodland. The Westmoreland and Wellston soils are better suited as sites for buildings than the Guernsey soils.

Major land use limitations are the moderately steep and steep slopes, erosion hazard, and the slow or moderately slow permeability of the Guernsey soils and their susceptibility to hillside slippage. The surface layer crusts after hard rains. Erosion can be reduced by conservation practices, such as conservation tillage that leaves crop residue on the soil surface, using crop rotations, grassed waterways, and planting winter cover crops. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry in the Guernsey soils.

6. Chagrin-Nolin Association

Deep, nearly level, well drained soils formed in alluvium; on flood plains

This association consists of soils on flood plains along major streams that are subject to rare or frequent flooding. These flood plains occur as two benches, one of which is at a higher level than the other. Areas along larger streams are long and one-quarter to one-half mile wide. Slopes range from 0 to 3 percent.

This association covers about 10 percent of the county. It is about 30 percent Chagrin soils, 20 percent Nolin soils, and 50 percent soils of minor extent.

Chagrin and Nolin soils are deep, well drained, nearly level soils on flood plains. Permeability is moderate, and runoff is slow. Chagrin soils are on two bench levels and are rarely or frequently flooded. Nolin soils are on the lowest portions of the flood plains and are frequently flooded. A seasonal high water table is between depths

of 48 and 72 inches in the Chagrin soils and between depths of 36 and 72 inches in the Nolin soils.

Some of the minor soils in this association are the well drained Hackers soils on alluvial fans and low terraces. The somewhat poorly drained Orrville and Newark soils are on flood plains. The somewhat poorly drained Fitchville and McGary soils, the moderately well drained Glenford and Licking soils, and the well drained Wheeling soils are on terraces.

Most areas of this association are farmed. These soils are suited to corn, soybeans, hay, and pasture. Winter grain crops are limited by the flooding hazard; however, the higher benches are better suited to small grains than the lower levels. These soils are generally unsuited as sites for buildings. They are well suited to woodland.

The soils in this association can be cropped intensively. The flooding hazard is the major limitation for most uses. Row crops should be planted after the normal period of flooding. Returning crop residue to the soil helps maintain fertility and tilth. Local roads and streets can be constructed on filled areas above expected high flood levels.

7. Omulga-Licking Association

Deep, gently sloping and strongly sloping, moderately well drained soils formed in loess, lacustrine sediments, and old alluvium; in preglacial valleys and on terraces along streams

This association consists of soils in preglacial valleys and on terraces. Soils are dominantly on smooth, uniform areas that are interspersed with drainageways. Slopes range from 3 to 15 percent.

This association covers about 6 percent of the county. It is about 50 percent Omulga soils, 15 percent Licking soils, and 35 percent soils of minor extent.

Omulga soils are deep, moderately well drained, gently sloping and strongly sloping soils in preglacial valleys. These soils have a fragipan in the lower part of the subsoil that restricts root penetration and water movement. Permeability is slow. Licking soils are deep, moderately well drained, gently sloping and strongly sloping soils on terraces. Permeability is slow. These soils have a high shrink-swell potential in the middle and lower parts of the soil. Omulga and Licking soils both have a seasonal high water table between depths of 24 and 42 inches.

Some of the minor soils in this association are the somewhat poorly drained Doles soils on terraces in preglacial valleys and the well drained Gallia, Parke, and Negley soils and moderately well drained Vincent soils on terraces. Also of minor extent are the well drained Westmoreland and Wellston soils and the moderately well drained Guernsey soils on uplands.

Most areas of this association are farmed. The soils are suited to corn, soybeans, small grain, hay, pasture, and trees. They are moderately well suited as a site for buildings and poorly suited to septic tank absorption fields.

The major land use limitations are the slow permeability, seasonal wetness, erosion hazard, high shrink-swell potential of the Licking soils, and fragipan in the Omulga soils. Including meadow crops in the cropping system will reduce the erosion hazard. The surface layer crusts after hard rains. Conservation tillage that leaves crop residues on the soil surface, grassed waterways, contour stripcropping, and cover crops are used to reduce soil loss by erosion and maintain tilth. Drains at the base of footings and exterior basement wall coatings are used to help keep basements dry. Backfilling around foundations with a low shrink-swell material will reduce damage from the shrinking and swelling of the Licking soils. Using drains around septic tank absorption fields and increasing the size of the absorption area will increase the absorption of effluent.

Detailed Soil Map Units

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

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, 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 or of the underlying material. They also can differ in slope, stoniness, wetness, 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, Guernsey silt loam, 3 to 8 percent slopes, is one of several phases in the Guernsey series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Westmoreland-Upshur complex, 8 to 15 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of 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.

Soil Descriptions

BaF—Barkcamp gravelly sandy loam, 40 to 70 percent slopes. This deep, very steep, well drained soil is mainly on the sides of mine spoil ridges in areas that have been surface mined for coal. Most areas have not been graded. The soil is a mixture of rock fragments and partially weathered fine earth material that was in or below the original soil. The coarse fragments, which are flat and round, are mainly sandstone, roof shale, and coal. Most areas are long and narrow and 4 to 105 acres in size.

Typically, the surface layer is yellowish brown, friable gravelly sandy loam about 4 inches thick. The substratum, to a depth of about 60 inches, is brown, very friable very gravelly sandy loam and extremely gravelly sandy loam. A few areas have been reclaimed by blanketing the surface with a layer of material from other soils.

Included with this soil in mapping are some intermingled areas of Bethesda soils and small areas of Richland soils on the edge of mapped areas. Bethesda soils are less acid and finer textured throughout than the Barkcamp soils. Richland soils are finer textured and contain fewer coarse fragments throughout. Also included are stony areas with stones 5 to 10 feet apart on the soil surface. These inclusions make up 5 to 10 percent of most areas.

This Barkcamp soil has moderately rapid or rapid permeability, low or very low available water capacity, and very rapid runoff. The substratum is extremely acid (pH is less than 3.6). Organic matter content is very low, and natural fertility is low.

Most areas are idle and are partially barren. Some areas have reverted to woodland and brush as a result of natural revegetation and reclamation.

This soil is too toxic to support most vegetation. In order to create a good root zone, it would be necessary to neutralize the extremely acid reaction, add plant nutrients, and blanket the soil with suitable soil material. Reclaimed areas would be suited to trees and woodland wildlife habitat.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the slope and susceptibility to hillside slippage.

This soil is in capability subclass VIIIs. It has not been assigned to a woodland suitability subclass.

BkD—Berks-Westmoreland silt loams, 15 to 25 percent slopes. This map unit consists of a moderately deep Berks soil and a deep Westmoreland soil on hillsides. These moderately steep, well drained soils are mainly on the upper third of the steeper and longer slopes. A few areas are on ridgetops and knolls of ridgetops. Slopes are mostly smooth, except for some dissection along a few small drainageways. Berks silt loam makes up 40 to 55 percent of most areas, and Westmoreland silt loam 30 to 45 percent. Areas of the two soils occur as relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Berks soil is commonly in the steeper areas and has some small flat stones on the surface. Most areas are long and narrow but are somewhat rounded on ridgetop knolls. They range from 5 to 30 acres in size.

Typically, the Berks soil has a dark grayish brown, friable, silt loam surface layer about 3 inches thick. The subsoil is yellowish brown, friable channery silt loam and very channery silt loam about 21 inches thick. Olive brown, siltstone bedrock is at a depth of about 24 inches.

Typically, the Westmoreland soil has a dark brown, friable, silt loam surface layer about 9 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable loam; the lower part is yellowish brown, friable and firm channery silty clay loam. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Included with these soils in mapping are long, narrow strips on benches and ridgetops of Guernsey, Elba, and Upshur soils with more clay and fewer coarse fragments in the subsoil. These included soils make up 10 to 20 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil and moderate in the Westmoreland soil. The Berks soil has a very low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff and good tilth. The root zone is moderately deep in the Berks soil and deep in the Westmoreland soil. Reaction of both soils is very strongly acid to medium acid in the subsoil. Natural fertility is low in the Berks soil and medium in the Westmoreland soil. Organic matter content is low in the Berks soil and moderately low in the Westmoreland soil.

Many areas are used for pasture and hay. These soils are moderately well suited to a cropping system of corn, small grain, hay, and pasture. Because of the severe erosion hazard, they are generally unsuited to continuous cultivated crops. Erosion can be reduced by using conservation tillage that leaves crop residues on the soil surface, no-till farming, grassed waterways, contour stripcropping, meadow crops in the cropping system, and cover crops. Proper stocking rates, rotation of pasture, and mowing to control weeds are good pasture management practices. Seeding by the no-till method reduces erosion.

Many areas are in trees. These soils are moderately well suited to woodland. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites have less exposure to the drying effects of the prevailing winds and the sun. Trees selected for planting on the Berks soil should be tolerant of dry conditions.

These soils are poorly suited as sites for buildings and septic tank absorption fields because of the slope and depth to bedrock. Landshaping is needed in most areas. Blasting is required for deep excavations in the Westmoreland soil. Buildings should be designed to conform to the natural slope of the land. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. To reduce erosion, plant cover should be maintained on the site as much as possible during construction.

These soils are in capability subclass IVe. The Berks soil is in woodland suitability subclass 3f on the north aspect and 4f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

BkE—Berks-Westmoreland silt loams, 25 to 40 percent slopes. This map unit consists of a moderately deep Berks soil and a deep Westmoreland soil on hillsides. These steep, well drained soils are mainly in narrow V-shaped valleys, but some areas are on hillsides above less sloping soils. Some areas have narrow benches, low bedrock escarpments, and an occasional landslip. Generally, Berks silt loam makes up 40 to 50 percent of most areas and Westmoreland silt loam 30 to 40 percent. Areas of the two soils occur in relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Berks soil is commonly on the steeper, eroded areas and has some

small flat stones on the surface. The Westmoreland soil dominates the lower hillside positions and small benches. Most areas are long and narrow and range from 5 to 100 acres in size.

Typically, the Berks soil has a very dark grayish brown, friable, silt loam surface layer about 5 inches thick. The subsoil is yellowish brown, friable channery silt loam and very channery silt loam about 18 inches thick. Olive brown, siltstone bedrock is at a depth of about 23 inches.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is yellowish brown, firm channery silty clay loam about 28 inches thick. The substratum is yellowish brown, firm channery clay loam. Olive brown, siltstone bedrock is at a depth of about 46 inches.

Included with these soils in mapping are narrow strips on benches of Guernsey and Elba soils that have more clay in the subsoil. Also included are long, narrow bedrock escarpments on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil and moderate in the Westmoreland soil. The Berks soil has a very low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff and good tilth. The root zone is moderately deep in the Berks soil and deep in the Westmoreland soil. Reaction in the subsoil of both soils is very strongly acid to medium acid. Natural fertility is low in the Berks soil and medium in the Westmoreland soil.

Some areas are in pasture. These soils are generally unsuited to cultivated crops, small grain, and hay because the slopes are too steep and uneven to be managed.

These soils are poorly suited to pasture. Controlling erosion and maintaining good stands of forage are concerns of management. Proper stocking rates, pasture rotation, and weed control are good management practices. Seeding by the no-till method reduces erosion.

Most areas are in woodland. These soils are moderately well suited to trees. The use of planting and logging equipment is limited by the steep slopes. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun. Trees planted on the Berks soil should be tolerant of dry conditions.

These soils are generally unsuited as sites for buildings and septic tank absorption fields because of the steep slopes and depth to bedrock.

These soils are in capability subclass VIe. The Berks soil is in woodland suitability subclass 3f on the north aspect and 4f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

BkF—Berks-Westmoreland silt loams, 40 to 70 percent slopes. This map unit consists of a moderately deep Berks soil and a deep Westmoreland soil on hillsides and walls of V-shaped valleys. Most areas of these very steep, well drained soils are on uneven slopes with some areas having narrow benches, bedrock escarpments, and an occasional landslip. Berks silt loam makes up 40 to 50 percent of most areas, and Westmoreland silt loam 30 to 40 percent. Areas of the two soils occur in relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Berks soil is commonly on the steeper, convex areas and has a few flat stones on the surface. The Westmoreland soil dominates the lower, concave hillside positions and small benches. Most areas are long and narrow and range from 10 to 125 acres in size.

Typically, the Berks soil has a very dark grayish brown, friable, silt loam surface layer about 5 inches thick. The subsoil is yellowish brown, friable channery silt loam about 18 inches thick. Olive brown, siltstone bedrock is at a depth of about 23 inches.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is yellowish brown, firm channery silty clay loam. The substratum is yellowish brown, firm channery clay loam. Olive brown, siltstone bedrock is at a depth of about 46 inches.

Included with these soils in mapping are long, narrow areas on benches of Guernsey and Elba soils that have more clay in the subsoil. Also included are long, narrow bedrock escarpments on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil and moderate in the Westmoreland soil. The Berks soil has a very low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff. The root zone is moderately deep in the Berks soil and deep in the Westmoreland soil. Reaction in the subsoil of both soils is very strongly acid to medium acid. Natural fertility is low in the Berks soil and medium in the Westmoreland soil.

These soils are generally unsuited to crops, hay, or pasture because the slopes are too steep and uneven to manage.

Most areas are in woodland. Some areas that were once cleared and used for pasture have reverted to woodland. These soils are moderately well suited to woodland. The erosion hazard is severe (fig. 2). Erosion can be reduced by such practices as placing logging

roads and skid trails on or near the contour and using water bars. The use of tree planting and mowing equipment is very difficult because of the very steep, uneven slopes. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as sites for buildings and septic tank absorption fields because of the very steep slopes and depth to bedrock.

These soils are in capability subclass VIIe. The Berks soil is in woodland suitability subclass 3f on the north aspect and 4f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

Figure 2.—Erosion of logging roads and skid trails is a severe hazard on Berks-Westmoreland silt loams, 40 to 70 percent slopes.

BoD—Bethesda shaly silty clay loam, 8 to 25 percent slopes. This strongly sloping and moderately steep, well drained, deep soil is mainly on side slopes of mine spoil in areas that have been surface mined for coal. It is a mixture of rock fragments and partially weathered fine earth material that was in or below the original soil. The rock fragments are mostly flat and 1 to 5 inches long. Most areas are long and narrow and 10 to 50 acres in size.

Typically, the surface layer is multicolored, friable, and firm shaly silty clay loam about 11 inches thick. The substratum, to a depth of about 60 inches, is multicolored, firm very shaly silty clay loam. In some areas the substratum is less acid.

Included with this soil in mapping are narrow, very steep escarpments and a few very stony or very bouldery soils. Also included are small intermingled areas of Barkcamp and Fairpoint soils. Fairpoint soils are less acid in the substratum than the Bethesda soil, and Barkcamp soils are more acid and coarser textured throughout. These inclusions make up 5 to 15 percent of most areas.

This Bethesda soil has moderately slow permeability, low available water capacity, and very rapid runoff. Tilth is poor. Depth of the root zone is variable within short distances because of changes in the density of the material. Unless the soil has been limed, the root zone is strongly acid to extremely acid. Natural fertility is low, and organic matter content is very low.

This soil is generally unsuited to hay and commonly grown field crops because of droughtiness, low fertility, and very low organic matter content. It is poorly suited to pasture and is a poor soil for root development. The surface layer is shaly, has weak structure, and puddles and crusts easily. Erosion is a severe or very severe hazard in cultivated areas. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow best on this soil. Proper stocking rates and rotation grazing are needed. Overgrazing reduces the stand and increases runoff and erosion.

Most areas are idle or are reverting to woodland and brush. This soil is best suited to trees that can tolerate droughty, strongly acid to extremely acid conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical tree planting is not practical in many areas because of rock fragments throughout the soil.

Once the soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings and poorly suited to septic tank absorption fields. Onsite investigation is needed to determine suitability. Depth of the soil over bedrock, susceptibility to hillside slippage, and control of storm water runoff are also important considerations. Areas where slopes are 15 to 25 percent are generally unsuited as sites for buildings and septic tank absorption fields. Slippage is a hazard. Because the root zone is limited, droughtiness is a hazard for lawns.

This soil is in capability subclass VIs. It has not been assigned to a woodland suitability subclass.

BoE—Bethesda shaly silty clay loam, 25 to 40 percent slopes. This steep, well drained, deep soil is mainly on side slopes of mine spoil in areas that have been surface mined for coal. It is a mixture of rock fragments and of partially weathered fine earth material that was in or below the original soil. The rock fragments are mostly flat and 1 to 5 inches long. Most areas are long and narrow and 10 to 75 acres in size.

Typically, the surface layer is multicolored, friable and firm shaly silty clay loam about 11 inches thick. The substratum, to a depth of about 60 inches, is multicolored, firm very shaly silty clay loam.

Included with this soil in mapping are narrow, very steep escarpments and a few very stony or very bouldery areas. Also included are small intermingled areas of Barkcamp and Fairpoint soils. Fairpoint soils are less acid in the substratum than the Bethesda soil, and Barkcamp soils are more acid and coarser textured throughout. These inclusions make up 10 to 20 percent of most areas.

This Bethesda soil has moderately slow permeability, low available water capacity, and very rapid runoff. Depth of the root zone is variable within short distances because of changes in the density of the material. Unless the soil has been limed, the root zone is strongly acid to extremely acid.

This soil is generally unsuited to hay, pasture, and commonly grown field crops because of steep slopes, droughtiness, low fertility, and very low organic matter content. Erosion is a very severe hazard in cultivated areas. Because the surface layer has a very weak structure and crusts easily, seedings should be mulched.

Most areas are idle or are reverting to woodland and brush. This soil is best suited to trees that tolerate droughty, acid conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting is not practical because of the steep slopes and the rock fragments throughout the soil.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes, the possibility of hillside slippage, and the moderately slow permeability.

This soil is in capability subclass VIIe. It has not been assigned to a woodland suitability subclass.

BoF—Bethesda shaly silty clay loam, 40 to 70 percent slopes. This very steep, well drained, deep soil is mainly on side slopes of mine spoil in areas that have been surface mined for coal. It is a mixture of rock fragments and partially weathered fine earth material that

was in or below the original soil. The rock fragments are mostly flat and 1 to 5 inches long. Most areas are long and narrow and 10 to 75 acres in size.

Typically, the surface layer is multicolored, friable shaly silty clay loam about 11 inches thick. The substratum, to a depth of about 60 inches, is multicolored, firm very shaly silty clay loam.

Included with this soil in mapping are narrow, very steep escarpments and a few very stony or very bouldery areas. Also included are small intermingled areas of Barkcamp and Fairpoint soils. Fairpoint soils are less acid in the substratum than the Bethesda soil, and Barkcamp soils are more acid and coarser textured throughout. These inclusions make up 10 to 20 percent of most areas.

This Bethesda soil has moderately slow permeability, low available water capacity, and very rapid runoff. Depth of the root zone is variable within short distances because of changes in the density of the material. The soil is strongly acid to extremely acid.

This soil is generally unsuited to hay, pasture, and row crops because of very steep slopes, droughtiness, low fertility, and very low organic matter content. Erosion is a very severe hazard.

Most areas are idle or are reverting to woodland and brush. This soil is best suited to trees that tolerate droughty, acid conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting is not practical because of the steep slopes and the rock fragments throughout the soil.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the very steep slopes, the possibility of hillside slippage, and the moderately slow permeability.

This soil is in capability subclass VIIe. It has not been assigned to a woodland suitability subclass.

BrC—Brookside silt loam, 8 to 15 percent slopes. This strongly sloping, moderately well drained, deep soil is primarily on foot slopes and benches below very steep hillsides. Some areas are on alluvial fans at the mouths of small drainageways. Seeps are in a few areas. Most areas are long and narrow with uneven slopes and are 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is strong brown, firm silty clay loam; the lower part is strong brown and yellowish brown, mottled, firm clay loam and clay. The substratum, to a depth of about 60 inches, is light olive brown, mottled, firm clay. Some areas have a redder subsoil.

Included with this soil in mapping at the edge of mapped areas are small areas of Richland soils that have less clay in the subsoil. These inclusions make up about 15 percent of most areas.

This Brookside soil has moderately slow permeability, moderate available water capacity, rapid runoff, and good tilth. The shrink-swell potential is high. The root zone is deep. The upper part of the subsoil is strongly acid to neutral, and the lower part is medium acid to mildly alkaline. This soil has a moderate organic matter content and high natural fertility. A seasonal high water table is between depths of 30 and 48 inches in late winter, spring, and other extended wet periods.

Most areas are farmed. This soil is moderately well suited to a cropping system of corn, small grain, and hay. The erosion hazard is severe in cultivated areas. The control of erosion and maintenance of tilth and organic matter content are concerns of management. Erosion can be reduced by conservation tillage that leaves crop residue on the soil surface, grassed waterways, contour stripcropping, including meadow crops in the cropping system, and the use of cover crops. Limiting tillage to when the soil is within the optimum moisture range will reduce soil compaction.

This soil is well suited to pasture. Restricted use during wet periods will reduce compaction and runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

This soil is poorly suited as a site for buildings and septic tank absorption fields because of the moderately slow permeability, high shrink-swell potential, seasonal wetness, slope, and susceptibility to slippage. Foundation drains and protective exterior wall coatings are used to help keep basements dry. Keeping cutting and filling operations to a minimum and diverting surface water away from foundations will help prevent slippage. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with a material that has a low shrink-swell potential. Septic tank absorption fields can be improved by placing the field in suitable fill material or increasing the size of the absorption field. Laying distribution lines on the contour will reduce seepage of effluent to the soil surface. Using a suitable base material under local roads and streets and providing artificial drainage will reduce damage from low strength and shrinking and swelling.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 1o.

BrD—Brookside silt loam, 15 to 25 percent slopes. This moderately steep, moderately well drained, deep soil is on foot slopes and benches below very steep hillsides. Seeps are in a few areas. This soil is subject to hillside slippage (fig. 3). Most areas are long and narrow with uneven slopes and are 5 to 50 acres in size.

Figure 3.—Hillside slippage can create uneven slopes on Brookside silt loam, 15 to 25 percent slopes.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is strong brown, firm silty clay loam; the lower part is strong brown and yellowish brown, mottled, firm clay loam and clay. The substratum, to a depth of about 60 inches, is light olive brown, mottled, firm clay. Some areas have a redder subsoil.

Included with this soil in mapping along the edges of most areas are small areas of Richland soils that have less clay in the subsoil. These inclusions make up about 15 percent of most areas.

This Brookside soil has moderately slow permeability, moderate available water capacity, very rapid runoff, and good tilth. The shrink-swell potential is high. The root zone is deep. The upper part of the subsoil is strongly acid to neutral, and the lower part is medium acid to mildly alkaline. This soil has a moderate organic matter content and high natural fertility. A seasonal high water table is between depths of 30 and 48 inches in late winter, spring, and other extended wet periods.

Most areas are used for pasture and hay. This soil is poorly suited to corn and small grain and moderately well suited to hay. Controlling erosion and maintaining the organic matter content and tilth are major management concerns if these soils are cultivated. Restricting tillage to when this soil is within the optimum moisture range will reduce soil compaction. Erosion can be reduced by conservation tillage that leaves crop residue on the soil surface, including meadow crops in the cropping system, and use of cover crops.

This soil is moderately well suited to pasture. Overgrazing or grazing when the soil is wet causes compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of slippage, slope, high shrink-swell potential, seasonal wetness, and moderately slow permeability. Minimizing cutting and filling operations will reduce slippage.

This soil is in capability subclass IVe. It is in woodland suitability subclass 1r on the north aspect and 2r on the south aspect.

BrE—Brookside silt loam, 25 to 40 percent slopes. This steep, moderately well drained, deep soil is on foot slopes and benches below very steep hillsides. Seeps are in a few areas. Most areas are long and narrow with uneven slopes and are 5 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is strong brown, firm silty clay loam with mottles below a depth of about 15 inches; the lower part is strong brown and yellowish brown, mottled, firm clay loam and clay. The substratum, to a depth of about 60 inches, is light olive brown, mottled, firm clay. Some areas have a redder subsoil.

Included with this soil in mapping on the edge of mapped areas are small areas of the Richland soils that have less clay in the subsoil. These inclusions make up about 15 percent of most areas.

This Brookside soil has moderately slow permeability, moderate available water capacity, very rapid runoff, and good tilth. The shrink-swell potential is high. The root zone is deep. The upper part of the subsoil is strongly acid to neutral, and the lower part is medium acid to mildly alkaline. This soil has a moderate organic matter content and high natural fertility. A seasonal high water table is between depths of 30 and 48 inches in late winter, spring, and other extended wet periods.

Many areas are used for pasture. This soil is generally unsuited to row crops and hay because the slopes are too steep and uneven to manage. This soil is poorly suited to permanent pasture. Overgrazing or grazing when the soil is wet causes surface compaction and increases runoff. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

Many areas are in woodland. This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by spraying, mowing, or disking. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of slippage, slope, high shrink-swell potential, seasonal wetness, and moderately slow permeability (fig. 4). Minimizing cutting and filling operations will reduce slippage.

This soil is in capability subclass VIe. It is in woodland suitability subclass 1r on the north aspect and 2r on the south aspect.

Cd—Chagrin loam, rarely flooded. This nearly level, deep, well drained soil is on the second bottom or the first terrace above the normal flood plain of streams. It is rarely flooded. Slope ranges from 0 to 3 percent. Areas are commonly long and narrow and are 10 to 60 acres in size.

Typically, the surface layer is dark brown, friable loam about 9 inches thick. The subsoil is about 26 inches thick. The upper part is dark yellowish brown and strong brown, friable loam; the lower part is strong brown, friable sandy clay loam and fine sandy loam. The substratum, to a depth of about 60 inches, is stratified dark yellowish brown and brown, loose loamy fine sand and sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Orrville soils in lower positions. These included soils make up as much as 10 percent of some areas.

This Chagrin soil has moderate permeability, high available water capacity, slow runoff, and good tilth. The subsoil is slightly acid. This soil has a moderately low organic matter content and high natural fertility. The root zone is deep. A seasonal high water table is between depths of 48 and 72 inches in late winter and other extended wet periods.

Nearly all areas are farmed. This soil is well suited to cultivated crops, small grain, and grasses and legumes for hay and pasture. It can be cropped intensively. Flooding is commonly of short duration and occurs during winter and spring. Returning crop residue to the soil helps maintain fertility and tilth.

When this soil is used for pasture, restricted use during wet periods will help prevent damage to the vegetation. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by site preparation and spraying, disking, or mowing. There are no limitations to harvesting or planting trees.

This soil is generally unsuited as a site for buildings but is well suited to septic tank absorption fields and most recreation uses. The addition of fill material to elevate the area above high flood levels will improve the use of the site for buildings and roads. Fills should not block the flow of floodwaters. Sloughing is a hazard in excavations.

This soil is in capability class I. It is in woodland suitability subclass 1o.

Figure 4.—Wall bulges as a result of hillside slippage of Brookside silt loam, 25 to 40 percent slopes.

Cg—Chagrin silt loam, frequently flooded. This deep, well drained, nearly level soil is on flood plains. It

is frequently flooded. Slopes range from 0 to 3 percent. Areas are long and narrow and range from 10 to 250 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown, friable silt loam and loam about 28 inches thick. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable loam. Some areas are moderately well drained and have gray mottles in the lower part of the subsoil. A few areas have more silt and less sand in the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Orville soils and the poorly drained Melvin soils in lower positions near streams, in old stream channels, and in backwater areas. These included soils make up about 15 percent of most areas.

This Chagrin soil has moderate permeability, high available water capacity, slow runoff, and good tilth. It has low shrink-swell potential. The subsoil is slightly acid or neutral. This soil has a moderately low organic matter content and high natural fertility. The root zone is deep. A seasonal high water table is between depths of 48 and 72 inches in late winter and other extended wet periods.

Most areas are farmed (fig. 5). This soil is well suited to cultivated crops and grasses and legumes for hay and pasture. Winter grain crops are limited by flooding. This soil can be cropped intensively. In some places gouging by floodwaters and undercutting of streambanks are problems. Returning crop residue to the soil helps maintain fertility and tilth. This soil crusts after hard rains, but shallow cultivation of intertilled crops will break up this crust.

When this soil is used for pasture, restricted use during wet periods will help prevent damage to the vegetation. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by site preparation and spraying, disking, or mowing. There are no limitations to planting or harvesting trees.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the frequent flooding (fig. 6). In some places roads are damaged by streambank erosion (fig. 7). This soil is suited to such recreational facilities as paths and trails. Local roads and streets can be constructed on filled areas above expected high flood levels.

This soil is in capability subclass IIw. It is in woodland suitability subclass 1o.

CmC—Clymer loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on ridgetops and the upper parts of side slopes on uplands. Generally, the slopes are convex. Most areas are long and narrow and are 5 to 20 acres in size.

Figure 5.—Chagrin silt loam, frequently flooded, is well suited to farming. Farm buildings in the distance are on Negley gravelly loam, 25 to 40 percent slopes.

Typically, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil is strong brown, friable loam and sandy loam about 26 inches thick. The substratum is yellowish brown, friable sandy loam. Yellowish brown, coarse sandstone bedrock is at a depth of about 46 inches. Some areas are more silty in the upper part of the soil.

Included with this soil in mapping are small areas of the moderately deep Steinsburg soils and the Westmoreland soils that have more silt and clay in the subsoil. These included soils are on the edge of mapped areas and make up about 15 percent of most of them.

Permeability of this Clymer soil is moderate. This soil has a low available water capacity, good tilth, and rapid runoff. The root zone is deep. The subsoil is slightly acid to strongly acid. The organic matter content is moderately low, and the natural fertility is medium or low.

Most areas are in cropland and pasture. This soil is moderately well suited to cultivated crops and small grain. It can be row cropped frequently, but the erosion hazard is a concern of management. Erosion can be reduced by the use of contour stripcropping, conservation tillage that leaves crop residues on the soil surface, winter cover crops, and grassed waterways. Returning crop residue to the soil helps maintain fertility and tilth.

This soil is well suited to pasture and hay, and both are effective in reducing erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds and brush will help keep the

Figure 6.—Flooding on Chagrin silt loam, frequently flooded. This soil is generally unsuited as a site for buildings.

pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because bedrock is at a depth of 40 to 60 inches, this soil is better suited to houses without basements than to houses with basements. Blasting is needed in deep excavations. Buildings should be designed to conform to the natural slope of the land. Septic tank absorption fields can be improved by placing the distribution lines in a suitable fill material. Increased runoff and erosion occur during construction, but these can be reduced by maintaining plant cover wherever possible.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

DtD—Dekalb-Westmoreland complex, 15 to 25 percent slopes. This map unit consists of a moderately deep Dekalb soil and a deep Westmoreland soil on hillsides. These moderately steep, well drained soils are mainly on the upper third of the steeper and longer slopes. A few areas are on ridgetops and knolls on ridgetops. Slopes are mostly smooth except for some dissection along a few small drainageways. Dekalb loam makes up 40 to 50 percent of most areas, and Westmoreland silt loam 30 to 45 percent. Areas of the two soils occur as relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Dekalb soil is commonly on the steeper slopes and has a few stones on the surface. Most areas of this unit are long and narrow but are somewhat rounded on ridgetop knolls. They range from 5 to 30 acres in size.

Typically, the Dekalb soil has a dark grayish brown, friable, loam surface layer about 6 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 15 inches thick. The substratum is yellowish brown, friable very channery sandy loam. Sandstone bedrock is at a depth of about 36 inches.

Typically, the Westmoreland soil has a dark brown, friable, silt loam surface layer about 9 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable silt loam; the middle part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown, firm channery silty clay loam. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Included with these soils in mapping are narrow strips on benches and ridgetops of moderately well drained Guernsey soils that have more clay in the subsoil. These included soils make up 10 to 20 percent of most areas.

Figure 7.—Streambank erosion has damaged this road on Chagrin silt loam, frequently flooded.

Permeability is moderately rapid or rapid in the Dekalb soil and moderate in the Westmoreland soil. The Dekalb soil has a very low or low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff and good tilth. The root zone is moderately deep in the Dekalb soil and deep in the Westmoreland soil. The subsoil is strongly acid to extremely acid in the Dekalb soil and very strongly acid to medium acid in the Westmoreland soil. Natural fertility is low in the Dekalb soil and medium in the Westmoreland soil. The organic matter content is low in the Dekalb soil and moderately low in the Westmoreland soil.

Many areas are used for pasture and hay. These soils are moderately well suited to a cropping system of corn, small grain, hay, and pasture. They are generally unsuited to continuous cultivated crops because of the severe erosion hazard. Erosion can be reduced by using conservation tillage that leaves crop residues on the soil surface, no-till farming, grassed waterways, contour stripcropping, legumes in the cropping system, and cover crops. Seeding grasses and legumes by the no-till method reduces erosion. Proper stocking rates, rotation of pasture, and mowing to control weeds are good pasture management practices.

Many areas are in woodland. These soils are moderately well suited to trees. Trees grow faster on the Westmoreland soil than on the Dekalb soil. Mechanical planting, mowing and disking to reduce plant competition, and logging are possible on the larger, more even areas. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are poorly suited as sites for buildings and septic tank absorption fields because of the slope and depth to bedrock. Landshaping is needed in most areas. Blasting is needed in deep excavations. Buildings should be designed to conform to the natural slope of the land. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. To reduce erosion, plant cover should be maintained on the site as much as possible during construction.

These soils are in capability subclass IVe. The Dekalb soil is in woodland suitability subclass 4f on the north aspect and 5f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

DtE—Dekalb-Westmoreland complex, 25 to 40 percent slopes. This map unit consists of a moderately deep Dekalb soil and a deep Westmoreland soil on hillsides. These steep, well drained soils are mainly on

uneven slopes with low bedrock escarpments, a few narrow benches, and an occasional landslip. Narrow drainageways are at the base of most slopes. Most areas are 40 to 50 percent Dekalb loam and 30 to 45 percent Westmoreland silt loam. Areas of Dekalb and Westmoreland soils occur in alternating bands on hillsides that are so intricately mixed or so narrow that it was not practical to separate them in mapping. The Dekalb soil is commonly on the steepest portion of the landscape with Westmoreland soils on lower parts of hillside positions and on narrow benches. Most areas are long and narrow and are 5 to 100 acres in size.

Typically, the Dekalb soil has a dark grayish brown, friable, loam surface layer about 6 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 15 inches thick. The substratum is yellowish brown, friable very channery sandy loam. Sandstone bedrock is at a depth of about 36 inches.

Typically, the Westmoreland soil has a dark brown, friable, silt loam surface layer about 9 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown and yellowish brown, friable silt loam and silty clay loam. The lower part is yellowish brown, firm channery silty clay loam. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Included with this soil in mapping are small areas of moderately well drained Guernsey soils with more clay in the subsoil on some less sloping areas. Also included are long, narrow bedrock escarpments on the upper part of slopes. These inclusions make up 10 to 15 percent of most areas.

Permeability is moderately rapid or rapid in the Dekalb soil and moderate in the Westmoreland soil. The Dekalb soil has a low or very low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff and good tilth. The Dekalb soil has a low organic matter content, and the Westmoreland soil has a moderately low organic matter content. The Dekalb soil has a moderately deep root zone, and the Westmoreland soil a deep root zone. The subsoil is strongly acid to extremely acid in the Dekalb soil and medium acid to very strongly acid in the Westmoreland soil.

These soils are generally unsuited to cultivated crops and hay because the slopes are too steep and uneven to manage. They are poorly suited to pasture. Controlling erosion and maintaining good stands of forage species are major concerns of management. Proper stocking rates, pasture rotation, restricted use during wet periods, timely deferment of grazing, and brush control help keep the pasture and soil in good condition.

These soils are mainly in woodland. Most areas that were once cleared of trees for pasture have reverted to woodland. These soils are moderately well suited to trees. The use of planting and logging equipment is limited by the steep slopes. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as sites for buildings and septic tank absorption fields because of the steep slopes and depth to bedrock.

These soils are in capability subclass VIe. The Dekalb soil is in woodland suitability subclass 4f on the north aspect and 5f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

DtF—Dekalb-Westmoreland complex, 40 to 70 percent slopes. This map unit consists of a moderately deep Dekalb soil and a deep Westmoreland soil on hillsides and on walls in V-shaped valleys. Most areas of these very steep, well drained soils are on uneven slopes with some areas having narrow benches, bedrock escarpments, and an occasional landslip. Dekalb loam makes up 40 to 50 percent of most areas, and Westmoreland silt loam 30 to 45 percent. Areas of the two soils occur in relatively narrow, alternating bands on hillsides. It was not practical to separate them in mapping. The Dekalb soil is commonly on the steeper, convex areas and has a few flat stones on the surface. Westmoreland soil dominates the lower, concave hillside positions and small benches. Most areas are long and narrow and range from 20 to 200 acres in size.

Typically, the Dekalb soil has a very dark grayish brown, friable, loam surface layer about 4 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, friable channery loam; the lower part is yellowish brown, friable very channery sandy loam. Sandstone bedrock is at a depth of about 29 inches.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is yellowish brown, firm channery silty clay loam. The substratum is yellowish brown, firm very channery clay loam. Olive brown, siltstone bedrock is at a depth of about 46 inches.

Included with these soils in mapping are narrow strips on benches of moderately well drained Guernsey soils. Also included are long, narrow bedrock escarpments on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

Permeability is moderately rapid or rapid in the Dekalb soil and moderate in the Westmoreland soil. The Dekalb soil has a very low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff. The Dekalb soil has a moderately deep root zone, and the

Westmoreland soil has a deep root zone. The subsoil is strongly acid to extremely acid in the Dekalb soil and very strongly acid to medium acid in the Westmoreland soil. Natural fertility is low in the Dekalb soil and medium in the Westmoreland soil. Organic matter content is low in the Dekalb soil and moderately low in the Westmoreland soil.

These soils are generally unsuited to crops, hay, or pasture because the slopes are too steep and uneven to manage.

Most areas are in woodland. Some areas that were cleared and used for pasture have reverted to woodland. These soils are moderately well suited to woodland. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The use of tree planting and mowing equipment is very difficult because the slopes are very steep and uneven. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as sites for buildings and septic tank absorption fields because of the very steep slopes and depth to bedrock.

These soils are in capability subclass VIIe. The Dekalb soil is in woodland suitability subclass 4f on the north aspect and 5f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

DuF—Dekalb-Westmoreland complex, benched, 40 to 70 percent slopes. This map unit consists of a moderately deep Dekalb soil and a deep Westmoreland soil on hillsides and on walls in V-shaped valleys. Most areas of these very steep, well drained soils are on uneven slopes with less sloping benches up to 150 feet wide and occasional bedrock escarpments. Generally, Dekalb loam makes up 40 to 50 percent of most areas and Westmoreland silt loam 25 to 45 percent. Areas of the two soils occur in relatively narrow, alternating bands on hillsides. It was not practical to separate them in mapping. The Dekalb soil is commonly on the steeper, convex areas, and it has a few flat stones on the surface. Westmoreland soil dominates the benches and lower parts of concave slopes. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the Dekalb soil has a very dark grayish brown, friable, loam surface layer about 4 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, friable channery loam; the lower part is yellowish brown, friable very channery sandy loam. Sandstone bedrock is at a depth of about 29 inches.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is yellowish brown, firm channery silty clay loam. The substratum is yellowish brown, firm very channery clay loam. Olive brown, siltstone bedrock is at a depth of about 45 inches.

Included with these soils in mapping are long, narrow strips of Guernsey and Upshur soils with more clay in the subsoil on benches. Also included are long, narrow bedrock escarpments on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

Permeability is moderately rapid or rapid in the Dekalb soil and moderate in the Westmoreland soil. The Dekalb soil has a very low available water capacity, and the Westmoreland soil has a moderate available water capacity. Both soils have very rapid runoff. The root zone is moderately deep in the Dekalb soil and deep in the Westmoreland soil. The subsoil is strongly acid to extremely acid in the Dekalb soil and very strongly acid to medium acid in the Westmoreland soil. Natural fertility is low in the Dekalb soil and medium in the Westmoreland soil. Organic matter content is low in the Dekalb soil and moderately low in the Westmoreland soil.

These soils are generally unsuited to crops, hay, or pasture because the slopes are too steep and uneven to manage.

Most areas are in woodland. Some areas that were cleared and used for pasture have reverted to woodland. These soils are moderately well suited to woodland. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The use of tree planting and mowing equipment is very difficult because of the very steep, uneven slopes. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as sites for buildings and septic tank absorption fields because of the very steep slopes and depth to bedrock.

These soils are in capability subclass VIIe. The Dekalb soil is in woodland suitability subclass 4f on the north aspect and 5f on the south aspect; the Westmoreland soil is in 2r on the north aspect and 3r on the south aspect.

DxA—Doles silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on high terraces in preglacial valleys. Most slopes are smooth and even. Areas are commonly somewhat long and narrow and are 3 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsurface layer is light brownish gray, friable silt loam about 6 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown and pale brown, mottled, friable silt loam and silty clay loam; the middle and lower

parts are yellowish brown and strong brown, mottled, firm and brittle, silty clay loam fragipan. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, firm silt loam.

Included with this soil in mapping are small areas of moderately well drained Omulga soils on slightly higher areas. These included soils make up 5 to 10 percent of most areas.

This soil has slow permeability, slow runoff, and good tilth. The shrink-swell potential is moderate. Roots are mainly restricted to the moderately deep zone above the fragipan. The available water capacity of this zone is moderate. The subsoil is commonly strongly acid above the fragipan. This soil has a moderately low organic matter content and medium natural fertility. The perched seasonal high water table is between depths of 12 and 24 inches in winter, spring, and other extended wet periods.

Most areas of this soil are farmed. This soil is well suited to corn, soybeans, and small grain. It can be cropped intensively. Removal of excess water by subsurface drains is the major concern of management. The surface layer crusts after hard rains. Returning crop residue to the soil helps maintain fertility and tilth.

This soil is well suited to grasses and legumes for hay and pasture but is poorly suited to grazing early in spring. Grazing when the soil is wet causes compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Good site preparation and control of competing vegetation can improve seedling survival rates. Trees planted should be tolerant of some wetness.

This soil is poorly suited as a site for buildings and septic tank absorption fields. Because of the seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry. Increasing the size of the absorption area, mounding the filter field, and installing drains around the absorption field help increase the absorption of effluent. Local roads and streets can be improved by using artificial drainage and a suitable base material to reduce damage from low soil strength and frost action.

This soil is in capability subclass IIw. It is in woodland suitability subclass 2o.

Dy—Dumps, mine. This unit consists mostly of nearly level to strongly sloping areas at the bottom of hillsides. It is near underground coal mines and coal processing and loading areas. Most areas are piles of coal refuse, including roof shale, underclay, rock, and coal fragments. Gullies are numerous. Most areas are long and narrow and are 3 to 10 acres in size.

Typically, the material to a depth of about 60 inches includes roof shale, underclay, rock, and coal fragments. Some areas contain acid-forming sulfur that is low in reaction and supports few, if any, plants. This material is difficult to reclaim and poses a hazard of sediment and acid drainage to local streams. Soil material used to cover these areas should be seeded with grasses or planted with trees that tolerate acid conditions and a fairly low available water capacity.

This unit has not been assigned to either a capability subclass or a woodland suitability subclass.

EbF—Elba-Brookside-Berks complex, benched, 40 to 70 percent slopes. This unit consists of very steep soils on uneven side slopes and on benches of varying width. A few siltstone escarpments occur above benches and landslips in some areas. The Elba soil is deep and well drained, the Brookside soil is deep and moderately well drained, and the Berks soil is moderately deep and well drained. Most areas are 40 to 50 percent Elba silty clay loam and 20 to 25 percent of both Brookside silt loam and Berks silt loam. Areas of the three soils are often so intricately mixed, or so small in size, that it was not practical to separate them in mapping. Elba and Berks soils commonly occur on the steeper portions of the landscape, and the Brookside soil is on the less sloping areas, including benches. Most areas are long and narrow and are 15 to 100 acres in size.

Typically, the Elba soil has a dark brown, firm, silty clay loam surface layer about 4 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown, firm silty clay; the lower part is light yellowish brown and light olive brown, firm silty clay loam. The substratum is pale olive, firm silty clay loam. Limestone bedrock is at a depth of about 42 inches.

Typically, the Brookside soil has a dark brown, friable, silt loam surface layer about 5 inches thick. The subsoil is about 48 inches thick. The upper part is strong brown, firm silty clay loam; the lower part is strong brown and yellowish brown, mottled, firm clay. The substratum, to a depth of about 60 inches, is light olive brown, mottled, firm clay.

Typically, the Berks soil has a very dark grayish brown, friable, silt loam surface layer about 5 inches thick. The subsoil is yellowish brown, friable channery silt loam and very channery silt loam about 18 inches thick. Olive brown, siltstone bedrock is at a depth of about 23 inches.

Included with these soils in mapping are narrow strips of Westmoreland soils in horizontal bands on the less sloping parts of areas and on benches. A few long, narrow escarpments are on the upper part of slopes. These inclusions make up about 15 percent of most areas.

Permeability is slow in the Elba soil, moderately slow in the Brookside soil, and moderate or moderately rapid in the Berks soil. The available water capacity is low or

moderate in the Elba soil, moderate in the Brookside soil, and very low in the Berks soil. Shrink-swell potential is high in the Elba and Brookside soils and low in the Berks soil. The Elba soil has a deep or moderately deep root zone, the Brookside soil has a deep root zone, and the Berks soil has a moderately deep root zone. The Elba soil is mildly alkaline or moderately alkaline in the subsoil. The subsoil of the Brookside soil is strongly acid to neutral in the upper part and medium acid to mildly alkaline in the lower part. The Berks soil is very strongly acid to medium acid in the subsoil. Elba and Brookside soils have a moderate organic matter content, and Berks soil is low organic matter content. The Brookside soil has a seasonal high water table between depths of 30 and 48 inches.

Nearly all areas are in woodland. Some areas, especially on the less sloping benches, that were used for pasture have reverted back to woodland. These soils are generally unsuited to row crops, small grain, hay, and pasture because of the very steep slopes. They are moderately well suited to woodland. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The wide bench positions are often suitable for logging roads. Mechanical tree planting and weed control are not practical because of the very steep and uneven slopes and the large amount of rock fragments in the Berks soil. Potential productivity is higher on north- and east-facing slopes than on south- and west-facing slopes. North- and east-facing slopes receive less exposure to the sun and prevailing winds. As a result, they are cooler and not as dry.

These soils are generally unsuited as sites for buildings and septic tank absorption fields because of the very steep slopes, slippage of the Brookside soil, and slow or moderately slow permeability and high shrink-swell potential of the Elba and Brookside soils.

These soils are in capability subclass VIIe. The Elba soil is in woodland suitability subclass 3c on the north aspect and 4c on the south aspect; the Brookside soil is in 1r on the north aspect and 2r on the south aspect; and the Berks soil is in 3f on the north aspect and 4f on the south aspect.

FaD—Fairpoint silt loam, 8 to 25 percent slopes. This strongly sloping and moderately steep, deep, well drained soil is mainly in reclaimed areas that were surface mined for coal and limestone. It has been reclaimed by grading and blanketing the surface with a layer of material from other soils. The substratum is a mixture of rock fragments and partly weathered fine earth material that was in or below the original soil. The rock fragments are mostly siltstone, shale, sandstone, some limestone, and coal. Slopes are generally smooth and convex. Most areas are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The substratum, to a depth of about 60 inches, is multicolored, friable very shaly clay loam. In some areas the soil is calcareous.

Included with this soil in mapping are small areas of the more acid Bethesda soils. These soils make up 5 to 15 percent of most areas.

This Fairpoint soil has moderately slow permeability and low available water capacity. Runoff is very rapid. The substratum, to a depth of about 60 inches, has a moderate shrink-swell potential and is medium acid to neutral. This soil has good tilth, low organic matter content, and low natural fertility.

Most areas are seeded and used for pasture or, to a lesser extent, hay. This soil is moderately well suited to small grain, hay, and pasture and poorly suited to corn. The hazard of erosion is severe if the soil is plowed for seedbed preparation. It is droughty during periods of low rainfall because of the high content of rock fragments in the substratum. The use of conservation tillage that leaves crop residue on the soil surface, no-till farming, grassed waterways, contour stripcropping, and the incorporation of crop residues into the surface layer help reduce erosion and maintain the organic matter content. Overgrazing or grazing when the soil is wet causes compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing to control weeds, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is best suited to trees that tolerate somewhat droughty conditions. Grasses and legumes provide plant cover to reduce erosion during establishment of trees. Mechanical planting and mowing reduce plant competition.

Once the soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings and poorly suited to septic tank absorption fields. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock, susceptibility to hillside slippage, and control of storm water runoff are important considerations. Areas where slopes are 15 to 25 percent are generally unsuited as sites for buildings and septic tank absorption fields because of the slope, slippage hazard, and moderately slow permeability.

This soil is in capability subclass IVs. It has not been assigned to a woodland suitability subclass.

FbE—Fairpoint shaly clay loam, 25 to 40 percent slopes. This steep, well drained, deep soil is in surface-mined areas. It is a mixture of rock fragments and partially weathered fine earth material that was in or below the original soil. The rock fragments are mostly flat and 1 to 5 inches long. Most areas are long and narrow and are 15 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly clay loam about 5 inches thick. The

substratum, to a depth of about 60 inches, is multicolored, friable very shaly clay loam.

Included with this soil in mapping are small areas of the extremely acid Barkcamp soils in long, narrow, very steep escarpments and a few very stony or very bouldery areas. Also included are small intermingled areas of the more acid Bethesda soils. These inclusions make up 10 to 20 percent of most areas.

This Fairpoint soil has moderately slow permeability, low available water capacity, and very rapid runoff. This soil has a moderate shrink-swell potential. The depth of the root zone varies within short distances because of changes in the density of the material. The substratum is medium acid to neutral. Natural fertility is low, and organic matter content is very low.

This soil is generally unsuited to hay, pasture, and commonly grown field crops because of steep slopes, droughtiness, low natural fertility, and very low organic matter content. The surface layer crusts after hard rains. Erosion is a very severe hazard. Seedlings should be mulched to reduce erosion.

Most areas are idle or are reverting to woodland and brush. This soil is best suited to trees that tolerate droughty conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting is not practical because of the steep slopes and rock fragments throughout the soil.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes, the possibility of hillside slippage, and the moderately slow permeability.

This soil is in capability subclass VIIe. It has not been assigned to a woodland suitability subclass.

FbF—Fairpoint shaly clay loam, 40 to 70 percent slopes. This very steep, well drained, deep soil is in surface-mined areas. It is a mixture of rock fragments and partially weathered fine earth material that was in or below the original soil. The rock fragments are mostly flat and 1 to 5 inches long. Most areas are long and narrow and are 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly clay loam about 5 inches thick. The substratum, to a depth of about 60 inches, is multicolored, friable very shaly clay loam and extremely shaly clay loam.

Included with this soil in mapping are a few small areas of the extremely acid Barkcamp soils, very steep escarpments, and a few very stony or very bouldery areas. Also included are small intermingled areas of the more acid Bethesda soils. These inclusions make up 10 to 20 percent of most areas.

This Fairpoint soil has moderately slow permeability, low available water capacity, and very rapid runoff. It has a moderate shrink-swell potential. The depth of the root zone varies within short distances because of changes in the density of the material. Natural fertility is low, and organic matter content is very low.

This soil is generally unsuited to hay, pasture, and commonly grown row crops because of very steep slopes, droughtiness, low natural fertility, and very low organic matter content. Erosion is a very severe hazard.

Most areas are idle or are reverting to woodland and brush. This soil is best suited to trees that tolerate droughty conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting is not practical because of very steep slopes and rock fragments throughout the soil.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the very steep slopes, the possibility of hillside slippage, and the moderately slow permeability.

This soil is in capability subclass VIIe. It has not been assigned to a woodland suitability subclass.

FcA—Fitchville silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on terraces along streams. Most slopes are smooth and even. Areas are commonly somewhat long and narrow and are 3 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper and middle parts are yellowish brown, mottled, firm silty clay loam; the lower part is yellowish brown, mottled, firm clay loam. The substratum, to a depth of about 60 inches, is dark yellowish brown, mottled, friable loam.

Included with this soil in mapping are small areas of McGary, Licking, and Glenford soils. The McGary soils have more clay in the subsoil and are in low depressional areas. The moderately well drained Licking and Glenford soils are on slightly higher areas. These included soils make up 10 to 20 percent of most areas.

This Fitchville soil has moderately slow permeability, slow runoff, and good tilth. The subsoil has a moderate shrink-swell potential and is strongly acid or medium acid in the upper part grading to neutral in the lower part. This soil has a deep root zone and a high available water capacity. The organic matter content is moderate, and natural fertility is medium. A seasonal high water table is between depths of 12 and 30 inches in fall, winter, spring, and other extended wet periods.

Most areas are farmed. This soil is well suited to corn, soybeans, and small grain if adequately drained. It may be cropped intensively. Subsurface and surface drains are commonly used to remove excess water. The surface layer crusts after hard rains. Shallow cultivation of intertilled crops will break up this crust. Returning crop residue to the soil helps maintain fertility and tilth.

This soil is well suited to hay and pasture, but poorly suited to grazing early in spring. Grazing when the soil is wet causes compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and

restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Trees planted should be tolerant of some wetness. Plant competition can be reduced by site preparation and spraying, mowing, or disking.

This soil is poorly suited as sites for buildings and septic tank absorption fields because of the seasonal wetness and moderately slow permeability. Building sites should be landscaped for good surface drainage away from foundations. Waterproofing basement walls and using drains at the base of footings will help keep basements dry. Increasing the size of the absorption area, mounding of the filter field, and installing drains around the absorption field will increase the absorption of effluent. Local roads can be improved by using artificial drainage and a suitable base material to reduce damage from frost action and low soil strength.

This soil is in capability subclass IIw. It is in woodland suitability subclass 2o.

GaC—Gallia loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on smooth, rounded ridges of high terraces in preglacial valleys. Most slopes are smooth and slightly convex. Areas are irregularly shaped and are 5 to 30 acres in size.

Typically, the surface layer is brown, friable loam about 4 inches thick. The subsurface layer is yellowish brown, friable loam about 5 inches thick. The subsoil, to a depth of about 60 inches, is strong brown and yellowish red, friable loam and firm clay loam in the upper part and yellowish red and reddish brown, firm sandy clay loam and friable sandy loam in the lower part. Some areas are moderately steep.

Included with this soil in mapping are small areas of moderately well drained Omulga and Vincent soils. Omulga soils are near the center of terraces, and Vincent soils are on the edge of mapped areas. These included soils make up 15 to 20 percent of most areas.

This Gallia soil has moderate permeability, moderate available water capacity, medium runoff, and good tilth. The upper and middle parts of the subsoil have a moderate shrink-swell potential. The subsoil is commonly strongly acid. The organic matter content is moderately low, and natural fertility is medium.

Most areas are used for row crops, small grain, hay, and pasture. This soil is moderately well suited to cropping systems of corn, small grain, and hay. The control of erosion and the maintenance of tilth and organic matter are concerns of management. Conservation tillage that leaves crop residues on the soil surface, grassed waterways, contour stripcropping, including grasses and legumes in the cropping system, and use of cover crops are used to help reduce erosion and maintain fertility and tilth.

The use of this soil for pasture can effectively control erosion. It is well suited to grazing early in spring. Maintenance of good tilth and the maximum stand of key forage species are concerns of management. Timely deferment of grazing, restricted use during wet periods, proper stocking rates, pasture rotation, and mowing for weed control will keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by good site preparation and spraying, mowing, or disking. There are no limitations to mechanical planting or harvesting of trees.

This soil is well suited as a site for buildings and septic tank absorption fields. Because of a moderate slope limitation, however, the less sloping areas should be selected for development. Damage from shrinking and swelling of the soil can be reduced by backfilling along foundations with soil material that has a low shrink-swell potential.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 1o.

GmA—Glenford silt loam, 0 to 3 percent slopes. This nearly level, deep, moderately drained soil is on slightly elevated terraces along streams. Most areas are 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown and brown, mottled, friable silt loam; the lower part is yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, firm silty clay loam and silt loam. Some areas are well drained.

Included with this soil in mapping are small areas of Fitchville and Licking soils. The somewhat poorly drained Fitchville soils are along drainageways, and Licking soils with more clay in the subsoil are on slightly higher areas. These included soils make up 5 to 15 percent of most areas.

This Glenford soil has moderate or moderately slow permeability, high available water capacity, slow runoff, and good tilth. The shrink-swell potential of the subsoil is moderate. The root zone is deep. The subsoil is very strongly acid to slightly acid. This soil has a moderately low organic matter content and medium natural fertility. The seasonal high water table is between depths of 24 and 42 inches in fall, winter, spring, and other extended wet periods.

Most areas are used for cropland. This soil is well suited to corn, soybeans, small grain, and grasses and legumes for hay and pasture. It can be cropped intensively. Surface drains should be used to remove excess surface water. Grassed waterways are needed in some areas to remove runoff from adjacent higher soils. The surface layer crusts after hard rains. Natural drainage is usually adequate for cropland, but random subsurface drains are needed in the included wetter

soils. Returning crop residues to the soil helps maintain fertility and tilth. Grazing when the soil is wet causes compaction and damage to vegetation. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by site preparation and spraying, mowing, or disking.

Some areas are in urban uses. This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness, this soil is better suited to buildings without basements than to buildings with basements. Building sites should be landscaped for good surface drainage away from foundations. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry. Damage from shrinking and swelling of the soil can be reduced by backfilling along basement walls and foundations with material that has a low shrink-swell potential. Increasing the size of the absorption area, mounding the filter field, and installing drains along the edges of the absorption field will increase the absorption of effluent. Using a suitable base material and artificial drainage will reduce the damage to local roads and streets caused by frost action and low soil strength.

This soil is in capability class I. It is in woodland suitability subclass 1o.

GmB—Glenford silt loam, 3 to 8 percent slopes. This gently sloping, deep, moderately well drained soil is on slightly elevated terraces along streams. Most areas are 5 to 15 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is brown, mottled, friable silt loam; and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, firm silty clay loam and silt loam. Some areas are well drained.

Included with this soil in mapping are small areas of Fitchville and Licking soils. The somewhat poorly drained Fitchville soils are along drainageways, and Licking soils that have more clay in the subsoil are on slightly higher areas. These included soils make up 5 to 15 percent of most areas.

This Glenford soil has moderate or moderately slow permeability, high available water capacity, medium runoff, and good tilth. The shrink-swell potential of the subsoil is moderate. The root zone is deep. The subsoil is very strongly acid to slightly acid. This soil has a moderately low organic matter content and medium natural fertility. The seasonal high water table is between depths of 24 and 42 inches in fall, winter, spring, and other extended wet periods.

Most areas are farmed. This soil is well suited to corn, soybeans, small grain, and grasses and legumes for hay and pasture. The erosion hazard is moderate if this soil is used for cultivated crops. The surface layer crusts after hard rains. Natural drainage is usually adequate for crops, but random subsurface drains are needed in the included wetter soils. This soil can be row cropped frequently if practices such as conservation tillage that leaves crop residues on the soil surface, contour farming, winter cover crops, and grassed waterways are used to reduce erosion. Returning crop residue to the soil helps maintain fertility and tilth. Overgrazing or grazing when the soil is wet causes soil compaction, excessive runoff, and poor tilth. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by site preparation and spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness, it is better suited to buildings without basements than to buildings with basements. Foundation drains and protective exterior wall coatings are used to help keep basements dry. Increasing the size of the absorption area, mounding the filter field, and installing drains along the edges of the absorption field will increase the absorption of effluent. Local roads can be improved by using artificial drainage and a suitable base material to reduce the damage caused by frost action and low soil strength.

This soil is in capability subclass IIe. It is in woodland suitability subclass 1o.

GmC—Glenford silt loam, 8 to 15 percent slopes. This strongly sloping, deep, moderately well drained soil is on slightly elevated terraces along streams. Most areas are 5 to 15 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is brown, mottled, friable silt loam; and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, firm silty clay loam and silt loam. Some areas are well drained.

Included with this soil in mapping are small areas of Fitchville and Licking soils. The somewhat poorly drained Fitchville soils are along drainageways, and Licking soils that have more clay in the subsoil are on slightly higher areas. These included soils make up 5 to 15 percent of most areas.

This Glenford soil has moderate or moderately slow permeability, high available water capacity, rapid runoff, and good tilth. The shrink-swell potential of the subsoil is moderate. The root zone is deep. The subsoil is very strongly acid to slightly acid. This soil has moderately

low organic matter content and medium natural fertility. The seasonal high water table is between depths of 24 and 42 inches in fall, winter, spring, and other extended wet periods.

Most areas are farmed. This soil is moderately well suited to corn, soybeans, small grain, and hay in a crop rotation. The erosion hazard is severe if this soil is used for cultivated crops. The surface layer crusts after hard rains. Natural drainage is usually adequate for crops, but random subsurface drains are needed in the included wetter soils. Practices such as conservation tillage that leaves crop residues on the soil surface, contour stripcropping, grassed waterways, and winter cover crops are used to help reduce erosion. Returning crop residue to the soil helps maintain fertility and tilth.

This soil is well suited to pasture. Overgrazing or grazing when the soil is wet causes soil compaction, excessive runoff, and poor tilth. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and the soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by site preparation and spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness, this soil is better suited to buildings without basements than to buildings with basements. Foundation drains and protective exterior wall coatings are used to help keep basements dry. Increasing the size of the absorption area, mounding the filter field, and installing drains along the edges of the absorption field increase the absorption of effluent. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Local roads can be improved by using artificial drainage and a suitable base material to reduce the damage from frost action and low soil strength.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 1o.

GsB—Guernsey silt loam, 3 to 8 percent slopes. This gently sloping, deep, moderately well drained soil is in long and narrow areas on ridgetops and rounded areas on knolls of uplands. Most areas are 3 to 20 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle and lower parts are dark yellowish brown and yellowish brown, firm and very firm silty clay and clay with mottles between depths of 23 and 33 inches. The substratum is yellowish brown, mottled, very firm clay. Light brownish gray, fractured, siltstone bedrock is at a depth of about 50 inches. Some areas are redder in the subsoil. A few areas have a thicker silt mantle.

Included with this soil in mapping are small areas of the well drained Woodsfield soils on the crests of a few ridges and the well drained Westmoreland soils on the edge of some areas. These included soils make up 10 to 20 percent of most areas.

Permeability of this Guernsey soil is moderately slow or slow. This soil has good tilth, moderate available water capacity, and medium runoff. It has a deep root zone and a high shrink-swell potential in the lower part of the soil. The subsoil is slightly acid to strongly acid in the upper part and strongly acid to mildly alkaline in the middle and lower parts. This soil has a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in winter, early spring, and other extended wet periods.

Most areas are farmed. This soil is well suited to cultivated crops and small grain. The erosion hazard is moderate in cultivated areas. The surface layer crusts after hard rains. Erosion is reduced by such practices as conservation tillage that leaves crop residues on the soil surface, contour farming, winter cover crops, and grassed waterways. Returning crop residue to the soil helps maintain fertility and tilth. Natural drainage is usually adequate for farming, but random subsurface drains are needed in seeps.

This soil is well suited to pasture and hay. Overgrazing or grazing when the soil is wet causes compaction, excessive runoff, and poor tilth. Plants such as alfalfa are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by good site preparation and spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. It is better suited to houses without basements than to houses with basements. Seasonal wetness and a high shrink-swell potential in the middle and lower parts of the subsoil limit the use of this soil for homesites, especially those with basements. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Septic tank absorption fields can be improved by using curtain drains, placing the field in suitable fill material, or increasing its size. Using a suitable base material will reduce the damage to local

roads and streets caused by shrinking and swelling, low strength, and frost action.

This soil is in capability subclass IIe. It is in woodland suitability subclass 2o.

GsC—Guernsey silt loam, 8 to 15 percent slopes. This strongly sloping, deep, moderately well drained soil is on ridgetops, crests of knolls on hilltops, side slopes, and on benches on hillsides. Most slopes are smooth and slightly convex. Some side slopes are concave. Most areas are long and narrow, but more rounded on knolls, and are 5 to 40 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle and lower parts are dark yellowish brown and yellowish brown, mottled, firm and very firm silty clay and clay. The substratum is yellowish brown, mottled, very firm clay. Light brownish gray, siltstone bedrock is at a depth of about 50 inches. Some areas are redder in the subsoil, and a few areas have a thicker silt mantle.

Included with this soil in mapping are small areas of the well drained Woodsfield and Upshur soils on the crests of ridges and the well drained Westmoreland soils near the edge of mapped areas. These included areas make up 10 to 20 percent of most areas.

Permeability is slow or moderately slow. This soil has a moderate available water capacity, rapid runoff, and good tilth. It has a deep root zone and a high shrink-swell potential in the lower part of the soil. The subsoil is strongly acid to slightly acid in the upper part and strongly acid to mildly alkaline in the middle and lower parts. This soil has a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in winter, early spring, and other extended wet periods.

Most areas of this soil are farmed. This soil is moderately well suited to corn, soybeans, and small grain. The erosion hazard is severe in cultivated areas. The control of erosion and the maintenance of tilth and organic matter content are major concerns of management. Practices such as conservation tillage that leaves crop residue on the soil surface, grassed waterways, grasses and legumes in the cropping system, contour stripcropping, cover crops, and the incorporation of crop residue into the plow layer are used to help reduce erosion and improve tilth.

This soil is well suited to hay and pasture. The control of erosion and the maintenance of good tilth and a maximum stand of key forage species are concerns of management. Grazing when this soil is wet causes compaction and excessive runoff. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, and mowing for weed control help keep the pasture and soil in good condition.

This soil is also well suited to woodland. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Minimizing the removal of vegetation, mulching, and making temporary seedings will help reduce erosion during construction. Seasonal wetness and high shrink-swell potential in the middle and lower parts of the subsoil limit the use of this soil for homesites, especially those with basements. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with a low shrink-swell material. Cutting and filling operations increase the hazard of hillside slippage. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the soil surface. Septic tank absorption fields can be improved by placing the field in suitable fill material or increasing the size of the field. Locating roads and streets on the contour and seeding roadcuts will help reduce erosion. Using a suitable base material will reduce the damage to local roads and streets caused by shrinking and swelling, low strength, and frost action.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

GuC—Guernsey-Upshur complex, 8 to 15 percent slopes. This map unit consists of a moderately well drained Guernsey soil and a well drained Upshur soil. These deep, strongly sloping soils are on ridgetops, side slopes, and narrow benches. Most areas are 40 to 70 percent Guernsey silt loam and 30 to 60 percent Upshur silty clay loam. These two soils are very intermixed in most areas. Areas of these soils are so intricately mixed or small in size that it was not practical to separate them in mapping. Areas are dominantly long and narrow, but some areas are more rounded on ridgetops. They are 5 to 20 acres in size.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam; the lower part is dark yellowish brown and yellowish brown, mottled, firm silty clay and clay. The substratum is yellowish brown, mottled, firm clay. Light brownish gray, siltstone bedrock is at a depth of about 50 inches. Some areas have a thicker silt mantle.

Typically, the Upshur soil has a brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm silty clay and clay about 32 inches thick. The substratum, to a depth of about 60 inches, is dark reddish brown and

reddish brown, firm silty clay loam and silty clay. Some areas are more silty in the upper part of the soil.

Included with these soils in mapping are small areas of Westmoreland soils that have less clay in the subsoil. They are on slope breaks on the edge of mapped areas. Also included are small areas of Elba soils with more lime in the subsoil on ridgetops. These included soils make up about 20 percent of most areas.

The Guernsey soil has good tilth, moderately slow or slow permeability, and a high shrink-swell potential in the lower part of the subsoil and in the substratum. The Upshur soil has fair tilth, slow permeability, and a high shrink-swell potential in the subsoil. Both soils have moderate available water capacity and rapid runoff. The root zone is deep in the Guernsey soil and moderately deep or deep in the Upshur soil. Reaction in the subsoil of both soils is higher in the lower part than in the upper part. Reaction ranges from very strongly acid to medium acid in the upper part to strongly acid to moderately alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. The Guernsey soil has a seasonal high water table between depths of 24 and 42 inches in winter, early spring, and other extended wet periods.

Most areas are farmed. These soils are moderately well suited to a cropping system of corn, small grain, and hay. The control of erosion and the maintenance of tilth and organic matter content are concerns of management. The silty clay loam surface layer of the Upshur soil becomes compact and cloddy if it is worked when wet and sticky. Conservation tillage that leaves crop residues on the soil surface, contour stripcropping, grassed waterways, and winter cover crops help improve tilth, reduce erosion, and maintain the organic matter content.

These soils are well suited to hay and pasture. Restricted use during wet periods will reduce the hazard of surface compaction and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition. Seeding by the no-till method reduces erosion.

These soils are well suited to trees. Plant competition can be reduced by spraying, mowing, or disking. Using seedlings that have been transplanted once or mulching the Upshur soil will reduce seedling mortality rates. The windthrow hazard in the Upshur soil can be reduced by proper harvesting techniques. The slippery and sticky nature of the Upshur soil limits the use of equipment. Logging can be done on this soil during the drier parts of the year.

These soils are moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Damage from shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry, especially in the Guernsey soil. Cutting and filling operations increase the hazard of hillside slippage. Using artificial drains where water collects helps to reduce this hazard. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Increasing the size of the field or placing it in suitable fill material will also increase the absorption of effluent. Using a suitable base material will reduce the damage to local roads and streets caused by frost action, low strength, and shrinking and swelling. Minimizing the removal of vegetation, mulching, or making temporary seedings will help reduce erosion during construction.

These soils are in capability subclass IIIe. The Guernsey soil is in woodland suitability subclass 2o and the Upshur soil is in 3c.

GuD—Guernsey-Upshur complex, 15 to 25 percent slopes. This map unit consists of a moderately well drained Guernsey soil and a well drained Upshur soil. These deep, moderately steep soils are on ridgetops, side slopes, and narrow benches. Most areas are 30 to 60 percent Guernsey silt loam and 20 to 50 percent Upshur silty clay loam. These two soils are very intermixed in most areas. Areas of these soils are so intricately mixed or so small in size that it was not practical to separate them in mapping. Areas are dominantly long and narrow, but are more rounded on ridgetops. Most areas are from 5 to 35 acres in size.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam; the lower part is dark yellowish brown and yellowish brown, mottled, firm silty clay and clay. The substratum is yellowish brown, mottled, firm clay. Light brownish gray, siltstone bedrock is at a depth of about 50 inches. Some areas have a thicker silt mantle.

Typically, the Upshur soil has a brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm silty clay and clay about 32 inches thick. The substratum, to a depth of about 60 inches, is dark reddish brown and reddish brown, firm silty clay loam and silty clay. Some areas are more silty in the upper part of the soil.

Included with these soils in mapping are small areas of Westmoreland soils that have less clay in the subsoil on the edge of mapped areas and Elba soils that have more lime in the subsoil on ridgetops. These included soils make up about 20 percent of most areas.

The Guernsey soil has good tilth, moderately slow or slow permeability, and a high shrink-swell potential in the lower part of the subsoil and in the substratum. The Upshur soil has fair tilth, slow permeability, and a high

shrink-swell potential in the subsoil. Both soils have moderate available water capacity and very rapid runoff. The root zone is deep in the Guernsey soil and moderately deep or deep in the Upshur soil. Reaction in the subsoil of both soils is higher in the lower part than in the upper part. It ranges from very strongly acid to medium acid in the upper part to strongly acid to moderately alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. The Guernsey soil has a seasonal high water table between depths of 24 and 42 inches in winter, early spring, and other extended wet periods.

Most areas are used for hay and pasture. These soils are poorly suited to corn and small grain and moderately well suited to hay. Controlling erosion and maintaining the organic matter content and tilth are major management concerns when these soils are cultivated. The silty clay loam surface layer of the Upshur soil becomes compact and cloddy if it is worked when wet and sticky. Limiting tillage to when the soil is within the optimum moisture range reduces the hazard of surface compaction. Good management practices include conservation tillage that leaves crop residues on the soil surface, no-till farming, grassed waterways, contour stripcropping, legumes in the cropping system, and use of cover crops.

These soils are moderately well suited to permanent pasture. Overgrazing and grazing when these soils are wet are concerns of pasture management. If these soils are grazed when wet, compaction increases runoff and soil loss. Good management practices include proper stocking rates, pasture rotation, deferment of grazing during wet periods, and mowing to control weeds.

Some areas are idle and reverting to woodland. These soils are well suited to trees. Using seedlings that have been transplanted once or mulching the Upshur soil will reduce seedling mortality rates. The windthrow hazard on the Upshur soil can be reduced by proper harvesting techniques. The slippery and sticky nature of the Upshur soil and the slope severely limit the use of equipment. Logging can be done on this soil during the drier parts of the year. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are poorly suited as a site for buildings and are generally unsuited to septic tank absorption fields because of the moderately steep slope, slow or moderately slow permeability, high shrink-swell potential, hillside seepage, and seasonal wetness of the Guernsey soil. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry, especially in the Guernsey soil. Cutting and filling increase the hazard of hillside slippage. Adding a suitable base material will reduce the damage to local roads and streets caused by low strength, frost action, and shrinking and swelling of the soils. Minimizing the removal of vegetation, mulching, or making temporary seedings will help reduce erosion during construction.

These soils are in capability subclass IVe. The Guernsey soil is in woodland suitability subclass 2r on the north aspect and 3r on the south aspect; the Upshur soil is in 3c on the north aspect and 4c on the south aspect.

HcA—Hackers silt loam, 0 to 3 percent slopes. This nearly level, well drained, deep soil is on alluvial fans and low terraces. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 30 inches thick. The upper and middle parts are yellowish red, friable and firm silty clay loam; the lower part is reddish brown, firm channery clay loam. The substratum, to a depth of about 60 inches, is reddish brown, firm channery clay loam.

Included with this soil in mapping are small areas of Moshannon and Nolin soils on flood plains. These included soils make up 5 to 15 percent of most areas.

This Hackers soil has moderate permeability, high available water capacity, slow runoff, and good tilth. The subsoil has a moderate shrink-swell potential and is medium acid or strongly acid. This soil also has a moderate organic matter content and medium natural fertility. The root zone is deep.

Most areas are used for crops or pasture. This soil is well suited to cultivated crops, small grain, and grasses and legumes for hay and pasture. This soil can be cropped intensively. Returning crop residue to the soil and planting winter cover crops help maintain fertility and tilth. When this soil is used for pasture, grazing should be restricted during wet periods to avoid excessive damage to the vegetation. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and the soil in good conditon.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

This soil is well suited as a site for buildings and septic tank absorption fields. Damage from the shrinking and swelling of the soil can be reduced by backfilling along basement walls and foundations with a material that has a low shrink-swell potential. Increasing the size of the absorption area will increase the absorption of effluent in septic tank absorption fields. Using a suitable base

material under local roads and streets will reduce the damage caused by low soil strength, frost action, and shrinking and swelling of the soil.

This soil is in capability class I. It is in woodland suitability subclass 2o.

LkB—Licking silt loam, 3 to 8 percent slopes. This gently sloping, deep, moderately well drained soil is on terraces along major streams in the county. Most areas are 3 to 15 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 47 inches thick. The upper part is brown, friable silt loam; the middle and lower parts are brown, mottled, firm silty clay and clay. The substratum, to a depth of about 60 inches, is brown, mottled, stratified, firm clay and silty clay. Some areas have more lime in the subsoil or a browner subsoil.

Included with this soil in mapping are small areas of McGary, Glenford, and Omulga soils. The somewhat poorly drained McGary soils are on the lower parts of slopes. Glenford and Omulga soils have more silt in the subsoil. They are on the edge of mapped areas. These included soils make up 5 to 20 percent of most areas.

This soil has slow permeability, moderate available water capacity, medium runoff, and good tilth. The shrink-swell potential in the middle and lower parts of the soil is high. The root zone is deep. The subsoil ranges from strongly acid to slightly acid. This soil has a moderate organic matter content, medium natural fertility, and a seasonal high water table between depths of 24 and 42 inches in winter, spring, and other extended wet periods.

Most areas are farmed. This soil is moderately well suited to corn, soybeans, and small grain. It can be row cropped frequently, but management practices are needed to reduce the moderate erosion hazard. The surface layer crusts after hard rains. Erosion is reduced by using conservation tillage that leaves crop residues on the soil surface, contour farming, winter cover crops, and grassed waterways. Returning crop residue to the soil helps maintain tilth and fertility. Random subsurface drains are needed in the included wetter soils.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet can cause surface compaction, increased runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing to control weeds, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if plant competition is reduced by spraying, disking, or mowing.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields because of the slow permeability, seasonal wetness, and the high shrink-swell potential in the middle and lower parts of the soil. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Septic tank absorption fields can be improved by using curtain drains, placing the field in suitable fill material, or increasing the size of the field. Using artificial drainage and a suitable base material will reduce the damage to local roads and streets caused by shrinking and swelling, low strength, and frost action.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

LkC—Licking silt loam, 8 to 15 percent slopes. This strongly sloping, deep, moderately well drained soil is on terraces along major streams and on slope breaks on terraces. Most slopes are smooth and slightly convex. Most areas are long and narrow and range from 3 to 10 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsurface layer is yellowish brown, friable silt loam about 5 inches thick. The subsoil is brown, mottled, firm silty clay and clay about 32 inches thick. The substratum, to a depth of about 74 inches, is brown, mottled, firm, stratified silty clay and clay. In some areas the subsoil has more lime or is browner.

Included with this Licking soil in mapping are small areas of Glenford and Omulga soils that have more silt in the subsoil. These soils are on the edge of the mapped areas and make up 5 to 20 percent of most of them.

This soil has slow permeability, moderate available water capacity, medium runoff, and good tilth. The shrink-swell potential is high in the middle and lower parts of the soil. The root zone is deep. The subsoil ranges from strongly acid to slightly acid. This soil has a moderate organic matter content, medium natural fertility, and a seasonal high water table between depths of 24 and 42 inches in winter, spring, and other extended wet periods.

Most areas are farmed. This soil is poorly suited to continuous corn and small grain crops. These crops can be grown in a cropping system with hay. The erosion hazard is severe if this soil is used for cultivated crops. The surface layer crusts after hard rains. The control of erosion and the maintenance of tilth and organic matter content are concerns of management. Conservation tillage that leaves crop residue on the soil surface, grassed waterways, contour stripcropping, and cover crops are used to help reduce erosion and maintain tilth.

This soil is moderately well suited to pasture and hay. Grazing when this soil is wet causes soil compaction and increased runoff. Proper stocking rates, pasture rotation,

and mowing for weed control help keep the pasture and soil in good condition.

This soil is well suited to woodland. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields because of the slow permeability, seasonal wetness, and high shrink-swell potential in the middle and lower parts of the soil. Foundation drains and protective exterior wall coatings are used to help keep basements dry. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Laying the distribution lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. Placing the absorption field in suitable fill material and increasing the size of the field will increase the absorption of effluent. Using artificial drainage and a suitable base material will reduce the damage to local roads and streets caused by low soil strength, frost action, and shrinking and swelling of the soil.

This soil is in capability subclass IVe. It is in woodland suitability subclass 2o.

McA—McGary silt loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained, deep soil is on terraces along major streams. Most areas range from 3 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is strong brown and yellowish brown, mottled, firm and very firm silty clay and clay about 44 inches thick. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, firm clay loam.

Included with this soil in mapping most areas are small areas of Licking and Fitchville soils. The moderately well drained Licking soils are near slope breaks. Fitchville soils have some clay in the subsoil and are on the edge of mapped areas. These included soils make up 10 to 20 percent of most areas.

This McGary soil has slow or very slow permeability, moderate available water capacity, slow runoff, and good tilth. The root zone is deep. The shrink-swell potential is high. The subsoil is strongly acid or medium acid. This soil has a moderate organic matter content and medium natural fertility. A seasonal high water table is between depths of 12 and 36 inches in winter, spring, and other extended wet periods.

Most areas are farmed. This soil is moderately well suited to corn, soybeans, and small grain. Wetness and slow or very slow permeability limit the use of this soil for crops. Surface and subsurface drains are used to remove excess water. The surface layer crusts after hard rains. Returning crop residue to the soil helps to maintain fertility and tilth. Restricting tillage to when the soil is within the optimum moisture range reduces the hazard of surface compaction.

This soil is poorly suited to grazing early in spring. Grazing when the soil is wet causes soil compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing to control weeds, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Trees planted should be tolerant of high clay content in the subsoil. Plant competition can be reduced by spraying, mowing, or disking. The windthrow hazard can be reduced by proper harvesting techniques. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rates.

This soil is poorly suited as a site for buildings and is generally unsuited to septic tank absorption fields because of the slow or very slow permeability, high shrink-swell potential, and seasonal wetness. Building sites should be landscaped for good surface drainage away from foundations. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Foundation drains and protective exterior wall coatings are used to help keep basements dry. Local roads can be improved by using artificial drainage and a suitable base material to reduce the damage from low soil strength and shrinking and swelling of the soil.

This soil is in capability subclass IIIw. It is in woodland suitability subclass 2c.

Mh—Melvin silt loam, frequently flooded. This nearly level, deep, poorly drained soil is on flood plains. It is frequently flooded. Slopes range from 0 to 3 percent. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 4 inches thick. The subsoil is grayish brown and light gray, mottled, friable silt loam about 24 inches thick. The substratum, to a depth of about 60 inches, is light gray, mottled, friable silty clay loam. Some areas are somewhat poorly drained and are not as gray in the subsoil.

This soil has moderate permeability, high available water capacity, and good tilth. It has a deep root zone. The subsoil is medium acid or slightly acid. This soil has a moderate organic matter content, medium natural fertility, and a seasonal high water table near or above the surface in winter, spring, and other extended wet periods. Runoff is very slow or ponded.

Many areas are used for pasture. Undrained areas are generally unsuited to crops and poorly suited to pasture. If the soil is protected from flooding and extensive artificial drainage is provided, it is suited to crops and

hay. Subsurface drains are commonly used to remove excess surface water. Good outlets for subsurface drains are not available in most areas. This soil is poorly suited to grazing early in spring. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition.

Many areas of this soil that were cleared for farming are reverting to brush and woodland. Undrained areas are poorly suited to woodland but are suited to habitat for wetland wildlife. Ponding and flooding severely limit the use of planting and logging equipment. Trees planted should be tolerant of flooding and ponding.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of ponding and flooding.

This soil is in capability subclass Vw. It is in woodland suitability subclass 4w.

Mp—Moshannon silt loam, frequently flooded. This deep, well drained, nearly level soil is on flood plains. It is frequently flooded. Slopes range from 0 to 3 percent. Areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is yellowish red and reddish brown, friable silt loam about 26 inches thick. The substratum, to a depth of about 60 inches, is reddish brown, firm gravelly clay loam. In some areas the soil is not as red, and it is moderately well drained and has gray mottles in the lower part of the subsoil.

Included with this soil in mapping are small areas of Nolin and Newark soils that are not as red throughout. Areas of the Nolin soils are intermingled with areas of the Moshannon soil, and the Newark soils are in low spots and former stream channels. These included soils make up 10 to 20 percent of most areas.

This Moshannon soil has moderate permeability, high available water capacity, slow runoff, and good tilth. The root zone is deep, and the subsoil is medium acid or slightly acid. The organic matter content is moderately low, and natural fertility is medium. A seasonal high water table is between depths of 48 and 72 inches in late winter and other extended wet periods.

Most areas are farmed. This soil is well suited to cultivated crops and grasses and legumes for hay and pasture. Frequent winter and spring floods damage fall-planted small grain. When this soil is used for cultivated crops, it can be cropped intensively. Returning crop residue to the soil helps maintain fertility and tilth. This soil crusts after hard rains. Shallow cultivation of intertilled crops will break up this crust. When used for pasture, restricted use during wet periods will reduce the hazard of surface compaction and damage to the vegetation. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by site preparation and spraying, disking, and mowing. There are no limitations to planting or harvesting trees.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the frequent flooding. During the nonflooding period, it is suited to such recreational facilities as paths and trails. Local roads and streets can be constructed on filled areas above expected high flood levels.

This soil is in capability subclass IIw. It is in woodland suitability subclass 1o.

NeC—Negley loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on side slopes of high outwash terraces. Slopes are smooth and slightly convex. Most areas are long and narrow and range in size from 5 to 25 acres.

Typically, the surface layer is brown, friable loam about 4 inches thick. The subsoil, to a depth of about 60 inches, is yellowish brown and strong brown, friable loam and gravelly loam in the upper part and strong brown, friable gravelly sandy clay loam and gravelly sandy loam in the middle and lower parts. Some areas are more sloping.

Included with this soil in mapping are small areas of Parke soils that have a thick silt mantle on less sloping terrace positions. These included soils make up 5 to 15 percent of most areas.

This Negley soil has moderate or moderately rapid permeability, moderate available water capacity, medium runoff, and good tilth. The root zone is deep. The subsoil is medium acid or strongly acid. The organic matter content is moderately low, and natural fertility is medium.

Most areas are cleared and used for crops and pasture. This soil is moderately well suited to a cropping system of corn, small grain, and hay. The erosion hazard is severe if this soil is used for cultivated crops. Conservation tillage that leaves crop residue on the soil surface, grassed waterways, contour stripcropping, meadow in the cropping system, and use of cover crops help reduce erosion and maintain the organic matter content.

These soils are well suited to permanent pasture. The control of erosion and the maintenance of a maximum stand of key forage species are concerns of management. Proper stocking rates, rotation of pastures, mowing for weed control, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by site preparation and mowing, spraying, or disking.

Some areas are used for urban uses. This soil is well suited as a site for buildings and septic tank absorption fields. Because of the moderate slope limitation, areas selected for development should be on the less sloping

areas. Laying out septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. This soil is a potential source of sand and gravel.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 1o.

NgE—Negley gravelly loam, 25 to 40 percent slopes. This deep, steep, well drained soil is on side slopes of high outwash terraces. Most areas are long and narrow and range from 20 to 50 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 4 inches thick. The subsoil, to a depth of about 60 inches, is yellowish red and strong brown, friable gravelly clay loam and gravelly loam in the upper part and brown, friable gravelly clay loam in the lower part. Some areas are moderately deep over bedrock.

Included with this soil in mapping are small areas of Parke soils with a thick mantle near the edge of mapped areas. Also included are well drained soils with bedrock between depths of 10 and 20 inches. These included soils make up 5 to 15 percent of most areas.

This Negley soil has moderate or moderately rapid permeability, moderate available water capacity, very rapid runoff, good tilth, low organic matter content, and medium natural fertility. The root zone is deep. The subsoil is medium acid or strongly acid.

A few areas are in permanent pasture. This soil is generally unsuited to cultivated crops, small grain, and hay because the slopes are too steep and uneven to be managed. It is poorly suited to permanent pasture. Pasture improvement is difficult. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing are good management practices.

Most areas are in woodland. This soil is well suited to trees. Mechanical planting, weed control, and harvesting are limited by the steep slopes. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes. It is a potential source of sand and gravel at a depth of 7 to 13 feet.

This soil is in capability subclass VIe. It is in woodland suitability subclass 1r.

Nn—Newark silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains. It is frequently flooded. Slopes range from 0 to 3 percent. Most areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the lower part is dark grayish brown and yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, firm silty clay loam. Some areas are moderately well drained and have fewer gray mottles in the upper part of the subsoil. A few areas are poorly drained and are grayer in the subsoil. Some areas are sandier and not as silty in the subsoil.

Included with this soil in mapping are small areas of well drained Nolin soils in slightly elevated areas. These included soils make up about 10 percent of most areas.

This Newark soil has moderate permeability, high available water capacity, very slow runoff, and good tilth. The root zone is deep. The subsoil is medium acid to neutral. This soil has moderate organic matter content, medium natural fertility, and a seasonal high water table between depths of 6 and 18 inches in fall, winter, spring, and other extended wet periods.

Most areas are farmed. Drained areas are well suited to row crops and grasses and legumes for hay and pasture. Row crops can be grown year after year if the soil is adequately drained and flooding is controlled or crops are planted after the normal period of flooding. Winter grain crops are limited by the flooding hazard. Subsurface drains are used to improve drainage. This soil crusts after hard rains. Returning crop residues helps maintain fertility and tilth. Restricted grazing during wet periods will reduce surface compaction and damage to plants.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by site preparation and spraying, disking, or mowing. Trees planted should be tolerant of some wetness.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of flooding and seasonal wetness. Constructing local roads and streets on filled areas above the expected high flood levels and using a suitable fill material will reduce the damage caused by low soil strength and flooding.

This soil is in capability subclass IIw. It is in woodland suitability subclass 1o.

No—Nolin silt loam, frequently flooded. This deep, well drained, nearly level soil is on flood plains. It is frequently flooded (fig. 8). Slopes range from 0 to 3 percent. Areas are long and narrow and are 10 to more than 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 37 inches thick. The upper part is dark brown, firm silty clay loam; the lower part is dark yellowish brown, friable silt loam. The substratum, to a depth of about 60 inches, is dark yellowish brown, friable silt loam. Some areas are moderately well drained and have gray mottles in the lower part of the subsoil. A few areas have more sand and less silt in the subsoil.

Figure 8.—Flooding on Nolin silt loam, frequently flooded. Westmoreland and Guernsey soils are on the hillsides.

Included with this soil in mapping are small areas of somewhat poorly drained Newark soils and poorly drained Melvin soils in lower positions near streams, in old stream channels, and in backwater areas. These included soils make up 10 to 20 percent of most areas.

This Nolin soil has moderate permeability, high available water capacity, slow runoff, and good tilth. It has a deep root zone. The subsoil is medium acid to neutral. This soil has a moderate organic matter content, high natural fertility, and a seasonal high water table between depths of 36 and 72 inches in late winter and other extended wet periods.

Most areas are farmed. This soil is well suited to cultivated crops and grasses and legumes for hay and pasture. Winter grain crops are limited by flooding. This soil can be row cropped intensively since the flooding is commonly of short duration and occurs during winter and spring. Returning crop residue to the soil helps maintain fertility and tilth. When this soil is used for pasture, restricted use during wet periods will reduce the hazards of surface compaction and damage to the vegetation. Proper stocking rates, pasture rotation, and timely deferment of grazing help keep the pasture in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by site preparation and spraying, disking, or mowing.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the frequent flooding. During the nonflooding period, it is suited to such recreational facilities as paths and trails. Local roads and streets can be constructed on fill material above expected high flood levels.

This soil is in capability subclass IIw. It is in woodland suitability subclass 1o.

Or—Orrville silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains along minor streams. It is frequently flooded. Slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is brown and grayish brown, mottled, friable loam about 27 inches thick. The substratum, to a depth of about 60 inches, is yellowish brown, mottled, friable loam and gray, stratified, friable loamy sand and silty clay loam. Some areas are moderately well drained and do not have gray mottles in the upper part of the subsoil. A few areas are poorly drained and grayer in the subsoil.

Included with this soil in mapping are small areas of well drained Chagrin soils in narrow bands along streams. These included soils make up about 15 percent of most areas.

This Orrville soil has a moderate or high available water capacity, very slow runoff, and good tilth. Permeability is moderate. The subsoil is strongly acid to slightly acid. The root zone is deep. The organic matter content is moderate, and natural fertility is medium. The seasonal high water table is between depths of 12 and 30 inches in fall, winter, spring, and other extended wet period.

Most areas are farmed. Drained areas are well suited to row crops and grasses and legumes for hay and pasture. Row crops can be grown year after year if the soil is adequately drained and flooding is controlled or crops are planted after the normal period of flooding. Winter grain crops are limited by the flooding hazard. Subsurface drains are used to improve drainage. This soil crusts after hard rains. Returning crop residues to the soil helps maintain fertility and tilth. Restricted grazing during wet periods will reduce the hazards of surface compaction and damage to plants. Proper stocking rates, pasture rotation, and mowing to control weeds also help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by site preparation and spraying, disking, or mowing. Trees planted should be tolerant of some wetness.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of flooding and seasonal wetness. Constructing local roads and streets on fill material above the expected high flood levels and using a suitable base material will reduce the damage from flooding and frost action.

This soil is in capability subclass IIw. It is in woodland suitability subclass 2o.

OtB—Omulga silt loam, 3 to 8 percent slopes. This gently sloping, deep, moderately well drained soil is on high terraces in preglacial valleys. Slopes are smooth and uniform. Most areas are irregularly shaped and are 7 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable silt loam with mottles below a depth of about 15 inches; the middle part is a yellowish brown, mottled, firm and brittle, clay loam fragipan; and the lower part is yellowish brown and strong brown, mottled, firm silty clay loam. The substratum, to a depth of about 60 inches, is brownish yellow, firm silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Doles soils along drainageways. Also included are areas of Licking soils with a higher clay content in the subsoil on slightly higher areas. Vincent soils with a reddish subsoil containing more clay are included on the edge of mapped areas in the eastern part of the county. These included soils make up 10 to 15 percent of most areas.

This Omulga soil has slow permeability, medium runoff, and good tilth. The shrink-swell potential is moderate. The root zone is mainly restricted to the moderately deep zone above the fragipan. This zone has a low available water capacity. The subsoil above the fragipan is commonly strongly acid or very strongly acid. This soil has a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in winter, spring, and other extended wet periods.

Most areas of this soil are farmed. This soil is well suited to cultivated crops and small grain. The erosion hazard is moderate when this soil is cultivated. This soil is subject to surface crusting. It can be cropped frequently when erosion is reduced by practices such as conservation tillage that leaves crop residues on the soil surface, contour farming, winter cover crops, and grassed waterways. Returning crop residue to the soil helps to maintain fertility and tilth. Random subsurface drains are needed in the included wetter soils.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when this soil is wet causes compaction, excessive runoff, and poor tilth. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by site preparation and spraying, mowing, or disking. There are no hazards or limitations to planting or harvesting trees.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of the seasonal wetness, it is better suited to houses without basements than to houses with basements. Foundation drains and protective exterior wall coatings are used to help keep basements dry. Increasing the size of the absorption area, mounding the filter field, and installing curtain drains help increase the absorption of effluent. Local roads can be improved by using artificial drainage and a suitable base material to

reduce the damage from low soil strength and frost action.

This soil is in capability subclass IIe. It is in woodland suitability subclass 2o.

OtC—Omulga silt loam, 8 to 15 percent slopes. This strongly sloping, deep, moderately well drained soil is on high terraces in preglacial valleys. Slopes are smooth and uniform. Most areas are long and narrow or irregularly shaped and are 3 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam; the middle part is a yellowish brown, mottled, firm and brittle, silty clay loam fragipan; and the lower part is a yellowish brown, mottled, firm silty clay loam. The substratum, to a depth of about 70 inches, is light brownish gray, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Doles soils on areas that are more nearly level and along drainageways. Also included are areas of Licking soils that have more clay in the subsoil and are in slightly higher areas. Vincent soils with a reddish subsoil that contains more clay are included on the edge of mapped areas in the eastern part of the county. These included soils make up 10 to 15 percent of most areas.

This Omulga soil has slow permeability, good tilth, and rapid runoff. The shrink-swell potential is moderate. Roots are mainly restricted to the moderately deep zone above the fragipan. This zone has a low available water capacity and is commonly strongly acid or very strongly acid. This soil has moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in winter, spring, and other extended wet periods.

Most areas of this soil are farmed. This soil is moderately well suited to cultivated crops and small grain. The erosion hazard is severe in cultivated areas. Conservation tillage that leaves crop residue on the soil surface, contour stripcropping, winter cover crops, and grassed waterways are good management practices to reduce erosion. Returning crop residue to the soil helps to maintain fertility and tilth. Random subsurface drains are needed in the included wetter soils.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Deep-rooted legumes are subject to frost heaving. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by site preparation and spraying, mowing, or disking. This soil is well suited to mechanical planting and harvesting.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited as a site for buildings without basements than to buildings with basements. Foundation drains and protective exterior wall coatings are used to help keep basements dry. Enlarging absorption areas, mounding the filter field, and installing curtain drains help increase the absorption of effluent. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Local roads can be improved by artificial drainage and using suitable base materials.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

PaB—Parke silt loam, 2 to 6 percent slopes. This well drained, deep, gently sloping soil is on terraces. Most areas are undulating or have uniform slopes. They range in size from 10 to 30 acres.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsurface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil, to a depth of about 60 inches, is yellowish brown and brown, friable silt loam and loam. It is mottled below a depth of about 52 inches. In some areas the silt mantle is thicker.

Included with this soil in mapping are small areas of the Negley soils that are sandier in the upper part of the subsoil and are near terrace breaks. Also included are small areas of the moderately well drained Omulga soils on toe slopes and the somewhat poorly drained Doles soils in slightly depressed areas. These included areas make up 10 to 20 percent of most areas.

This Parke soil has moderate permeability, high available water capacity, medium runoff, and good tilth. The root zone is deep. The upper part of the subsoil has moderate shrink-swell potential. The subsoil is strongly acid or very strongly acid. This soil has a moderately low organic matter content and medium natural fertility.

Most areas are used for crops. This soil is well suited to cultivated crops, small grain, and grasses and legumes for hay and pasture. It can be cropped frequently. The erosion hazard is moderate, if this soil is cultivated. Conservation tillage that leaves crop residues on the soil surface, winter cover crops, and grassed waterways are used to help reduce erosion. Returning crop residue to the soil helps maintain fertility and tilth. When used for pasture, restricted use during wet periods will reduce the hazards of soil compaction and damage to the plants. Proper stocking rates, pasture rotation, and timely deferment of grazing keep the pasture in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by site preparation and spraying, disking, or mowing.

Some areas are used for urban uses. This soil is well suited as a site for buildings and septic tank absorption fields. It provides some of the best building sites in the county. Damage from shrinking and swelling of the soil can be reduced by backfilling along foundations with a material that has a low shrink-swell potential. Using a suitable base material under local roads and streets will reduce the damage caused by frost action and low soil strength.

This soil is in capability subclass IIe. It is in woodland suitability subclass 1o.

Pg—Pits, gravel. This map unit consists of nearly level to very steep areas on terraces from which gravel and sand have been taken or are presently being taken for use in construction. Actively mined pits are continually being enlarged. Most pits are long and narrow to broad and range from 5 to 60 acres in size.

The material that is mined consists of stratified layers of gravel and sand of varying thickness and orientation. The kind and grain size of aggregates are generally uniform within any one layer but differ from layer to layer.

Because the soils around pits are commonly disturbed during excavation, erosion is a severe hazard. Uncontrolled runoff results in gullying and siltation of lower areas, nearby drainageways, and gravel pits. The material remaining after mining is poorly suited to plant growth. Available water capacity and organic matter content are very low.

Some of the pits are filled with water and are potentially suitable for development of wildlife habitat or for water-related uses. Some areas that are no longer being mined support weeds and trees.

This unit has not been assigned to either a capability subclass or a woodland suitability subclass.

RcC—Richland loam, 8 to 15 percent slopes. This strongly sloping, well drained, deep soil is primarily on foot slopes of very steep hillsides. Some areas are on fans of small drainageways. Most slopes are slightly uneven. Areas are commonly long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and strong brown, friable channery loam; the lower part is yellowish brown, firm channery clay loam. The substratum, to a depth of about 60 inches, is strong brown, firm channery clay loam. In a few areas stones on the surface interfere with cultivation.

Included with this soil in mapping are narrow strips of Brookside, Dekalb, and Steinsburg soils. Brookside soils have more clay in the subsoil and Dekalb and Steinsburg soils have less clay and more sand in the subsoil. These included soils make up 15 to 25 percent of most areas.

This Richland soil has moderate permeability and available water capacity and rapid runoff. It has good tilth and moderate shrink-swell potential. This soil has a deep root zone, moderately low organic matter content, and medium natural fertility. Reaction in the subsoil is strongly acid or medium acid. A seasonal high water table is between depths of 36 and 72 inches in winter, spring, and other extended wet periods.

Most areas are farmed. This soil is moderately well suited to cropping systems of corn, small grain, and hay. The erosion hazard is severe in cultivated areas. Erosion is reduced by conservation practices such as conservation tillage that leaves crop residues on the soil surface, grassed waterways, contour stripcropping, including grasses and legumes in the cropping system, use of cover crops, and the incorporation of crop residues into the plow layer.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of some seasonal wetness, it is better suited to houses without basements than to houses with basements. Using exterior basement wall coatings will help keep basements dry. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Damage from shrinking and swelling of the soil can be reduced by backfilling along foundations with a material that has a low shrink-swell potential and using extra reinforcement in foundations. Using a suitable base material under local roads and streets will reduce the damage from low soil strength and frost action. Septic tank absorption can be improved by using drains around the edges of the field. Installing distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Increased runoff and erosion occur during construction, but these can be reduced by maintaining plant cover wherever possible.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

RcD—Richland loam, 15 to 25 percent slopes. This moderately steep, deep, well drained soil is on foot slopes of very steep hillsides. Slopes are dominantly irregular. Most areas are long and narrow and are 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable loam and silt loam; the lower part is dark yellowish brown, friable channery silt loam. The substratum, to a depth of about 60 inches, is yellowish brown, firm channery clay loam.

Included with this soil in mapping are narrow bands of Brookside soils and small areas of Dekalb and Steinsburg soils. Brookside soils have more clay in the subsoil and Dekalb and Steinsburg soils have less clay and more sand in the subsoil. These included soils make up 15 to 20 percent of most areas.

This Richland soil has moderate permeability and available water capacity and very rapid runoff. It has good tilth and moderate shrink-swell potential. The root zone is deep. The subsoil is strongly acid or medium acid. This soil has a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 36 and 72 inches in winter, spring, and other extended wet periods.

Many areas are in pasture. This soil is moderately well suited to hay and pasture and a cropping system of corn, small grain, and hay. The slope and erosion hazard are concerns of management. Using conservation tillage that leaves crop residue on the soil surface, no-till farming, cover crops, grassed waterways, and returning crop residue to the soil help to maintain the organic matter content and reduce erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition.

Many areas are in woodland. This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by spraying, mowing, or disking. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars.

This soil is poorly suited as a site for buildings and septic tank absorption fields. Buildings should be designed to conform to the natural slope of the land. Using exterior basement wall coatings will help keep basements dry. Backfilling along foundations with a material that has a low shrink-swell potential and using extra reinforcements in foundations will reduce the damage from shrinking and swelling of the soil. Using a suitable base material under local roads and streets will reduce the damage from low soil strength and frost action. Installing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. To reduce erosion, plant cover should be maintained on the site as much as possible during construction.

This soil is in capability subclass IVe. It is in woodland suitability subclass 2r.

RcE—Richland loam, 25 to 40 percent slopes. This deep, steep, well drained soil occurs in long, narrow bands at the base of very steep hillsides. Some areas are on both sides of small streams in narrow valleys. Slopes are irregular and are cut by drainageways. The upper parts of slopes are generally concave, and the lower parts are convex. Most areas are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable loam and silt loam; the lower part is dark yellowish brown, friable channery silt loam. The substratum, to a depth of about 60 inches, is yellowish brown, firm channery clay loam.

Included with this soil in mapping are small areas of Brookside, Vandalia, and Steinsburg soils on the edge of mapped areas. Small surface landslips, or surface creep, are associated with Brookside and Vandalia soils that have more clay in the subsoil than this soil. Steinsburg soils have more sand in the subsoil and are moderately deep over bedrock. These included soils make up 15 to 20 percent of most areas.

This Richland soil has moderate permeability, moderate available water capacity, very rapid runoff, good tilth, and moderate shrink-swell potential. The root zone is deep. The subsoil is strongly acid or medium acid. The organic matter content is moderately low, and natural fertility is medium. A seasonal high water table is between depths of 36 and 72 inches in wet periods.

A few areas are in pasture. This soil is generally unsuited to cultivated crops because the slopes are too steep and uneven to manage. This soil is poorly suited to pasture. Overgrazing or grazing when the soil is wet causes soil compaction and excessive erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition. Seeding by the no-till method reduces erosion.

Most areas are used for woodland. This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by site preparation and spraying. The slope limits the use of planting and logging equipment. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes, moderate shrink-swell potential, and some seasonal wetness.

This soil is in capability subclass VIe. It is in woodland suitability subclass 2r.

StD—Steinsburg sandy loam, 15 to 25 percent slopes. This moderately steep, moderately deep, well drained soil is on knolls and the upper parts of hillsides. Slopes are commonly convex and smooth. Most areas are long and narrow, but on ridgetop knolls the areas are more rounded. They are 5 to 25 acres in size.

Typically, the surface layer is dark brown, loose sandy loam about 5 inches thick. The subsoil is yellowish brown, very friable sandy loam and channery sandy loam about 14 inches thick. The substratum is yellowish brown, very friable channery sandy loam. Yellowish brown, sandstone bedrock is at a depth of about 37 inches.

Included with this soil in mapping are small areas of deep Clymer soils on less sloping areas. Also included are a few eroded areas that are shallow over sandstone bedrock and some sandstone bedrock outcroppings on

the upper part of slopes. These inclusions make up 15 to 20 percent of most areas.

This Steinsburg soil has moderately rapid permeability, low or very low available water capacity, very rapid runoff, and fair tilth. It has a low organic matter content and low natural fertility. This soil has a moderately deep root zone, and the subsoil is strongly acid or very strongly acid.

Some areas are used for hay and pasture. This soil is poorly suited to cultivated crops and small grain because of the moderately steep slopes, bedrock between depths of 24 and 40 inches, and low or very low available water capacity. It is moderately well suited to hay and pasture and is well suited to grazing early in spring. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, and restricted grazing during extended dry periods help keep the pasture and soil in good condition.

Most areas are used for woodland. This soil is moderately well suited to trees. Mechanical planting, weed control, and harvesting are possible on this soil. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. Trees planted should be tolerant of dry conditions.

This soil is poorly suited as a site for buildings and generally unsuited to septic tank absorption fields because of the moderately steep slopes and bedrock between depths of 24 and 40 inches. Buildings should be designed to conform to the natural slope of the land. To reduce erosion, plant cover should be maintained on the site as much as possible during construction.

This soil is in capability subclass IVe. It is in woodland suitability subclass 3r.

StE—Steinsburg sandy loam, 25 to 40 percent slopes. This steep, moderately deep, well drained soil is on hillsides, knolls, and side slopes along small drainageways. Most slopes are smooth and convex and are dissected by small drainageways. Stones are on the surface near some slope breaks. Most areas are long and narrow, but the areas on knolls are somewhat rounded. Areas are 10 to 50 acres in size.

Typically, the surface layer is dark brown, loose sandy loam about 5 inches thick. The subsoil is yellowish brown, very friable sandy loam and channery sandy loam about 14 inches thick. The substratum is yellowish brown, very friable channery sandy loam. Yellowish brown, sandstone bedrock is at a depth of about 37 inches.

Included with this soil in mapping are small areas of deep Clymer soils on less sloping areas and deep Richland and Westmoreland soils on lower parts of hillsides and along deeply dissected drainageways. Also included are a few bedrock outcroppings on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

This Steinsburg soil has moderately rapid permeability, low or very low available water capacity, very rapid runoff, and fair tilth. It has a low organic matter content and low natural fertility. This soil has a moderately deep root zone, and the subsoil is strongly acid or very strongly acid.

This soil is generally unsuited to cultivated crops, small grain, and hay because of the steep slopes, low or very low available water capacity, and bedrock between depths of 24 and 40 inches. It is poorly suited to pasture. Controlling erosion and maintaining key forage species are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during extended dry periods help keep the pasture in good condition.

Most areas are in woodland, but in the past approximately 60 percent of the area had been cleared and used for pasture. This soil is moderately well suited to trees. Trees planted should be tolerant of dry conditions. Erosion can be reduced by practices such as placing logging roads and skid trails on or near the contour and using water bars.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the steep slope and bedrock between depths of 24 and 40 inches.

This soil is in capability subclass VIIe. It is in woodland suitability subclass 3r.

StF—Steinsburg sandy loam, 40 to 70 percent slopes. This very steep, moderately deep, well drained soil is on hillsides and along small drainageways. Slopes are smooth and convex and dissected by small drainageways. Stones are on the surface near some slope breaks. Most areas are long and narrow and are 10 to 100 acres in size.

Typically, this soil has a dark brown, loose, sandy loam surface layer about 5 inches thick. The subsoil is yellowish brown, very friable sandy loam and channery sandy loam about 14 inches thick. The substratum is yellowish brown, very friable channery sandy loam. Yellowish brown, sandstone bedrock is at a depth of about 37 inches.

Included with this soil in mapping are areas of deep Richland and Westmoreland soils on lower parts of hillsides and in deep drainageways. Also included are a few bedrock outcroppings on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

This Steinsburg soil has moderately rapid permeability, low or very low available water capacity, and very rapid runoff. It has low organic matter content and natural fertility. This soil has a moderately deep root zone, and the subsoil is strongly acid or very strongly acid.

This soil is generally unsuited to crops, hay, and pasture because the slopes are too steep and uneven to manage.

Most areas are in woodland. This soil is moderately well suited to woodland. The erosion hazard is severe. Placing logging roads and skid trails on the contour will reduce erosion. Mechanical tree planting and weed control are not practical because of the very steep, uneven slopes.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of the very steep slope and bedrock between depths of 24 and 40 inches.

This soil is in capability subclass VIIe. It is in woodland suitability subclass 3r.

Ud—Udorthents, loamy. These soils occur as areas of cut and fill. They are mainly in areas of construction, in landfills, and in low areas adjacent to streams. In areas that have been cut, the remaining soil material is similar to the subsoil or substratum of adjacent soils. In fill or disposal areas the characteristics of the soil material are more varied, and this material generally is the subsoil and substratum of nearby soils. Slopes range from 0 to 70 percent. Most areas are irregularly shaped and 5 to 40 acres in size.

Typically, the upper 60 inches is loam, clay loam, silty clay loam, or clay. The available water capacity is variable but is dominantly low or very low in the root zone. Internal water movement and runoff are variable. Tilth is poor. Hard rains tend to seal the surface in poorly vegetated areas. As a result, the infiltration rate is reduced and the emergence and growth of plants is restricted.

Most areas are used for building sites, highways, and recreational uses. The suitability of the soils as a site for buildings and sanitary facilities varies. Onsite investigation is needed to determine the potential and limitation for any proposed use.

This soil has not been assigned to either a capability subclass or a woodland suitability subclass.

UpC—Upshur silty clay loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on ridgetops. Most slopes are smooth or slightly convex. Most areas are long and narrow or irregularly shaped and are 2 to 40 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm clay and silty clay about 32 inches thick. The substratum is dark reddish brown and reddish brown, firm silty clay and silty clay loam. In some areas there is more silt in the upper part of the soil.

Included with this soil in mapping are small areas of the Elba, Guernsey, and Westmoreland soils. Elba and Guernsey soils are not as red in the subsoil and are on the ridge crests. Westmoreland soils are on the edge of mapped areas and have less clay and more sand and coarse fragments in the subsoil. These included soils make up 10 to 20 percent of most areas.

This soil has slow permeability, moderate available water capacity, rapid runoff, and fair tilth. The root zone is deep or moderately deep. The subsoil has a high shrink-swell potential. It is very strongly acid to medium acid in the upper part and strongly acid to moderately alkaline in the lower part. The organic matter content is moderately low. Natural fertility is medium.

Most areas of this soil are farmed. This soil is poorly suited to corn, soybeans, and small grain. An occasional row crop can be grown where erosion is controlled. The erosion hazard is severe in cultivated areas. The control of erosion and the maintenance of tilth and organic matter are concerns of management. This soil becomes compact and cloddy if it is worked when it is wet and sticky. Conservation tillage that leaves crop residues on the soil surface, no-till farming, contour stripcropping, grassed waterways, and cover crops are good management practices to reduce erosion and maintain tilth. Limiting tillage to when the soil is within the optimum moisture range will reduce the hazards of soil compaction and clodding.

This soil is moderately well suited to pasture and hay. Overgrazing or grazing when the soil is wet causes compaction, increased runoff, and soil loss. Proper stocking rates, pasture rotation, and weed control are good management practices.

This soil is moderately well suited to trees. Using seedlings that have been transplanted once or mulching will reduce seedling mortality rates. The windthrow hazard can be reduced by proper harvesting techniques. The slippery and sticky nature of this soil when it is wet limits the use of equipment.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with a low shrink-swell material. Cutting and filling increase the hazard of hillside slippage. Using artificial drains where water collects helps to reduce this hazard. Slope and slow permeability limit this soil for septic tank absorption fields. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Increasing the size of the field or placing it in suitable fill material will also increase the absorption of effluent. Using a suitable base material will reduce the damage to local roads and streets caused by the low strength and the shrinking and swelling. Minimizing the removal of vegetation, mulching, or making temporary seedings will help reduce erosion during construction.

This soil is in capability subclass IVe. It is in woodland suitability subclass 3c.

UpD—Upshur silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is

on ridgetops, side slopes, and narrow benches. Most areas are dominantly long and narrow, but the areas on ridgetops are more rounded. They range from 3 to 60 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm clay and silty clay about 32 inches thick. The substratum is dark reddish brown and reddish brown, firm silty clay and silty clay loam over dark yellowish brown, calcareous shale at a depth of about 70 inches. In some areas there is more silt in the upper part of the soil.

Included with this soil in mapping are small areas of Elba, Guernsey, and Westmoreland soils scattered throughout the unit or on the edge of most areas. Elba and Guernsey soils are not as red in the subsoil and Westmoreland soils have more sand and coarse fragments and less clay in the subsoil. These included soils make up 20 percent of most areas.

This Upshur soil has fair tilth, moderate available water capacity, very rapid runoff, moderately low organic matter content, and medium natural fertility. The root zone is deep or moderately deep and has a high shrink-swell potential. Permeability is slow. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to moderately alkaline in the lower part.

Most areas are farmed. This soil is generally unsuited to row crops and small grain because of the moderately steep slopes and severe erosion hazard. It is poorly suited to hay and pasture. The soil becomes compact and cloddy if it is worked when it is wet and sticky. Grazing when the soil is wet causes soil compaction and increases runoff and soil loss. Seeding by the no-till method reduces erosion. Good management practices include proper stocking rates, pasture rotation, deferment of grazing during wet periods, and mowing to control weeds.

Some areas are idle and are reverting back to woodland. This soil is moderately well suited to trees. Plant competition can be reduced by spraying, mowing, or disking. Using seedlings that have been transplanted once or mulching will reduce seedling mortality rate. The windthrow hazard can be reduced by proper harvesting techniques. Placing logging roads and skid trails on the contour will reduce erosion. The slippery and sticky nature of the soil when wet and the slope severely limit the use of equipment. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

This soil is poorly suited as a site for buildings and generally unsuited to septic tank absorption fields because of the moderately steep slope, slow permeability, high shrink-swell potential in the subsoil, and hillside slippage. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Cutting and filling operations increase the hazard of hillside slippage. Adding a suitable base material will reduce the damage to local roads and streets caused by low strength and shrinking and swelling of the soil. Minimizing the removal of vegetation, mulching, or making temporary seedings will help reduce erosion during construction.

This soil is in capability subclass VIe. It is in woodland suitability subclass 3c on the north aspect and 4c on the south aspect.

UsC—Upshur-Elba silty clay loams, 8 to 15 percent slopes. These strongly sloping, deep, well drained soils are in oval or long and narrow areas on ridgetops. Most areas are 40 to 50 percent Upshur silty clay loam and 30 to 40 percent Elba silty clay loam. The Upshur soil is commonly on the lower part of the slope, and the Elba soil is on higher positions. Areas of these soils are so intricately mixed or so small in size that it was not practical to separate them in mapping. Most areas are 3 to 40 acres in size.

Typically, the Upshur soil has a dark brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm silty clay and clay about 32 inches thick. The substratum is dark reddish brown and reddish brown, firm silty clay and silty clay loam. Dark yellowish brown, calcareous shale is at a depth of about 70 inches. In some areas there is more silt in the upper part of the Upshur soil.

Typically, the Elba soil has a dark brown, firm, silty clay loam surface layer about 4 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown, firm silty clay; the middle and lower parts are light olive brown and light yellowish brown, firm silty clay loam. The substratum is pale olive, firm silty clay loam. Limestone bedrock is at a depth of about 42 inches. In some areas the Elba soil is slightly wetter and deeper over bedrock.

Included with these soils in mapping are small areas of Westmore soils with more silt and less clay in the upper part of the subsoil. These included soils make up 10 to 20 percent of most areas.

The soils in this unit have slow permeability, rapid runoff, fair tilth, high shrink-swell potential in the subsoil, and medium natural fertility. The Upshur soil has a moderate available water capacity, and the Elba soil a low or moderate available water capacity. These soils have a moderately deep or deep root zone. In the Upshur soil, reaction is very strongly acid to medium in the upper part of the subsoil and strongly acid to moderately alkaline in the lower part. The subsoil of the Elba soil is mildly alkaline or moderately alkaline. The organic matter content is moderately low in the Upshur soil and moderate in the Elba soil.

Most areas of these soils are farmed. These soils are poorly suited to corn and small grain. The erosion hazard is severe in cultivated areas. The control of erosion and the maintenance of tilth and organic matter content are concerns of management. These soils become compacted and cloddy if worked when they are wet and sticky. Conservation tillage that leaves crop residues on the soil surface, no-till farming, contour stripcropping, grassed waterways, and cover crops are good management practices to reduce erosion and maintain tilth. Limiting tillage to when these soils are within the optimum moisture range reduces the hazards of soil compaction and clodding.

These soils are moderately well suited to hay and pasture but are poorly suited to grazing during wet periods. Overgrazing or grazing when these soils are wet causes surface compaction and increases runoff and soil loss. Proper stocking rates, pasture rotation, and weed control are good management practices.

These soils are moderately well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by spraying, mowing, or disking. The slippery and sticky nature of the soils limits the use of equipment, but logging can be done during the drier parts of the year. Using seedlings that have been transplanted once or mulching will reduce seedling mortality rates. The windthrow hazard can be reduced by proper harvesting techniques.

These soils are moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Cutting and filling operations increase the hazard of hillside slippage. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Increasing the size of the field or placing it in suitable fill material will also increase the absorption of effluent. Using a suitable base material under local roads and streets will reduce the damage caused by the low strength and the shrinking and swelling. To reduce erosion during construction, plant cover should be maintained on the site as much as possible.

These soils are in capability subclass IVe. They are in woodland suitability subclass 3c.

UsD—Upshur-Elba silty clay loams, 15 to 25 percent slopes. These moderately steep, deep, well drained soils are on ridgetops and the upper part of the side slopes. Most areas are 40 to 50 percent Upshur silty clay loam and 30 to 40 percent Elba silty clay loam. The Upshur soil is commonly on the lower part of slopes, and the Elba soil is on higher positions. Areas of these soils are so intricately mixed or so small in size that it was not practical to separate them in mapping. Most areas are narrow strips 3 to 150 acres in size.

Typically, the Upshur soil has a dark brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm silty clay and clay about 32 inches thick. The substratum, to a depth of about 60 inches, is dark reddish brown and reddish brown, firm silty clay and silty clay loam. A few areas have slopes of 25 to 30 percent.

Typically, the Elba soil has a dark brown, firm, silty clay loam surface layer about 4 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown, firm silty clay; the middle and lower parts are light olive brown and light yellowish brown, firm silty clay loam with mottles below a depth of about 25 inches. The substratum is pale olive, firm silty clay loam. Limestone bedrock is at a depth of about 42 inches.

Included with these soils in mapping are small areas of Westmoreland soils. These Westmoreland soils have less clay in the subsoil and are on the edge of most areas. These included soils make up 10 to 20 percent of most areas.

The soils in this unit have slow permeability, very rapid runoff, fair tilth, high shrink-swell potential in the subsoil, and medium natural fertility. The Upshur soil has a moderate available water capacity, and the Elba soil a low or moderate available water capacity. These soils have a deep or moderately deep root zone. In the Upshur soil, reaction is very strongly acid to medium acid in the upper part of the subsoil and strongly acid to moderately alkaline in the lower part. The subsoil of the Elba soil is mildly alkaline or moderately alkaline. Organic matter content is moderately low in the Upshur soil and moderate in the Elba soil.

Many areas are in pasture. These soils are generally unsuited to row crops and small grain because of the moderately steep slopes and severe erosion hazard. These soils are poorly suited to hay and pasture. The slope and the erosion hazard are concerns of management. The soils become compacted and cloddy if worked when they are wet and sticky. Grazing when the soils are wet causes soil compaction and increases runoff and soil loss. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, and mowing to control weeds are good management practices.

Many areas are in woodland. These soils are moderately well suited to trees. Plant competition can be reduced by spraying, mowing, or disking. Placing logging roads and skid trails on the contour will reduce soil loss. The slippery and sticky nature of the soils when wet and the slope severely limit the use of equipment. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun. Using seedlings that have been transplanted once or mulching

will reduce seedling mortality rates. The windthrow hazard can be reduced by proper harvesting techniques.

These soils are poorly suited as a site for buildings and generally unsuited to septic tank absorption fields because of the moderately steep slopes, slow permeability, high shrink-swell potential in the subsoil, and the susceptibility of the Upshur soil to hillside slippage. Cutting and filling increase the hazard of hillside slippage. The effect of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Using a suitable base material under local roads and streets will reduce the damage caused by the low strength and the shrinking and swelling of the soil. Minimizing the removal of vegetation, mulching, or making temporary seedings will help reduce erosion during construction.

These soils are in capability subclass VIe. They are in woodland suitability subclass 3c on the north aspect and 4c on the south aspect.

VaC—Vandalia silty clay loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on foot slopes and benches below very steep hillsides. Slopes are uneven. Most areas are long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is dark brown, friable silty clay loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is reddish brown and yellowish red, firm silty clay loam and silty clay; the lower part is reddish brown, firm channery silty clay. The substratum, to a depth of about 60 inches, is dark red, very firm channery clay. In some areas there are carbonates in the lower part of the subsoil.

Included with this soil in mapping are small areas of the Richland soils that have a yellower subsoil. Areas of these soils are intermixed with areas of this Vandalia soil and are on the edge of mapped areas. These included soils make up to 20 percent of most areas.

This soil has moderately slow or slow permeability, moderate available water capacity, rapid runoff, and medium tilth. The shrink-swell potential is high. The root zone is deep or moderately deep. The subsoil is very strongly acid to medium acid. This soil has a moderate organic matter content and medium natural fertility. A seasonal high water table is between depths of 48 and 72 inches in winter, spring, and other extended wet periods.

Most areas are farmed. This soil is moderately well suited to corn and small grain. The erosion hazard is severe in cultivated areas. This soil receives runoff and seepage from higher adjacent soils and stays wet in winter and early spring. It dries slowly. This soil becomes compacted and cloddy if worked when it is wet and sticky. Erosion is reduced by conservation practices such as no-till farming, conservation tillage that leaves crop residue on the soil surface, contour stripcropping, grassed waterways, and winter cover crops.

This soil is moderately well suited to pasture and hay. Overgrazing or grazing when the soil is wet causes compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing to control brush, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is moderately well suited to trees. Seedlings grow well if competing vegetation is controlled by site preparation and spraying, mowing, or disking. The sticky nature of the surface layer when wet limits the use of equipment, but planting and logging can be done during the drier part of the year.

This soil is poorly suited as a site for buildings and septic tank absorption fields because of the slow or moderately slow permeability, high shrink-swell potential, slope, and susceptibility to slippage. Foundation drains and protective exterior wall coatings are used to intercept lateral movement of water and help keep basements dry. Minimizing cutting and filling operations and diverting surface water away from foundations will help prevent slippage. The effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Septic tank absorption fields can be improved by placing the field in suitable fill material or increasing the size of the field. Laying leach lines on the contour will reduce seepage of effluent to the surface. Using a suitable base material under local roads and streets will reduce the damage caused by low strength and shrinking and swelling.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 3c.

VbD—Vandalia-Brookside complex, 15 to 25 percent slopes. This map unit consists of a well drained Vandalia soil and a moderately well drained Brookside soil on foot slopes and benches below very steep hillsides. Most areas of these moderately steep, deep soils are 40 to 50 percent Vandalia silty clay loam and 30 to 40 percent Brookside silt loam. Areas of these two soils are intermixed, but the Brookside soil is dominantly on the flatter concave benches and on the lower part of concave foot slopes. Areas of these soils are so small in size that it was not practical to separate them in mapping. Most areas are long and narrow and are 5 to 250 or more acres in size.

Typically, the Vandalia soil has a reddish brown, firm, silty clay loam surface layer about 5 inches thick. The subsoil is about 43 inches thick. The upper part is reddish brown and yellowish red, firm silty clay loam; the lower part is dark red and reddish brown, firm silty clay

and channery silty clay. The substratum, to a depth of about 60 inches, is dark red, very firm channery clay. In some areas, carbonates are in the lower part of the soil.

Typically, the Brookside soil has a dark brown, friable, silt loam surface layer about 5 inches thick. The subsoil is about 43 inches thick. The upper part is strong brown, firm silty clay loam; the lower part is strong brown and yellowish brown, mottled, firm clay loam and clay. The substratum, to a depth of about 60 inches, is light olive brown, mottled, firm clay.

Included with these soils in mapping are small areas of Richland soils with more sand and less clay in the subsoil on the edge of mapped areas. These included soils make up 10 to 20 percent of most areas.

The Vandalia soil has moderately slow or slow permeability and medium natural fertility. The Brookside soil has moderately slow permeability and high natural fertility. Both soils have moderate available water capacity, high shrink-swell potential, moderate organic matter content, and very rapid runoff. The root zone is deep in the Brookside soil and deep or moderately deep in the Vandalia soil. The subsoil of the Vandalia soil is very strongly acid to medium acid. The upper part of the subsoil in the Brookside soil is strongly acid to neutral, and the lower part is medium acid to mildly alkaline. A seasonal high water table is between depths of 48 and 72 inches in the Vandalia soil and between depths of 30 and 48 inches in the Brookside soil.

Most areas have been cleared and are used for pasture and hay. These soils are moderately well suited to hay and poorly suited to an occasional row crop in cropping systems with small grain and hay. Erosion is reduced by conservation tillage that leaves crop residues on the soil surface, no-till farming, contour stripcropping, grassed waterways, and cover crops. Uneven slopes in some areas limit the use of equipment. Incorporating crop residues and limiting tillage to when the soils are within the optimum moisture range help maintain tilth and organic matter content and reduce soil compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

Some areas are in woodland or are reverting to trees. These soils are well suited to trees. Mechanical planting and weed control are possible on the more even areas. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of slippage, slope, high shrink-swell potential, seasonal wetness, and moderately slow or slow permeability. Minimizing cutting and filling operations will reduce slippage.

These soils are in capability subclass IVe. The Vandalia soil is in woodland suitability subclass 2c on the north aspect and 3c on the south aspect; the Brookside soil is in 1r on the north aspect and 2r on the south aspect.

VbE—Vandalia-Brookside complex, 25 to 40 percent slopes. This complex consists of a well drained Vandalia soil and a moderately well drained Brookside soil on foot slopes and benches below very steep hillsides. Slopes are uneven due to soil creep and slippage. Most areas of these deep, steep soils are 40 to 50 percent Vandalia silty clay loam and 30 to 40 percent Brookside silt loam. Areas of these two soils are intermixed, but the Brookside soil is dominantly on the flatter concave benches and on the lower part of concave foot slopes. Areas of these soils are so small in size it was not practical to separate them in mapping. Most areas are long and narrow and are 5 to 35 acres in size.

Typically, the Vandalia soil has a reddish brown, firm, silty clay loam surface layer about 5 inches thick. The subsoil is about 43 inches thick. The upper part is reddish brown and yellowish red, firm silty clay loam; the lower part is dark red and reddish brown, firm silty clay and channery silty clay. The substratum, to a depth of about 60 inches, is dark red, very firm channery clay. In some areas carbonates are in the lower part of the soil.

Typically, the Brookside soil has a dark brown, friable, silt loam surface layer about 5 inches thick. The subsoil is about 43 inches thick. The upper part is strong brown, firm silty clay loam; the lower part is strong brown and yellowish brown, mottled, firm clay loam and clay. The substratum, to a depth of about 60 inches, is light olive brown, mottled, firm clay.

Included with these soils in mapping are small areas of the Richland soils with more sand and less clay in the subsoil on the edge of mapped areas. These included soils make up about 15 percent of most areas.

The Vandalia soil has moderately slow or slow permeability and medium natural fertility. The Brookside soil has moderately slow permeability and high natural fertility. Both soils have moderate available water capacity, high shrink-swell potential, moderate organic matter content, and very rapid runoff. The subsoil of the Vandalia soil is very strongly acid to medium acid. The upper part of the subsoil in the Brookside soil is strongly acid to neutral, and the lower part is medium acid to mildy alkaline. A seasonal high water table is between depths of 48 and 72 inches in the Vandalia soil and between depths of 30 and 48 inches in the Brookside soil.

Some areas are used for pasture. These soils are generally unsuited to cultivated crops, small grain, or hay because the slopes are too steep and uneven to

manage. These soils are poorly suited to pasture. The control of erosion and maintenance of a good stand of forage are the major concerns of management, but uneven slopes make pasture improvement difficult. Grazing when the soils are wet causes soil compaction and increases runoff and erosion. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing are good management practices.

Many areas are in woodland. These soils are well suited to trees, but the slope limits the use of planting and logging equipment. Because of the erosion hazard, logging roads and skid trails should be constructed on the contour where possible. The north- and east-facing slopes of these soils are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as a site for buildings, local roads and streets, and septic tank absorption fields because of slippage (fig. 9), slope, high shrink-swell potential, seasonal wetness, and moderately slow or slow permeability. Minimizing cutting and filling operations will reduce slippage.

These soils are in capability subclass VIe. The Vandalia soil is in woodland suitability subclass 2c on the north aspect and 3c on the south aspect; the Brookside soil is in 1r on the north aspect and 2r on the south aspect.

VcD—Vandalia-Richland complex, 15 to 25 percent slopes. These deep, moderately steep, well drained soils are on foot slopes and benches below very steep hillsides. Some areas have uneven slopes. Most areas are 40 to 50 percent Vandalia silty clay loam and 30 to 40 percent Richland loam. The Richland soil is

Figure 9.—Road damaged by slippage of Vandalia and Brookside soils.

commonly on the upper part of foot slopes, and the Vandalia soil is on the lower part. Areas of these soils are so intricately mixed or in areas so small in size that it was not practical to separate them in mapping. Most areas are long and narrow and are 5 to 140 acres in size.

Typically, the Vandalia soil has a reddish brown, firm, silty clay loam surface layer about 5 inches thick. The subsoil is about 43 inches thick. The upper part is reddish brown and yellowish red, firm silty clay loam; the middle and lower parts are dark red and reddish brown, firm silty clay, clay, and channery silty clay. The substratum, to a depth of about 60 inches, is dark red, very firm channery silty clay. In some areas carbonates are in the lower part of the soil.

Typically, the Richland soil has a dark grayish brown, friable, loam surface layer about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable loam and silt loam; the lower part is dark yellowish brown, friable channery silt loam. The substratum, to a depth of about 60 inches, is yellowish brown, firm channery clay loam.

Included with these soils in mapping are small areas of the moderately deep Dekalb and Steinsburg soils on the edge of mapped areas. These included soils make up about 15 percent of most areas.

The Vandalia soil has moderately slow or slow permeability, medium tilth, moderate organic matter content, and a moderately deep or deep root zone. The Richland soil has moderate permeability, good tilth, a moderately low organic matter content, and a deep root zone. Both soils have a moderate available water capacity, very rapid runoff, and medium natural fertility. The Vandalia soil has a high shrink-swell potential, and the Richland soil a moderate shrink-swell potential. The subsoil is very strongly acid to medium acid in the Vandalia soil and strongly acid or medium acid in the Richland soil. A seasonal high water table is between depths of 48 to 72 inches in the Vandalia soil and between depths of 36 and 72 inches in the Richland soil.

Most areas are used for pasture and hay. These soils are moderately well suited to hay and pasture and to occasional row crops in cropping systems of corn, small grain, and hay. Erosion is reduced by conservation tillage that leaves crop residues on the soil surface, minimum tillage, no-till farming, contour stripcropping, grassed waterways, and cover crops. Limiting tillage and grazing to when these soils are within the optimum moisture range helps maintain tilth and reduce soil compaction. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

Some areas are idle and are reverting to woodland. These soils are well suited to woodland. Mechanical planting, weed control, and harvesting can be accomplished on the more even areas. Placing logging roads and skid trails on the contour where practical helps reduce runoff and erosion. The north- and east-facing slopes provide better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are poorly suited as a site for buildings and septic tank absorption fields. The Richland soil is better suited to these uses than the Vandalia soil. Buildings should be designed to conform to the natural slope of the land and cutting and filling operations kept to a minimum to reduce the possibility of slippage in the Vandalia soil. Diverting surface runoff from higher adjacent soils and removing excess water through subsurface drains will also reduce slippage. Backfilling along foundations with material that has a low shrink-swell potential and using reinforcement in foundations will reduce the damage from shrinking and swelling of the soils. Using a suitable base material will improve local roads and streets. Septic tank absorption fields in this unit should be located in the Richland soil where possible. Installing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. To reduce erosion during construction, plant cover should be maintained on the site as much as possible.

These soils are in capability subclass IVe. The Vandalia soil is in woodland suitability subclass 2c on the north aspect and 3c on the south aspect; the Richland soil is in 2r on both aspects.

VcE—Vandalia-Richland complex, 25 to 40 percent slopes. These steep, deep, well drained soils are on foot slopes and benches below very steep hillsides. Most areas are 40 to 50 percent Vandalia silty clay loam and 30 to 40 percent Richland loam. The Richland soil is commonly on the upper part of foot slopes, and the Vandalia soil is on the lower part. Areas of these soils are so intricately mixed or so small in size that it was not practical to separate them in mapping. Most areas are long and narrow and are 5 to 50 acres in size.

Typically, the Vandalia soil has a reddish brown, firm, silty clay loam surface layer about 5 inches thick. The subsoil is about 43 inches thick. The upper part is reddish brown and yellowish red, firm silty clay loam; the lower part is dark red and reddish brown, firm silty clay and channery silty clay. The substratum, to a depth of about 60 inches, is dark red, very firm channery clay. In some areas, carbonates are in the lower part of the soil.

Typically, the Richland soil has a dark grayish brown, friable, loam surface layer about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable loam and silt loam; the lower part is dark yellowish brown, friable channery silt loam. The substratum, to a depth of about 60 inches, is yellowish brown, firm channery clay loam.

Included with these soils in mapping are small areas of the moderately deep Dekalb and Steinsburg soils on the

edge of mapped areas. These included soils make up about 10 percent of most areas.

The Vandalia soil has moderately slow or slow permeability, medium tilth, moderate organic matter content, and a moderately deep or deep root zone. The Richland soil has moderate permeability, good tilth, a moderately low organic matter content, and a deep root zone. Both soils have moderate available water capacity, very rapid runoff, and medium natural fertility. The Vandalia soil has a high shrink-swell potential, and the Richland soil a moderate shrink-swell potential. The subsoil is very strongly acid to medium acid in the Vandalia soil and strongly acid or medium acid in the Richland soil. A seasonal high water table is between depths of 48 and 72 inches in the Vandalia soil and between depths of 36 and 72 inches in the Richland soil.

Many areas are in unimproved pasture. These soils are generally unsuited to row crops, small grain, and hay because the slopes are too steep and uneven to be managed. They are poorly suited to permanent pasture. Pasture improvement is difficult. Seeding by the no-till method reduces erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing are good management practices.

Most areas are in woodland. These soils are well suited to trees, but the steep, uneven slopes limit mechanical planting, weed control, and harvesting. Placing logging roads and skid trails on the contour will reduce erosion. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes; some seasonal wetness; and the high shrink-swell potential, moderately slow or slow permeability, and susceptibility of the Vandalia soil to hillside slippage. Diverting surface runoff from higher adjacent soils will reduce slippage.

These soils are in capability subclass VIe. The Vandalia soil is in woodland suitability subclass 2c on the north aspect and 3c on the south aspect; the Richland soil is in 2r on both aspects.

VtC—Vincent silt loam, 6 to 12 percent slopes. This strongly sloping, moderately well drained, deep soil is on high lacustrine terraces on ridgetops. Most areas have smooth slopes. Areas range in size from 5 to 20 acres.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 45 inches thick. The upper part is strong brown, firm silty clay loam; the lower part is yellowish red or red, firm silty clay loam and silty clay with mottles below a depth of about 27 inches. The substratum, to a depth of about 60 inches, is yellowish red, firm silty clay.

Included with this soil in mapping are small areas of Gallia soils with more sand and less clay in the subsoil and Omulga soils that have a fragipan. These included soils are on the edge of mapped areas and to a lesser extent on slightly elevated areas. They make up as much as 15 percent of most areas.

This Vincent soil has slow permeability, high available water capacity, rapid runoff, and good tilth. The root zone is deep. The shrink-swell potential is high, and the subsoil is very strongly acid to medium acid. This soil has moderately low organic matter content, medium natural fertility, and a seasonal high water table between depths of 24 and 48 inches in winter, spring, and other extended wet periods.

Most areas are used for crops and pasture. This soil is moderately well suited to cultivated crops and small grain and well suited to grasses and legumes for hay and pasture. The erosion hazard is severe if this soil is cultivated. Conservation practices, such as grassed waterways, conservation tillage or no-till methods that leave crop residues on the soil surface, contour stripcropping, returning crop residues, and planting cover crops, help reduce runoff and soil loss by erosion. Proper stocking rates, pasture rotation, mowing to control weeds, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Competing vegetation can be reduced by site preparation and mowing, spraying, or disking. Planting trees that are tolerant of the high clay content in the subsoil will reduce the windthrow hazard and seedling mortality rates.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Damage from shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large-spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry. Placing the distribution lines on the contour will reduce lateral seepage of effluent to the surface. Using a suitable base material will reduce the damage to local roads and streets caused by low strength and shrinking and swelling. Minimizing the removal of vegetation, mulching, or making temporary seedings will help reduce erosion during construction.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2c.

WdB—Wellston silt loam, 3 to 8 percent slopes. This gently sloping, deep, well drained soil is on broad ridgetops and in saddles on uplands. Slopes are smooth and convex. Most areas are long and narrow and are 3 to 15 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 40

inches thick. The upper part is yellowish brown, friable silty clay loam and silt loam; the lower part is yellowish brown, firm clay loam and friable channery loam. Yellowish brown fine grained sandstone and siltstone are at a depth of about 48 inches.

Included with this soil in mapping are small areas of the moderately well drained Guernsey soils with more clay in the subsoil and the moderately well drained Zanesville soils with a fragipan. These included soils are generally on portions of the landscape that are more nearly level. They make up about 20 percent of most areas.

This soil has moderate permeability, moderate available water capacity, medium runoff, and good tilth. The root zone is deep. The subsoil is medium acid or strongly acid. The organic matter content is moderately low and natural fertility is medium.

Most areas of this soil are farmed. This soil is well suited to row crops and small grain. It can be frequently cultivated if erosion is controlled. It crusts after hard rains. Erosion is reduced by using contour farming, conservation tillage that leaves crop residue on the soil surface, winter cover crops, and grassed waterways. Returning crop residue to the soil helps maintain fertility and reduce crusting.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes soil compaction and increases runoff soil loss. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing to control weeds and brush, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Planting and harvesting are easily accomplished. Seedlings survive and grow well if competing vegetation is controlled by spraying, mowing, or disking.

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. Because of the bedrock between depths of 40 and 60 inches, this soil is better suited to houses without basements than to houses with basements. Selecting sites that are the deepest over bedrock or using suitable fill material will improve septic tank absorption fields. Using a suitable base material under local roads and streets will reduce the damage from the high potential frost action.

This soil is in capability subclass IIe. It is in woodland suitability subclass 2o.

WdC—Wellston silt loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on ridgetops and on upper parts of side slopes and on knolls on ridgetops on uplands. Slopes are commonly convex. Most areas are long and narrow and are 3 to 10 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 28 inches thick. The upper and middle parts are yellowish brown, friable silt loam with mottles between depths of 18 and 26 inches; the lower part is yellowish brown, firm clay loam. The substratum is yellowish brown, friable channery loam. Yellowish brown siltstone and fine grained sandstone bedrock is at the depth of about 48 inches.

Included with this soil in mapping are small areas of the moderately well drained Guernsey and Zanesville soils. Guernsey soils are on slightly higher areas and Zanesville soils are on less sloping areas near the center of broad ridgetops. These included soils make up 10 to 15 percent of most areas.

This soil has moderate permeability, moderate available water capacity, rapid runoff, and good tilth. The subsoil is medium acid or strongly acid. The root zone is deep. The organic matter content is moderately low, and natural fertility is medium.

Most areas are farmed. This soil is moderately well suited to cultivated crops and small grain. The erosion hazard is severe if it is used for cultivated crops. The surface layer crusts after hard rains. Conservation practices, such as contour farming, conservation tillage that leaves crop residues on the surface, winter cover crops, crop rotation, and grassed waterways, are used to help reduce excessive soil loss. Returning crop residue to the soil helps maintain fertility, improve tilth, and reduce crusting.

This soil is well suited to pasture and hay. Overgrazing or grazing when the soil is wet causes soil compaction, runoff, and poor tilth. Proper stocking, pasture rotation, timely deferment of grazing, mowing to control weeds and brush, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Planting and harvesting are easily accomplished. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. Because of the bedrock between depths of 40 and 60 inches, it is better suited to houses without basements than to houses with basements. Landshaping is needed in some areas. Selecting sites that are the deepest over bedrock or using suitable fill material will improve septic tank absorption fields. Installing distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Strengthening or replacing the base material of local roads and streets helps to prevent the damage caused by frost action. Increased runoff and erosion occur during construction, but these can be reduced by maintaining plant cover wherever possible.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

WeB—Westmore silt loam, 3 to 8 percent slopes. This gently sloping, deep, well drained soil is on

ridgetops on uplands. Slopes are slightly convex. Most areas are long and narrow and are 3 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 53 inches thick. The upper part is strong brown, friable silt loam and firm silty clay loam; the lower part is strong brown, mottled, firm silty clay loam and silty clay. The substratum, to a depth of about 60 inches, is strong brown, mottled, firm silty clay. In some areas the silt mantle is thinner and in other areas there is more sand and less silt in the upper part of the subsoil.

Permeability is moderate in the upper part of the subsoil and slow or moderately slow in the lower part. This soil has a moderate or high available water capacity, medium runoff, and good tilth. The subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part. The shrink-swell potential is high in the lower part of the subsoil and in the substratum. This soil has a moderate organic matter content and high natural fertility.

Most areas are farmed. This soil is well suited to row crops and small grains. It can be row cropped frequently if the hazard of erosion is controlled and good management is used. It crusts after hard rains. Minimum tillage, returning crop residues to the soil, contour farming, and planting winter cover crops will reduce erosion and improve tilth.

This soil is well suited to pasture and hay. Restricted use during wet periods will reduce compaction and soil loss. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Backfilling along foundations with material that has a low shrink-swell potential and using extra reinforcement in foundations will reduce the damage from the shrinking and swelling of the soil. Using a suitable base material under local roads and streets will reduce the damage from low soil strength and frost action. Septic tank absorption fields can be improved by enlarging the field or placing it in suitable fill material.

This soil is in capability subclass IIe. It is in woodland suitability subclass 2o.

WeC—Westmore silt loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on ridgetops on uplands. Slopes are slightly convex. Most areas are long and narrow and are 3 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 53 inches thick. The upper part is strong brown, friable silt loam and firm silty clay loam; the lower part is strong brown, mottled, firm silty clay loam and silty clay. The substratum, to a depth of about 60 inches, is strong brown, mottled, firm silty clay. In some areas the silt mantle is thinner, and in other areas there is more sand and less silt in the upper part of the subsoil.

Permeability is moderate in the upper part of the subsoil and slow or moderately slow in the lower part. This soil has a moderate or high available water capacity, rapid runoff, good tilth, and a high shrink-swell potential in the lower part of the subsoil and in the substratum. The root zone is deep. The subsoil is medium acid or strongly acid in the upper part and medium acid to neutral in the lower part. This soil has a moderate organic matter content and high natural fertility.

Most areas are farmed. This soil is moderately well suited to cultivated crops and small grain. The erosion hazard is severe in cultivated areas. The surface layer crusts after hard rains. Erosion can be reduced by using conservation tillage that leaves crop residue on the soil surface, no-till farming, contour stripcropping, cover crops, and grassed waterways. Returning crop residue to the soil helps maintain fertility and improve tilth.

This soil is well suited to hay and pasture. Restricted use during wet periods will help maintain good soil tilth and reduce runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled or removed by site preparation and spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of the high shrink-swell potential in the lower part of the subsoil and in the substratum, this soil is better suited to houses without basements than to houses with basements. Backfilling along foundations with material that has a low shrink-swell potential and using extra reinforcement in foundations will reduce the damage from the shrinking and swelling of the soil. Using a suitable base material under local roads and streets will reduce the damage caused by low soil strength and frost action. Septic tank absorption fields can be improved by enlarging the field or placing it in a suitable fill material. Installing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Increased runoff and erosion occur during construction, but these can be reduced by maintaining plant cover wherever possible.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

WhC—Westmoreland-Guernsey silt loams, 8 to 15 percent slopes. This map unit consists of a well drained Westmoreland soil and a moderately well drained Guernsey soil on ridgetops, on upper parts of side

slopes, and on benches. These soils are deep and strongly sloping. Most areas have 40 to 70 percent Westmoreland silt loam and 30 to 60 percent Guernsey silt loam. Areas of these two soils occur as relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. Most areas are long and narrow and are 3 to 30 acres in size.

Typically, the Westmoreland soil has a dark brown and brown, friable, silt loam surface layer about 9 inches thick. The subsoil is dark yellowish brown, friable and firm loam, silty clay loam, and channery silty clay loam about 20 inches thick. The substratum is strong brown, firm extremely channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle and lower parts are dark yellowish brown and yellowish brown, mottled, firm and very firm silty clay and clay. The substratum is yellowish brown, mottled, firm clay. Light brownish gray, siltstone bedrock is at a depth of about 50 inches. In some areas the silt mantle is thicker.

Included with these soils in mapping are small areas of Berks, Dekalb, and Upshur soils. The moderately deep Berks and Dekalb soils are on shoulder slopes. Upshur soils are redder in the subsoil and are on knolls. These included soils make up 10 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Both soils have moderate available water capacity, rapid runoff, and good tilth. Both soils have a deep root zone. The shrink-swell potential is low in the Westmoreland soil and high in the middle and lower parts of the subsoil of the Guernsey soil. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is strongly acid to slightly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in the Guernsey soil in winter, early spring, and other extended wet periods.

Most areas of these soils are farmed. These soils are moderately well suited to corn and small grain. Controlling erosion is the major concern of management. The surface layer crusts after hard rains. Good management practices include using conservation tillage that leaves crop residue on the soil surface, no-till farming, grassed waterways, contour stripcropping, meadow crops in the cropping system, cover crops, and returning crop residues to the soil. Random subsurface drains are needed in seeps in the Guernsey soil.

These soils are well suited to pasture and hay. Overgrazing and grazing when the soils are wet causes soil compaction and increased runoff and soil loss. Proper stocking rates, pasture rotation, deferment of grazing, and mowing to control weeds are good management practices to help maintain key forage species.

These soils are well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

These soils are moderately well suited as a site for buildings and septic tank absorption fields. Because of better drainage and less clay in the middle and lower parts of the subsoil, the Westmoreland soil is better suited to these uses than the Guernsey soil. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry in the Guernsey soil. Using walls that have pilasters and are reinforced with concrete or backfilling along foundations with material that has a low shrink-swell potential will reduce the damage in the Guernsey soil caused by shrinking and swelling. Septic tank absorption fields in the Guernsey soil can be improved by increasing the size of the absorption field or placing it in suitable fill material. Distribution lines in both soils should be on the contour to reduce lateral seepage of effluent to the surface. Using a suitable base material under local roads in both soils and providing artificial drainage in the Guernsey soil will reduce the damage caused by frost action and low strength. To reduce erosion during construction, plant cover should be maintained on the site as much as possible.

The soils are in capability subclass IIIe. The Westmoreland soil is in woodland suitability subclass 3o; the Guernsey soil is in 2o.

WhD—Westmoreland-Guernsey silt loams, 15 to 25 percent slopes. This map unit consists of a well drained Westmoreland soil and a moderately well drained Guernsey soil on hillsides and on some benches. Most areas of these deep, moderately steep soils are on the upper third of the steeper and longer slopes. A few areas of this complex are on ridgetops and knolls on ridgetops. The slopes are mostly smooth with some dissection along a few small drainageways. Westmoreland silt loam makes up 40 to 50 percent of most areas, and Guernsey silt loam about 35 to 40 percent. Areas of these two soils occur as relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Westmoreland soil is commonly on the steeper part of the slope and has thin, flat stone fragments on the surface in some places.

Typically, the Westmoreland soil has a dark brown, friable, silt loam surface layer about 5 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable loam; the middle and lower parts are yellowish brown, friable and firm channery silty clay loam. The substratum is strong brown, firm extremely channery silty clay loam. Light

brownish gray, siltstone bedrock is at a depth of about 45 inches.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, firm silty clay loam; the middle part is yellowish brown, mottled, firm clay and silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum is yellowish brown, mottled, firm channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 50 inches. In some areas the silt mantle is thicker. In a few areas the subsoil is redder. Some areas have bedrock between depths of 40 and 50 inches.

Included with these soils in mapping are small areas of the moderately deep Berks and Dekalb soils on shoulder slopes. Also included on knolls are small areas of Upshur soils with a redder subsoil. These inclusions make up about 15 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Both soils have moderate available water capacity, very rapid runoff, and good tilth. Both soils have a deep root zone. The shrink-swell potential is low in the Westmoreland soil and high in the middle and lower parts of the subsoil of the Guernsey soil. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is strongly acid to slightly acid in the upper part and strongly acid to mildly alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in the Guernsey soil in winter, early spring, and other extended wet periods.

Many areas are used for pasture and hay. These soils are moderately well suited to hay and pasture and to an occasional crop of corn and small grain. The slope and the erosion hazard are major concerns of management. Erosion can be reduced by using conservation tillage that leaves crop residue on the soil surface, no-till farming, contour stripcropping, legumes in the cropping system, cover crops, and returning crop residues to the soil. Limiting tillage to when the soil is within the proper moisture range will reduce the hazard of soil compaction. Grazing on these soils when they are wet causes soil compaction and increased runoff and soil loss. Good management practices include proper stocking rates to maintain key plant species, rotation of pasture, deferment of grazing during wet periods, and mowing to control weeds.

Many areas are in woodland. These soils are well suited to woodland. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are poorly suited as sites for buildings and septic tank absorption fields. Because of better drainage and less clay in the middle and lower parts of the subsoil, the Westmoreland soil is better suited to these uses than the Guernsey soil. Waterproofing basement walls and installing drains at the base of footings will help keep basements dry in the Guernsey soil. Using walls that have pilasters and are reinforced with concrete or backfilling along foundations with material that has a low shrink-swell potential will reduce damage in the Guernsey soil from shrinking and swelling. Placing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Cutting and filling of the Guernsey soil increases the hazard of hillside slippage. Using a suitable base material under local roads in both soils and providing artificial drainage in the Guernsey soil will reduce the damage caused by frost action and low strength. To reduce erosion during construction, plant cover should be maintained on the site as much as possible.

These soils are in capability subclass IVe. They are in woodland suitability subclass 2r on the north aspect and 3r on the south aspect.

WhE—Westmoreland-Guernsey silt loams, 25 to 40 percent slopes. This map unit consists of a well drained Westmoreland soil and a moderately well drained Guernsey soil on hillsides. These deep, steep soils are commonly on smooth slopes, but some of the slopes are dissected by drainageways. Westmoreland silt loam makes up 40 to 70 percent of most areas, and Guernsey silt loam makes up 30 to 60 percent. Areas of the two soils are in relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Westmoreland soil is commonly on the steeper, convex slopes, and the Guernsey soil dominates the lower, concave parts of hillsides. Most areas are long and narrow and range from 10 to 100 acres in size.

Typically, the Westmoreland soil has a dark brown and brown, friable, silt loam surface layer about 9 inches thick. The subsoil is about 20 inches thick. The upper part is dark yellowish brown and yellowish brown, friable silt loam and silty clay loam; the lower part is yellowish brown, firm channery silty clay loam. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, firm silty clay loam; the middle part is yellowish brown, mottled, firm clay and silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum is yellowish brown, mottled, firm

channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 50 inches. In a few areas the subsoil is redder. In some areas bedrock is between depths of 40 and 50 inches.

Included with these soils in mapping are small areas of moderately deep Berks and Dekalb soils. These included soils are above bedrock escarpments and on the edge of most areas. They make up 15 to 20 percent of most areas of this unit.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Both soils have moderate available water capacity, very rapid runoff, and good tilth. Both soils have a deep root zone. The shrink-swell potential is low in the Westmoreland soil and high in the middle and lower parts of the subsoil of the Guernsey soil. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is strongly acid to slightly acid in the upper part and strongly acid to mildly alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in the Guernsey soil in winter, early spring, and other extended wet periods.

Some areas are in pasture. These soils are generally unsuited to row crops, small grain, or hay because of the steep slopes. They are poorly suited to permanent pasture. Pasture management is limited by the slopes. Seeding by the no-till method reduces erosion. Good management practices include proper stocking rates, pasture rotation, timely deferment of grazing, and weed control.

Many areas are in woodland (fig. 10). These soils are well suited to trees. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The slope limits the use of planting and logging equipment. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes, high shrink-swell potential in the middle and lower parts of the subsoil of the Guernsey soil, the susceptibility of the Guernsey soil to hillside slippage, and the slow or moderately slow permeability of the Guernsey soil.

These soils are in capability subclass VIe. Both soils are in woodland suitability subclass 2r on the north aspect and 3r on the south aspect.

WhF—Westmoreland-Guernsey silt loams, 40 to 70 percent slopes. This map unit consists of a well drained Westmoreland soil and a moderately well drained Guernsey soil on hillsides and valley walls. These deep, very steep soils are on uneven slopes with some areas having narrow benches, bedrock escarpments, and an occasional landslip. Westmoreland silt loam makes up 40 to 60 percent of most areas, and Guernsey silt loam 30 to 40 percent. Areas of these two soils occur as relatively narrow, alternating bands on hillsides, and it was not practical to separate them in mapping. The Westmoreland soil is commonly on the steeper convex slopes, and the Guernsey soil dominates small benches and the lower concave parts of hillsides.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is yellowish brown, firm channery silty clay loam. The substratum is yellowish brown, firm channery clay loam. Olive brown, siltstone bedrock is at a depth of about 46 inches.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, firm silty clay loam; the middle part is yellowish brown, mottled, firm clay and silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum consists of yellowish brown, firm channery silty clay loam. Yellowish brown, siltstone bedrock is at a depth of about 50 inches. In some areas the subsoil is redder, and a few areas have bedrock between depths of 40 and 50 inches.

Included with these soils in mapping are long, narrow bedrock escarpments and small areas of moderately deep Berks and Dekalb soils immediately above the bedrock escarpment and on the edge of mapped areas. These inclusions make up 15 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Both soils have moderate available water capacity and very rapid runoff. Both soils have a deep root zone. The shrink-swell potential is low in the Westmoreland soil and high in the middle and lower parts of the subsoil of the Guernsey soil. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is strongly acid to slightly acid in the upper part and strongly acid to mildly alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in the Guernsey soil in winter, early spring, and other extended wet periods.

These soils are generally unsuited to crops, hay, and pasture because the slopes are too steep and uneven to manage. Most areas are in woodland. Some areas that were once cleared and used for pasture have reverted to woodland. These soils are well suited to woodland. The erosion hazard is severe. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The very steep slopes severely limit the use of equipment. The north-

Figure 10.—Wooded area of Westmoreland-Guernsey silt loams, 25 to 40 percent slopes.

and east-facing slopes are better woodland sites than the south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of the very steep slopes, high shrink-swell potential in the middle and lower parts of the subsoil of the Guernsey soil, the susceptibility of the Guernsey soil to hillside slippage, and the slow or moderately slow permeability of the Guernsey soil.

These soils are in capability subclass VIIe. They are in woodland suitability subclass 2r on the north aspect and 3r on the south aspect.

WkF—Westmoreland-Guernsey silt loams, benched, 40 to 70 percent slopes. This map unit consists of a well drained Westmoreland soil and a moderately well drained Guernsey soil on hillsides and valley walls. These deep, very steep soils are on uneven and benched slopes. The less sloping benches are up to 150 feet wide. Generally, the Westmoreland silt loam makes up 40 to 60 percent of most areas and Guernsey silt loam 30 to 40 percent. Areas of these two soils occur in relatively narrow, alternating bands on the hillsides, and it was not practical to separate them in mapping. The Westmoreland soil is commonly on the steep, convex slopes, and the Guernsey soil is on benches and concave slopes on the lower parts of

hillsides. Bedrock escarpments and landslips occur in some areas. Most areas are long and narrow and are 10 to 200 or more acres in size.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam; the lower part is yellowish brown, firm channery silty clay loam. The substratum is yellowish brown, firm channery clay loam. Olive brown, siltstone bedrock is at a depth of about 46 inches.

Typically, the Guernsey soil has a dark yellowish brown, friable, silt loam surface layer about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark brown, firm silty clay loam; the middle part is yellowish brown, mottled, firm clay and silty clay; and the lower part is grayish brown, mottled, firm silty clay loam. The substratum is yellowish brown, firm channery silty clay loam. Yellowish brown, siltstone bedrock is at a depth of about 50 inches. In a few areas the subsoil is redder. In some areas bedrock is between depths of 40 and 50 inches.

Included with these soils in mapping are long, narrow bedrock escarpments and small areas of moderately deep Berks and Dekalb soils immediately above bedrock escarpments and on the edge of some areas. These inclusions make up 10 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. Both soils have moderate available water capacity and very rapid runoff. Both soils have a deep root zone. The shrink-swell potential is low in the Westmoreland soil and high in the middle and lower parts of the subsoil of the Guernsey soil. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is strongly acid to slightly acid in the upper part and strongly acid to mildly alkaline in the lower part. Both soils have a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 42 inches in the Guernsey soil in winter, spring, and other extended wet periods.

These soils are generally unsuited to crops, hay, and pasture because the slopes are too steep and uneven to manage. Nearly all areas are in woodland. The erosion hazard is severe. To reduce erosion, logging roads and skid trails should be placed on the benches and on the contour where possible. The use of equipment is severely limited by the very steep, uneven slopes. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun. Because of seepage, the areas of the Guernsey soil on benches are generally better woodland sites than the areas of the Westmoreland soil.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of the very steep slopes, high shrink-swell potential in the middle and lower parts of the subsoil of the Guernsey soil, the susceptibility of the Guernsey soil to hillside slippage, and the slow or moderately slow permeability of the Guernsey soil.

These soils are in capability subclass VIIe. They are in woodland suitability subclass 2r on the north aspect and 3r on the south aspect.

WmC—Westmoreland-Upshur complex, 8 to 15 percent slopes. These strongly sloping, deep, well drained soils are on ridgetops and rounded knolls. Slopes are smooth with some dissection along a few small drainageways. Westmoreland silt loam makes up 40 to 60 percent of most areas, and Upshur silty clay loam 20 to 40 percent. On any slope, however, either soil can be dominant. Areas of the two soils occur in relatively narrow, alternating, nearly horizontal bands, and it was not practical to separate them in mapping. The Westmoreland soil is also common on slope breaks and near the edge of mapped areas. Most areas are long and narrow, but those on ridgetop knolls are somewhat rounded. They range from 3 to 20 acres in size.

Typically, the Westmoreland soil has a dark brown and brown, friable, silt loam surface layer about 9 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable loam and firm silty clay loam and channery silty clay loam about 20 inches thick. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Typically, the Upshur soil has a brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm clay and silty clay about 32 inches thick. The substratum, to a depth of about 60 inches, is dark reddish brown and reddish brown, firm silty clay and silty clay loam. In some areas there is more silt in the upper part of the soil.

Included with these soils in mapping are small areas of the moderately well drained Guernsey soils and Elba soils that have carbonates closer to the surface. These soils are on higher parts of ridgetops and knolls. They make up 15 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and slow in the Upshur soil. Both soils have moderate available water capacity, rapid runoff, moderately low organic matter content, and medium natural fertility. The shrink-swell potential in the subsoil is low in the Westmoreland soil and high in the Upshur soil. The subsoil is commonly very strongly acid to medium acid in the Westmoreland soil. Reaction is very strongly acid to medium acid in the upper part of the subsoil in the Upshur soil and strongly acid to moderately alkaline in the lower part.

Most areas are used for crops and pasture. These soils are moderately well suited to corn and small grain. Controlling erosion and maintaining the organic matter

content and tilth are the major concerns of management when these soils are cultivated. Erosion can be reduced by using conservation tillage that leaves crop residues on the soil surface, no-till farming, grassed waterways, contour stripcropping, meadow crops in the cropping system, and cover crops. The Upshur soil becomes compacted and cloddy if it is worked when it is wet and sticky. Limiting tillage to when this soil is within the optimum moisture range reduces compaction and clodding.

These soils are well suited to pasture and hay. Maintenance of key forage species is the major concern of management. Grazing when the soil is wet increases compaction, runoff, and soil loss. Good management practices include proper stocking rates, pasture rotation, deferment of grazing during wet periods, and mowing to control weeds.

These soils are moderately well suited to woodland. The use of logging and planting equipment on the Upshur soil is limited because the soil is soft and slippery when wet, but logging on this soil can be done during the drier parts of the year. Using seedlings that have been transplanted once or mulching the Upshur soil will reduce seedling mortality rates. The windthrow hazard on the Upshur soil can be reduced by proper harvesting techniques. Plant competition can be reduced by spraying, mowing, or disking.

These soils are moderately well suited as a site for buildings and septic tank absorption fields. Because there is less clay throughout the Westmoreland soil, it is better suited to these uses than the Upshur soil. Buildings should be designed to conform to the natural slope of the land. Using walls that have pilasters and are reinforced with concrete or backfilling along foundations with material that has a low shrink-swell potential will reduce the damage in the Upshur soil from shrinking and swelling. Septic tank absorption fields in the Upshur soil can be improved by increasing the size of the field or placing it in a suitable fill material. Distribution lines in both soils should be placed on the contour to reduce lateral seepage of effluent to the surface. Using a suitable base material under local roads and streets in both soils will reduce the damage caused by frost action, low strength, and the shrinking and swelling of the Upshur soil. To reduce erosion during construction, plant cover should be maintained on the site as much as possible.

These soils are in capability subclass IIIe. The Westmoreland soil is in woodland suitability subclass 3o, and the Upshur soil is in 3c.

WmD—Westmoreland-Upshur complex, 15 to 25 percent slopes. These moderately steep, deep, well drained soils are on hillsides. A few areas are on ridgetops and knolls. Slopes are smooth and convex on the upper part of hillsides and smooth and concave on the lower part. Westmoreland silt loam makes up 40 to 60 percent of most areas, and Upshur silty clay loam about 30 to 40 percent. Areas of these two soils occur in relatively narrow, alternating, nearly horizontal bands with the Westmoreland soil commonly on the steeper parts of most areas. It was not practical to separate them in mapping. Most areas are long and narrow or irregularly shaped and are 5 to 40 acres in size.

Typically, the Westmoreland soil has a dark brown and brown, friable, silt loam surface layer about 9 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable loam and firm silty clay loam and channery silty clay loam about 20 inches thick. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Typically, the Upshur soil has a dark brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm clay and silty clay about 32 inches thick. The substratum is dark reddish brown and reddish brown, firm silty clay and silty clay loam. Dark yellowish brown, calcareous, shale bedrock is at a depth of about 70 inches. In some areas there is more silt in the upper part of the soil.

Included with these soils in mapping are small areas of the moderately deep Berks and Dekalb soils on some shoulder slopes. Also included are some areas of the moderately well drained Guernsey soils on knolls. These included soils make up 10 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and slow in the Upshur soil. Both soils have moderate available water capacity, very rapid runoff, moderately low organic matter content, and medium natural fertility. The shrink-swell potential in the subsoil is low in the Westmoreland soil and high in the Upshur soil. The subsoil is commonly very strongly acid to medium acid in the Westmoreland soil. Reaction is very strongly acid to medium acid in the upper part of the subsoil in the Upshur soil and strongly acid to moderately alkaline in the lower part.

Most areas are in pasture or hay. These soils are suited to permanent hay and moderately well suited to cropping systems of corn, small grain, and hay. Controlling erosion and maintaining the organic matter content and tilth are the major concerns of management when these soils are cultivated. Erosion can be reduced by using conservation tillage that leaves crop residues on the soil surface, no-till farming, grassed waterways, contour stripcropping, meadows in the cropping system, and cover crops. The Upshur soil becomes compact and cloddy if it is worked when it is wet and sticky. Limiting tillage to when this soil is within the optimum moisture range reduces soil compaction and clodding.

These soils are moderately well suited to pasture. Maintenance of key forage species and controlling erosion are the major management concerns. Grazing these soils when they are wet causes soil compaction and increased runoff and soil loss. Good management

practices include proper stocking rates, pasture rotation, deferment of grazing during wet periods, and mowing to control weeds.

These soils are moderately well suited to woodland. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The use of equipment is not as much of a limitation on the Westmoreland soil as on the Upshur soil. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun. Using seedlings that have been transplanted once or mulching the Upshur soil will reduce seedling mortality rates. The windthrow hazard can be reduced on the Upshur soil by proper harvesting techniques.

These soils are poorly suited as sites for buildings and septic tank absorption fields. Because there is less clay throughout the Westmoreland soil, it is better suited to these uses than the Upshur soil. The Upshur soil is also subject to hillside slippage. Buildings should be designed to conform to the natural slope of the land. Using walls that have pilasters and are reinforced with concrete or backfilling along foundations with material that has a low shrink-swell potential will reduce the damage in the Upshur soil caused by shrinking and swelling. Cutting and filling operations on the Upshur soil increase the hazard of hillside slippage. The distribution lines should be on the contour in both soils to reduce lateral seepage of effluent to the surface. Using a suitable base material under local roads and streets in both soils will reduce the damage caused by frost action, low strength, and the shrinking and swelling of the Upshur soil. To reduce erosion during construction, plant cover should be maintained on the site as much as possible.

These soils are in capability subclass IVe. The Westmoreland soil is in woodland suitability subclass 2r on the north aspect and 3r on the south aspect; the Upshur soil is in 3c on the north aspect and 4c on the south aspect.

WmE—Westmoreland-Upshur complex, 25 to 40 percent slopes. These steep, deep, well drained soils are on hillsides, knolls, and along drainageways. Some areas have narrow benches, low bedrock escarpments, and an occasional landslip. Westmoreland silt loam makes up 40 to 60 percent of most areas, and Upshur silty clay loam 25 to 40 percent. Areas of these two soils occur as relatively narrow, alternating bands that are too narrow to separate in mapping. The Westmoreland soil is commonly on the steeper parts of most areas, and the Upshur soil is on the less steep slopes and benches. Most areas are long and narrow and range from 10 to 70 acres in size.

Typically, the Westmoreland soil has a dark brown and brown, friable, silt loam surface layer about 9 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable loam and firm and channery silty clay loam about 20 inches thick. The substratum is strong brown, firm very channery silty clay loam. Light brownish gray, siltstone bedrock is at a depth of about 45 inches.

Typically, the Upshur soil has a brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm clay and silty clay about 32 inches thick. The substratum is dark reddish brown and reddish brown, firm silty clay and silty clay loam. Dark yellowish brown, calcareous, shale bedrock is at a depth of about 70 inches.

Included with these soils in mapping are small areas of the moderately well drained Guernsey soils on less sloping areas and the moderately deep Berks and Dekalb soils on the edge of most areas. Also included are long, narrow, low bedrock escarpments on the upper part of slopes. These inclusions make up 15 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and slow in the Upshur soil. Both soils have moderate available water capacity, very rapid runoff, moderately low organic matter content, and medium natural fertility. The shrink-swell potential of the subsoil is low in the Westmoreland soil and high in the Upshur soil. The subsoil is commonly very strongly acid to medium acid in the Westmoreland soil. Reaction is very strongly acid to medium acid in the upper part of the subsoil in the Upshur soil and strongly acid to moderately alkaline in the lower part.

Some areas are in permanent pasture. These soils are generally unsuited to row crops, small grain, and hay because of the steep slopes. They are poorly suited to pasture. Controlling erosion and maintaining fertility and key forage species are the major management concerns. Grazing this soil when it is wet increases soil compaction, runoff, and soil loss. Good management practices include proper stocking rates, pasture rotation, deferment of grazing during wet periods, and mowing to control weeds.

Most areas are in woodland. These soils are moderately well suited to trees. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The slope and sticky and slippery nature of the surface layer of the Upshur soil when it is wet limit the use of equipment. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun. Using seedlings that have been transplanted once or mulching the Upshur soil will reduce seedling mortality rates. The windthrow hazard on the Upshur soil can be reduced by proper harvesting techniques.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of the steep slopes, high shrink-swell potential in the

subsoil of the Upshur soil, the susceptibility of the Upshur soil to hillside slippage, and the slow permeability of the Upshur soil.

These soils are in capability subclass VIe. The Westmoreland soil is in woodland suitability subclass 2r on the north aspect and 3r on the south aspect; the Upshur soil is in 3c on the north aspect and 4c on the south aspect.

WmF—Westmoreland-Upshur complex, 40 to 70 percent slopes. These very steep, deep, well drained soils are on hillsides and along drainageways. Some areas have narrow benches, low bedrock escarpments, and an occasional landslip. Westmoreland silt loam makes up 50 to 60 percent of most areas, and Upshur silty clay loam 20 to 30 percent. Areas of these two soils occur as relatively narrow, alternating bands that are too narrow to separate in mapping. The Westmoreland soil is generally on the steeper parts of most areas, and the Upshur soil is in areas with less slope and on benches. Most areas are long and narrow and are 5 to 50 acres in size.

Typically, the Westmoreland soil has a brown, friable, silt loam surface layer about 4 inches thick. The subsoil is yellowish brown, friable silt loam and firm channery silty clay loam about 28 inches thick. The substratum is yellowish brown, firm channery clay loam. Olive brown, siltstone bedrock is at a depth of about 46 inches.

Typically, the Upshur soil has a brown, friable, silty clay loam surface layer about 6 inches thick. The subsoil is reddish brown and dark reddish brown, firm clay and silty clay about 32 inches thick. The substratum, to a depth of about 60 inches, is dark reddish brown and reddish brown, firm silty clay and silty clay loam.

Included with these soils in mapping are small areas of the moderately well drained Guernsey soils and the moderately deep Berks and Dekalb soils. Guernsey soils are in less sloping areas, and Dekalb and Berks soils are on the edge of mapped areas. Also included are long, narrow, low bedrock escarpments on the upper part of slopes. These inclusions make up 10 to 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and slow in the Upshur soil. Both soils have moderate available water capacity, very rapid runoff, moderately low organic matter content, and medium natural fertility. The shrink-swell potential of the subsoil is low in the Westmoreland soil and high in the Upshur soil. The subsoil is commonly very strongly acid to medium acid in the Westmoreland soil. Reaction is very strongly acid to medium acid in the upper part of the subsoil in the Upshur soil and strongly acid to moderately alkaline in the lower part.

These soils are generally unsuited to corn, small grain, hay, and pasture because the slopes are too steep and uneven to manage.

Nearly all areas of these soils are in woodland. These soils are moderately well suited to trees. Erosion can be reduced by such practices as placing logging roads and skid trails on or near the contour and using water bars. The very steep slopes and sticky and slippery nature of the surface layer of the Upshur soil severely limit the use of equipment. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because they are cooler and not as dry. The better sites are less exposed to the drying effects of the prevailing winds and the sun. The windthrow hazard on the Upshur soil can be reduced by proper harvesting techniques.

These soils are generally unsuited as a site for buildings and septic tank absorption fields because of the very steep slopes, high shrink-swell potential in the subsoil of the Upshur soil, the susceptibility of the Upshur soil to hillside slippage, and the slow permeability of the Upshur soil.

These soils are in capability subclass VIIe. The Westmoreland soil is in woodland suitability subclass 2r on the north aspect and 3r on the south aspect; the Upshur soil is in 3c on the north aspect and 4c on the south aspect.

WpB—Wheeling loam, 3 to 10 percent slopes. This gently sloping, well drained, deep soil is on elevated terraces. Most areas are long and narrow and range in size from 15 to 40 acres.

Typically, the surface layer is dark brown, friable loam about 11 inches thick. The subsoil, to a depth of about 60 inches, is yellowish brown, friable loam.

Included with this soil in mapping are small areas of moderately well drained Glenford soils on the edge of mapped areas. These included soils make up 5 to 10 percent of most areas.

This Wheeling soil has moderate permeability, moderate available water capacity, medium runoff, and good tilth. The root zone is deep, and the subsoil is strongly acid. This soil has a moderately low organic matter content and medium natural fertility.

Most areas are used for corn, soybeans, small grain, hay, and specialty crops. This soil is well suited to cultivated crops, small grain, and grasses and legumes for hay and pasture. It can be cropped frequently. The erosion hazard is moderate if it is used for cultivated crops. Grassed waterways and contour stripcropping will help reduce excessive soil loss. Returning crop residue to the soil helps maintain fertility and tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and mowing to control weeds help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by spraying, mowing, or disking.

This soil is well suited as a site for buildings and septic tank absorption fields. Using a suitable base material

under local roads and streets will reduce the damage caused by frost action and low soil strength.

This soil is in capability subclass IIe. It is in woodland suitability subclass 2o.

WtB—Woodsfield silt loam, 3 to 8 percent slopes. This gently sloping, deep, well drained soil is on ridgetops. Most slopes are smooth and slightly convex and grade to nearly level near the middle of some of the broader ridgetops. Most areas are irregularly shaped and 2 to 35 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil, to a depth of about 60 inches, is strong brown and dark brown, friable silt loam and silty clay loam in the upper part and reddish brown, dark reddish brown, and weak red, firm clay and silty clay in the lower part. The subsoil is mottled below a depth of about 49 inches.

Included with this soil in mapping are small areas of Westmore soils that are yellower in the lower part of the soil. These included soils are on the edge of mapped areas and make up 10 to 20 percent of most areas.

Permeability of this Woodsfield soil is moderate in the upper part of the subsoil and moderately slow or slow in the lower part. This soil has moderate or high available water capacity, medium runoff, and good tilth. The shrink-swell potential is high in the lower part of the subsoil. The root zone is deep. The subsoil is slightly acid to strongly acid in the upper part and medium acid to mildly alkaline in the lower part. The organic matter content is moderate, and the natural fertility is medium.

Most of the larger areas are farmed. This soil is well suited to cultivated crops, small grain, and hay. The erosion hazard is moderate if it is used for cultivated crops. The surface layer crusts after hard rains. This soil can be row cropped frequently if practices such as conservation tillage that leaves crop residues on the soil surface, contour tillage, winter cover crops, grassed waterways, and returning crop residues to the soil are used to reduce erosion and maintain fertility and tilth.

This soil is well suited to pasture. Overgrazing or grazing when the soil is wet causes soil compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, mowing for weed control, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to woodland. Seedlings survive and grow well if competing vegetation is controlled by site preparation and spraying, mowing, or disking.

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. Backfilling along foundations with material that has a low shrink-swell potential and using extra reinforcing in foundations will reduce the damage caused by shrinking and swelling of the soil. Using a suitable base material under local roads and streets will reduce the damage caused by low soil strength and shrinking and swelling of the soil. Septic tank absorption fields can be improved by enlarging the field or placing it in suitable fill material.

This soil is in capability subclass IIe. It is in woodland suitability subclass 2o.

WtC—Woodsfield silt loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is mainly on smooth, rounded ridgetops, on crests of knolls on hilltops, and on the upper part of side slopes. Most slopes are smooth and slightly convex. Individual areas are oval, long and narrow, or irregularly shaped. They range in size from 5 to 35 acres.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil is about 49 inches thick. The upper part is strong brown and dark brown, friable silt loam and silty clay loam; the lower part is reddish brown and dark reddish brown, firm clay. The substratum, to a depth of about 70 inches, is weak red, firm silty clay. Some areas are eroded.

Included with this soil in mapping are small areas of the Westmore, Westmoreland, and Guernsey soils that are yellower in the lower part of the soil. These included soils are usually near the edge of mapped areas and make up 15 to 20 percent of most areas.

Permeability of this Woodsfield soil is moderate in the upper part of the subsoil and moderately slow or slow in the lower part. This soil has a moderate or high available water capacity, medium runoff, and good tilth. The shrink-swell potential is high in the lower part of the subsoil. The subsoil is slightly acid to strongly acid in the upper part and medium acid to mildly alkaline in the lower part. The organic matter content is moderate, and natural fertility is medium.

Most areas of this soil are farmed. This soil is moderately well suited to cultivated crops, small grain, and hay in a crop rotation. The erosion hazard is severe in cultivated areas. The surface layer crusts after hard rains. The control of erosion and the maintenance of tilth and organic matter content are concerns of management. Using conservation tillage that leaves crop residues on the soil surface, grassed waterways, contour stripcropping, cover crops, grasses and legumes in the cropping system, and returning crop residues to the soil help to reduce erosion and maintain the tilth and organic matter content.

This soil is well suited to pasture. Grazing when the soil is wet causes soil compaction, excessive runoff, and erosion. Proper stocking rates, rotation of grazing, and mowing for weed control help keep the pasture and soil in good condition.

This soil is well suited to woodland. Mechanical planting, weed control, and harvesting are easily accomplished. Trees survive and grow well if competing vegetation is removed or controlled by spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption

fields. Because of the high shrink-swell potential in the lower part of the subsoil and in the substratum, this soil is better suited to houses without basements than to houses with basements. Backfilling along foundations with material that has a low shrink-swell potential and using extra reinforcement in foundations will reduce the damage from shrinking and swelling of the soil. Using a suitable base material under local roads and streets will reduce the damage caused by the low soil strength and the shrinking and swelling of the soil. Septic tank absorption fields can be improved by enlarging the field or placing the field in suitable fill material. Installing the distribution lines of septic tank absorption fields on the contour will reduce lateral seepage of effluent to the surface. Increased runoff and erosion occur during construction but can be reduced by maintaining plant cover wherever possible.

This soil is in capability subclass IIIe. It is in woodland suitability subclass 2o.

ZnB—Zanesville silt loam, 3 to 8 percent slopes. This gently sloping, deep, moderately well drained soil is on ridgetops. Most slopes are slightly convex and have stronger slopes at the edges of the ridgetops. Most areas are long and narrow and are 3 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil, to a depth of about 60 inches, is yellowish brown, firm silt loam and silty clay loam in the upper part; a yellowish brown and brownish yellow, firm and very firm, silty clay loam fragipan in the middle part; and yellowish brown, firm silty clay loam in the lower part. Some areas do not have a fragipan.

This soil has low available water capacity, good tilth, and medium runoff. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. The root zone is mainly restricted to the moderately deep zone above the fragipan. The subsoil is medium acid to very strongly acid. This soil has a moderately low organic matter content and medium natural fertility. A seasonal high water table is between depths of 24 and 36 inches in winter, spring, and other extended wet periods.

Most areas are used for row crops, hay, and pasture. This soil is well suited to cultivated crops and small grain. It can be cropped frequently, if erosion is controlled. Conservation tillage that leaves crop residues on the soil surface, contour farming, winter cover crops, returning crop residues to the soil, and grassed waterways are good management practices to reduce soil loss and maintain tilth.

This soil is well suited to pasture and hay. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, mowing to control weeds, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings grow well if competing vegetation is controlled by site preparation and mowing, disking, or spraying. This soil is well suited to mechanical planting and harvesting.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Drains at the base of footings and exterior basement wall coatings are used to help keep basements dry. Local roads and streets can be improved by providing artificial drainage and a suitable base material to reduce the damage from low soil strength and frost action. Increasing the size of the absorption field, placing the field in suitable fill material, and installing drains around it will increase the absorption of effluent.

This soil is in capability subclass IIe. It is in woodland suitability subclass 3o.

Prime Farmland

The best land for farming is called 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 providing the Nation's short- and long-range needs for food and fiber. Because the amount of this high quality farmland is limited, it should be used with wisdom and foresight.

Detailed information on the criteria for prime farmland is available from the local staff of the Soil Conservation Service. In general, however, prime farmland is the land best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops where it is treated and managed with acceptable farming methods. Given minimal inputs of energy and economic resources, prime farmland produces higher yields and causes less damage to the environment than farming other kinds of land.

Prime farmland may now be in crops, pasture, woodland, or anything other than urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

The soils that make up prime farmland usually have an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity is suitable. These soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope gradient is mostly less than 6 percent.

About 6,400 acres, or nearly 2 percent, of Athens County is prime farmland. Most of this acreage is used for crops. Areas are mainly in map units 6 and 7 of the general soil map.

A recent trend in some parts of the county has been the conversion of prime farmland to industrial and urban uses. Such loss of prime farmland to nonfarm uses increases the agricultural use of less suitable soils, which are generally more erodible, droughty, and difficult to cultivate and are usually less productive.

The detailed soil map units that make up prime farmland in Athens County are listed in table 5. This list, however, is not a recommendation for a particular land use.

Some soils that have a limitation, such as a high water table, may qualify as prime farmland if the limitation is overcome by corrective measures. Any corrective measures needed are shown in parentheses after the map unit name in table 5. Onsite evaluation is necessary, however, to see if the corrective measures are effective.

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 avoid 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 behavior 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 recreation facilities; and for wildlife habitat. It can be used to identify the potentials and 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 and Pasture

Robert W. Steele, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture 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 Soil Conservation Service is explained; and the estimated yields of the main crops and hay 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 "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to the Conservation Needs Inventory, about 34 percent of Athens County was in crops and pasture in 1967 (*6*). The principal crops are corn, soybeans, wheat, oats, and hay.

The hazard of erosion is a major concern of farming. The slope is greater than 15 percent on nearly 71 percent of the county, or 228,270 acres. Even though the soils in some of these areas are used for row crops, they are better suited to woodland and pasture.

Many soils in the county need lime or fertilizer, or both, for maximum crop production. The amount needed depends on the natural content of lime and plant nutrients, as determined by laboratory analysis of soil samples, on the needs of the crop, and on the level of yields desired. Only general suggestions for applications of lime and fertilizer are given in this publication.

The content of organic matter is low or moderately low in most of the soils. Increasing the organic matter content to a high level is not economical, but it is important to maintain the present organic matter content by applying farm manure, leaving crop residues on the surface, and growing sod and green-manure crops.

Most soils that have a silt loam surface layer are subject to crusting after heavy rains. Tillage tends to break down soil structure. It should be kept to the minimum necessary to break the crust, prepare a seedbed, and control weeds.

The soils in Athens County are dominantly well or moderately well drained. Except for small, wet, seepy areas, artificial drainage is seldom needed for crop production. By draining the wet areas, some fields are made more usable and productive. The somewhat poorly drained soils are mainly on bottom land and low terraces. Some receive runoff from the adjacent uplands, while some receive water from seeps and springs in the nearby hillsides. Using diversions to intercept the runoff from hillsides allows these soils to dry faster. Surface and subsurface drains are used to remove water and allow earlier field operations.

Erosion is a hazard on the gently sloping and steeper soils. It is generally a greater hazard on soils with steeper slopes. The erodibility of a particular soil, however, depends also on its physical properties. For example, an Upshur soil is more susceptible to erosion than a Dekalb soil, assuming the soils have similar slopes and plant cover. This is mainly the result of differences in the permeability and texture of the surface layers.

Erosion also is a greater hazard on a soil in a cultivated area than one in a wooded area. Cropland erosion is commonly controlled by diversions, grassed waterways, contour stripcropping, contour tillage, sod crops, and leaving crop residue on the surface. No-till planting and chemical weed control are increasingly popular in corn production. Systems can be designed to effectively control erosion by using combinations of these practices. The local representative of the Soil Conservation Service can assist in planning conservation practices.

Pasture and hayland is a major use of open land in Athens County. Yield figures for grass-legume hay are given in table 6. Because of variability in the quality of pastures, pasture yields were not estimated. Commonly grown plants are alfalfa, red clover, white clover, bluegrass, orchardgrass, tall fescue, timothy, and bromegrass.

The ability of a pasture to produce forage and protect the soil is influenced by the number of livestock, the length of time they graze, and the season they graze. Practices that contribute to good pasture management include the use of proper stocking rates to maintain key forage species, pasture rotation, deferred grazing during wet periods, mowing to control weeds, applications of appropriate amounts of lime and fertilizer, and strategically located water supplies.

Since many of the soils used for pasture are moderately steep or steep, care must be exercised to reduce erosion. Control of erosion is particularly important during seeding. Mulch seeding or the use of a small grain as a companion crop helps reduce the erosion hazard.

The need for lime and fertilizer should be determined by soil tests. Adequate amounts should be applied to meet the requirements of the crop to maintain plant vigor and reduce competition from undesirable species.

Soil compaction, caused by grazing on the soils when they are wet, can greatly reduce the vigor of pasture plants. It also reduces permeability, which results in increased runoff and erosion. Compaction is particularly a hazard on the Brookside, Elba, Guernsey, Upshur, and Vandalia soils.

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 6. 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 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 insures 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 6 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 Soil 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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider 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 and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*10*). Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman 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 limitation is 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. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Forested lands make up approximately 56 percent, or 180,043 acres, of the total land area in Athens County (*6*). Most of the forested land is privately owned. The state owns approximately 10,000 acres of woodland in Athens County. About 10,000 acres is also in the Wayne National Forest. The most extensive wooded areas lie in the northern part of the county.

The woodland of Athens County is a predominantly mixed mesophytic forest dominated by oak. Other major types of trees include hickory, beech, yellow-poplar, walnut, and maple. Yellow-poplar and red maple tend to be early successional species, with oak, hickory, beech, and maple being the climax species that are characteristic of a mature forest.

In places the woodland shows abuse and neglect. Heavy cutting without planning for future timber crops has resulted in understocked stands of mature trees. High grading practices have continually removed the best trees and left the worst. Culls and low-value trees occupy valuable growing space on many excellent woodland soils. Low-value American elm, cull beech, and poorly formed black cherry and red maple now occupy thousands of acres where yellow-poplar, oak, and sugar maple once grew. Grazing by livestock has destroyed leaf litter, killed young trees, damaged roots, increased erosion, and compacted the soil. Good management, in time, can restore this woodland to a higher level of production.

Soils differ in their suitability for tree growth. The capacity of a soil to supply moisture, or the available water capacity of a soil, is very important for tree growth. It is influenced by the soil's depth, texture, permeability, and internal drainage. The direction the slope of the soil faces, or aspect, and the position of the soil on the landscape are also important. Other properties to be considered in evaluating a soil for woodland are the slope gradient, the degree of past erosion, the acidity, and the natural fertility of the soil.

Aspect is the compass direction toward which the slope faces. The north aspect refers to those slopes that have an azimuth of 355 degrees to 95 degrees; the south aspect refers to those slopes that have an azimuth of 96 to 354 degrees (*4*). Tree growth is generally better on the north aspect. Some of the factors that make the south aspect less productive are higher soil temperatures as a result of more direct sun rays, higher evaporation used by exposure to the prevailing winds, earlier melting of snow, and more freezing and thawing.

In addition to aspect, the position of the soil on the slope also determines the moisture supply available for tree growth. Soils on the lower parts of slopes are generally moister than soils on the higher parts. On the lower parts of slopes, the soils are generally deeper than those on the upper parts, the loss of soil moisture by evaporation is less, and the soil temperature is somewhat lower.

Steepness of slope is another important factor in woodland management. Very steep slopes present serious equipment limitations. Also, as the percent of slope increases, the rate of water infiltration decreases and the rate of runoff and the hazard of erosion increase.

Erosion reduces the amount of soil material available for water storage. Severe erosion removes the more porous surface layer and exposes the less porous subsoil, thus increasing runoff and lowering the water-intake rate. As a result, erosion affects both tree growth and natural reseeding.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The

table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well-managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. The shape of the slope and the landscape position can cause a variation of as much as 10 feet. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland from soil blowing and crops from drying winds, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well-prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service; the Cooperative Extension Service; the Ohio Department of Natural Resources, Division of Forestry; or from a nursery.

Recreation

The steep and very steep topography and extensive wooded areas help make recreation an important enterprise in Athens County. Facilities for fishing, swimming, boating, camping, hiking, picnicking, and hunting are available at one or more of the following: Burr Oak and Strouds Run State Parks, Snowden Lake, Fox Lake, Trimble and Waterloo Wildlife Areas, Gifford State Forest, and Wayne National Forest. Burr Oak also has a lodge, cabins, tennis courts, and a golf course. In addition, there are several privately owned camp areas that provide recreational facilities. The Ohio River can be

used for many forms of water recreation, and water skiing is available near Albany. In fall, the colorful foliage enhances the woodland for travelers and hikers.

Hunting attracts many people from other parts of the state as well as from out of state. The major game animal is deer, the population of which is estimated at 4,300. Other game animals include rabbit; squirrel; and, to a lesser extent, turkey, beaver, and grouse.

The soils of the survey area are rated in table 10 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 sewerlines. 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 recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, 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 by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

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, horseback riding, and bicycling 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

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 11, 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 (*1*). 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 flood hazard. 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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, 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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and milkweed.

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, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, beech, maple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, 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, duckweed, reed canarygrass, 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 shallow 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. The 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, and deer.

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. The ratings are given in the following tables: 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 need to 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 to 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 kind 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 (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) 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 12 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, a cemented pan, 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 the 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, 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, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 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 or to a cemented pan, 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), shrink-swell potential, frost action potential, 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 or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials 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 13 shows the degree and the 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.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. 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 or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow 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.

Table 13 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 or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of 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, bedrock, and cemented pans 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 needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type 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 type 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 soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as 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 14 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 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, 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 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 the depth to the water table is 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. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, 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 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 15 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; embankments, dikes, and levees; and aquifer-fed excavated ponds. 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, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

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, to a cemented pan, 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; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. 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 reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or 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 or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, 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.

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. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, 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 16 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 "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 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 (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

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, SP-SM.

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 in the field to weight percentage.

Percentage (of soil particles) passing designated 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.

Physical and Chemical Properties

Table 17 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, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving 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, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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.

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 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 change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

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 0.05 to 0.69. 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 table 17, 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 of 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 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils 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 moderate rate of water transmission.

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 permanent 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, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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 absence of distinctive horizons that form in soils that are not subject to flooding.

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 depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; 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 table 18.

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. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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 specified as 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.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is

not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

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 creates a severe corrosion environment. 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

Samples of several of the soils in Athens County were analyzed by the Soil Characterization Laboratory, Department of Agronomy, The Ohio State University, Columbus, Ohio. Data obtained on most samples include those on particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of these soils and in evaluating their behavior under various land uses. Four of the profiles were selected as representative of their respective series and are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Steinsburg (AT-19), Upshur (AT-11), Vandalia (AT-20), and Westmoreland (AT-21).

In addition to the Athens County data, data are also available from nearby counties in southeastern Ohio. All of these data are on file at the Department of Agronomy, The Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Two of the soils in Athens County were analyzed for engineering properties by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. Their series name and laboratory identification numbers are Vandalia (AT-20) and Westmoreland (AT-21).

In addition to the Athens County data, engineering test data are also available from nearby counties that have many of the same soils. These data and the Athens County data are on file at the Department of Agronomy, The Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). 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 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten 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 Alfisol.

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 Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

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; 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 Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic 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 known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other 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 (*9*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*11*). Unless otherwise stated, 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."

Barkcamp Series

The Barkcamp series consists of deep, well drained soils formed in a mixture of extremely acid, loamy fine earth material and fragments of medium and coarse grained sandstone from surface mining. Permeability is moderately rapid or rapid. Slope ranges from 40 to 70 percent.

Typical pedon of Barkcamp gravelly sandy loam, 40 to 70 percent slopes, about 3 miles southwest of Nelsonville, York Township, 300 feet north and 1,400 feet east of the southwest corner of sec. 35, T. 12 N., R. 15 W.

A—0 to 4 inches; yellowish brown (10YR 5/4) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; very friable; common roots; 17 percent sandstone and coal fragments; very strongly acid; clear wavy boundary.

C1—4 to 17 inches; brown (10YR 5/3) very gravelly sandy loam; massive; very friable; few roots; lense of strong brown (7.5YR 5/6) silty clay; 35 percent sandstone fragments, 10 percent siltstone fragments, and 10 percent coal fragments; extremely acid; clear wavy boundary.

C2—17 to 60 inches; brown (10YR 5/3) extremely gravelly sandy loam; massive; very friable; 55 percent sandstone fragments, 10 percent coal fragments, and 5 percent siltstone fragments; extremely acid.

Content of coarse fragments ranges from 15 to 50 percent in the A horizon and 35 to 75 percent in the C horizon. Coarse fragments are mostly less than 10 inches in diameter, but there are some larger stones and boulders.

The C horizon has hue of 5YR to 2.5Y, value of 5 or 6, and chroma of 1 to 8. Clay content ranges from 6 to 18 percent.

Berks Series

The Berks series consists of moderately deep, well drained, moderately or moderately rapidly permeable soils formed in residuum from siltstone, shale, and fine grained sandstone on hillsides and ridgetops. Slope ranges from 15 to 70 percent.

Berks soils are similar to Dekalb and Steinsburg soils and are commonly adjacent to Brookside, Elba, and Westmoreland soils. Dekalb soils have less clay in the B horizon. Brookside, Elba, and Westmoreland soils are commonly on the lower part of slopes. Brookside and Elba soils have more clay and fewer coarse fragments in the subsoil and are deeper over bedrock. Steinsburg and Westmoreland soils have fewer coarse fragments in the subsoil. Westmoreland soils have an argillic horizon and are deeper over bedrock.

Typical pedon of Berks silt loam from an area of Berks-Westmoreland silt loams, 40 to 70 percent slopes, about 1.4 miles west of Athens, Athens Township, 1,320 feet southwest of the intersection of State Routes 56 and 682, along State Route 56, then 330 feet east, T. 9 N., R. 14 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many roots; 10 percent coarse fragments; slightly acid; clear wavy boundary.

Bw1—5 to 12 inches; yellowish brown (10YR 5/6) channery silt loam; moderate fine and medium subangular blocky structure; friable; common roots; 20 percent siltstone fragments; strongly acid; clear wavy boundary.

Bw2—12 to 16 inches; yellowish brown (10YR 5/4) channery silt loam; moderate fine and medium subangular blocky structure; friable; 35 percent siltstone fragments; strongly acid; clear wavy boundary.

BC—16 to 23 inches; yellowish brown (10YR 5/4) very channery silt loam; moderate fine and medium subangular blocky structure; friable; 60 percent siltstone fragments; strongly acid; clear wavy boundary.

R—23 inches; olive brown (2.5Y 4/4) siltstone.

Solum thickness ranges from 18 to 26 inches, and the depth to bedrock ranges from 20 to 40 inches. Fragments of thin, flat siltstone, shale, or fine grained sandstone range from 10 to 15 percent of the A horizon and from 15 to 65 percent of individual subhorizons in the B horizon. Reaction, unless the soil has been limed, is very strongly acid to medium acid throughout.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is commonly silt loam but is loam in some pedons. The B horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 8. The fine earth fraction is silty clay loam, silt loam, or loam. Clay content ranges from 15 to 30 percent, and silt content ranges from about 40 to 60 percent. A C horizon is present in some pedons. It has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. Texture is silt loam in the fine earth fraction, which is 60 to 85 percent coarse fragments. The bedrock is commonly fractured siltstone, shale, or fine grained sandstone.

Bethesda Series

The Bethesda series consists of deep, well drained, moderately slowly permeable soils. The soils formed in a mixture of fine earth material and fragments of shale, siltstone, and sandstone from surface mining. Slope ranges from 8 to 70 percent.

Typical pedon of Bethesda shaly silty clay loam, 25 to 40 percent slopes, about .75 mile southwest of Nelsonville, York Township, 2,200 feet east and 1,200 feet south of the northwest corner of sec. 23, T. 12 N., R. 15 W.

A1—0 to 3 inches; variegated brown (10YR 5/3), dark gray (N 4/0), and yellowish brown (10YR 5/8) shaly silty clay loam, dominant dry color pale brown (10YR 6/3); weak medium granular structure; friable; common roots; 17 percent siltstone fragments and 3 percent coal fragments; strongly acid; abrupt smooth boundary.

A2—3 to 11 inches; variegated brown (10YR 5/3), dark gray (N 4/0), and yellowish brown (10YR 5/8) shaly silty clay loam; weak medium subangular blocky

structure; firm; few roots; 27 percent siltstone fragments and 3 percent coal fragments; strongly acid; clear wavy boundary.

C1—11 to 23 inches; variegated yellowish brown (10YR 5/4), dark gray (N 4/0), and grayish brown (10YR 5/2) very shaly silty clay loam; massive; firm; 55 percent siltstone fragments and 5 percent coal fragments; strongly acid; clear wavy boundary.

C2—23 to 60 inches; variegated yellowish brown (10YR 5/4 and 5/8) and gray (N 5/0) very shaly silty clay loam; massive; firm; few lenses of silty clay; 57 percent siltstone fragments and 3 percent coal fragments; strongly acid.

Reaction ranges from strongly acid to extremely acid throughout the soil. Coarse fragments include shale, siltstone, coal, and sandstone. They range in size from 1 to 8 inches in diameter, but there are some larger stones and boulders. Content of coarse fragments in the C horizon ranges from 35 to 75 percent and averages about 45 percent.

The A horizon is commonly shaly silty clay loam but is channery silty clay loam in some pedons. It has hue of 7.5YR, 10YR, or neutral; value of 4 or 5; and chroma of 0 to 8. The C horizon is very or extremely channery or shaly silty clay loam. It has hue of 7.5YR, 10YR, or neutral; value of 4 to 6; and chroma of 0 to 8.

Brookside Series

The Brookside series consists of deep, moderately well drained, moderately slowly permeable soils formed in colluvium on foot slopes, toe slopes, and benches. Slope ranges from 15 to 70 percent.

Brookside soils are similar to Elba, Guernsey, and Vandalia soils and are commonly adjacent to Berks, Elba, Richland, and Vandalia soils. Berks, Elba, and Richland soils are on slightly higher positions on the landscape. Berks and Richland soils have less clay in the subsoil, and Berks soils do not have an argillic horizon. Elba soils have carbonates at a depth of 30 inches. Guernsey soils have gray mottles in the upper 10 inches of the argillic horizon. Vandalia soils are redder in the subsoil and are in positions similar to those of the Brookside soils.

Typical pedon of Brookside silt loam, 25 to 40 percent slopes, about 1 mile southwest of Athens, Athens Township, 1,320 feet west of the intersection of U.S. 33 and Township Road 32, along Township Road 32, then 500 feet south, T. 9 N., R. 14 W.

A—0 to 5 inches; dark brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium and fine granular structure; friable; many roots; 4 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—5 to 8 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium and fine angular blocky structure; firm; common roots; brown (7.5YR 5/4) coatings on faces of peds; 5 percent coarse fragments; medium acid; clear wavy boundary.

Bt1—8 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium and fine angular blocky structure; firm; common roots; thin patchy clay films on faces of peds; brown (7.5YR 5/4) coatings on faces of peds; 5 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—15 to 20 inches; strong brown (7.5YR 5/6) silty clay loam; common fine distinct brown (10YR 5/3) mottles; moderate medium and fine angular blocky structure; firm; thin patchy clay films on faces of peds; brown (7.5YR 5/4) coatings on faces of peds; 7 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—20 to 30 inches; strong brown (7.5YR 5/6) clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and fine angular blocky structure; firm; thin patchy clay films on faces of peds; pale brown (10YR 6/3) coatings on faces of peds; 10 percent coarse fragments; common black (N 2/0) concretions; strongly acid; clear wavy boundary.

Bt4—30 to 36 inches; strong brown (7.5YR 5/6) clay; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and coarse angular blocky structure; firm; thin patchy brown (7.5YR 5/4) clay films on faces of peds; common 5 percent black (N 2/0) concretions; 15 percent coarse fragments; medium acid; clear wavy boundary.

Bt5—36 to 48 inches; yellowish brown (10YR 5/4) clay; common medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) mottles; weak coarse angular blocky structure; firm; thin patchy clay films on faces of peds; 10 percent coarse fragments, common black (N 2/0) concretions; slightly acid; clear wavy boundary.

C—48 to 60 inches; light olive brown (2.5Y 5/6) clay; common medium distinct grayish brown (10YR 5/2), yellowish brown (10YR 5/4), and dark red (2.5YR 3/6) mottles; massive; firm; 10 percent coarse fragments; common black (N 2/0) concretions; neutral.

Solum thickness ranges from 40 to 60 inches. Content of coarse fragments, which are mostly small, flat fragments, is commonly 0 to 5 percent in the A horizon, 3 to 15 percent in the upper and middle parts of the B horizon, and 3 to 25 percent in the lower part of the B horizon and in the C horizon. The upper 30 inches of the soil ranges from strongly acid to neutral. The lower part of the B horizon ranges from medium acid to mildly alkaline.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is typically silt loam but is silty clay loam in some pedons. The B horizon has hue

of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, clay loam, or clay and channery analogs in the lower part. Clay content ranges from 35 to 55 percent. The C horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 6. It is clay, clay loam, or silty clay loam and channery analogs. It is typically neutral or mildly alkaline and ranges to medium acid in some pedons.

Chagrin Series

The Chagrin series consists of deep, well drained, moderately permeable soils on flood plains. The soils formed in recent alluvium deposited by floodwaters. Slope ranges from 0 to 3 percent.

Chagrin soils are similar to Moshannon and Nolin soils and are commonly adjacent to Orrville soils. All of these soils are on flood plains. Moshannon and Nolin soils have more silt and less sand in the subsoil. Moshannan soils are redder throughout. Orrville soils are somewhat poorly drained and are in lower positions.

Typical pedon of Chagrin silt loam, frequently flooded, about 3.5 miles northwest of Coolville, Troy Township, 1,715 feet south and 33 feet west of the northeast corner of sec. 36, T. 5 N., R. 11 W.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many roots; dark brown (10YR 4/3) coatings on faces of peds; medium acid; gradual smooth boundary.

Bw1—8 to 30 inches; dark yellowish brown (10YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; few roots; slightly acid; gradual wavy boundary.

Bw2—30 to 36 inches; dark yellowish brown (10YR 4/4) loam; moderate coarse subangular blocky structure; friable; slightly acid; gradual wavy boundary.

C—36 to 60 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; slightly acid.

Solum thickness ranges from 24 to 48 inches. Content of coarse fragments ranges from 0 to 15 percent in the B horizon and C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. Some pedons have an A horizon that is 1 to 4 inches thick and has value of 2 to 4 and chroma of 1 to 4. Texture of the Ap or A horizon typically is silt loam or loam. Reaction is medium acid to neutral. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Texture is dominantly silt loam, sandy clay loam, or fine sandy loam but includes thin subhorizons of sandy loam. The average clay content of the textural control section is 18 to 30 percent. Reaction is slightly acid or neutral. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. Texture is commonly silt loam, loam, or sandy loam and ranges from relatively uniform to highly stratified. Loamy fine sand is below a depth of 40 inches in some pedons. Reaction ranges from medium acid to neutral.

Clymer Series

The Clymer series consists of deep, well drained, moderately permeable soils formed in residuum from coarse grained sandstone on ridgetops and the upper part of side slopes on uplands. Slope ranges from 8 to 15 percent.

In Athens County, these soils are less acid, have fewer coarse fragments, have less clay in the subsoil, and have a thicker solum than is defined for the Clymer series. These differences, however, do not alter the usefulness or behaviour of the soils.

Clymer soils are commonly adjacent to Steinsburg, Wellston, and Zanesville soils. Steinsburg soils are commonly on the upper part of side slopes. They are moderately deep over bedrock and do not have an argillic horizon. Wellston and Zanesville soils are commonly on ridgetops. Wellston soils have more silt and less sand in the subsoil. Zanesville soils are moderately well drained and have a fragipan.

Typical pedon of Clymer loam, 8 to 15 percent slopes, about 2 miles southeast of Amesville, Bern Township, 2,000 feet east and 1,900 feet north of the southwest corner of sec. 26, T. 7 N., R. 12 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; dark grayish brown (10YR 4/2) silt coatings on faces of peds; 1 percent sandstone fragments; slightly acid; abrupt smooth boundary.

BE—8 to 13 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; 1 percent sandstone fragments; slightly acid; clear wavy boundary.

Bt1—13 to 24 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; 1 percent sandstone fragments; slightly acid; clear wavy boundary.

Bt2—24 to 34 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; friable; thin patchy brown (7.5YR 5/4) clay films on faces of peds; 2 percent sandstone fragments; medium acid; clear wavy boundary.

C—34 to 46 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; 5 percent coarse fragments; strongly acid; clear wavy boundary.

R—46 inches; yellowish brown (10YR 5/4) weathered coarse grained sandstone.

Solum thickness and depth to bedrock range from 40 to 60 inches. Content of sandstone and siltstone

fragments ranges from 0 to 25 percent in the B and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is medium acid to neutral. The B horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. It is loam or sandy loam and is slightly acid to strongly acid. Some pedons do not have a C horizon.

Dekalb Series

The Dekalb series consists of moderately deep, well drained, moderately rapidly or rapidly permeable soils formed in residuum from sandstone on hillsides and ridgetops. Slope ranges from 15 to 70 percent.

Dekalb soils are similar to Berks and Steinsburg soils and are commonly adjacent to Westmoreland soils. Berks soils have less sand in the subsoil. Steinsburg and Westmoreland soils have fewer coarse fragments in the subsoil. Westmoreland soils have an argillic horizon and are deeper over bedrock. They are commonly on the lower part of slopes.

Typical pedon of Dekalb loam from an area of Dekalb-Westmoreland complex, 40 to 70 percent slopes, about .5 mile north of Nelsonville, York Township, 3,035 feet north and 925 feet west of the southeast corner of sec. 24, T. 12 N., R. 15 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; many roots; 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bw1—4 to 11 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; friable; common roots; 15 percent coarse fragments; strongly acid; clear wavy boundary.

Bw2—11 to 18 inches; yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable; few roots; some clay bridging; 30 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—18 to 29 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak coarse subangular blocky structure; friable; 50 percent coarse fragments; very strongly acid; clear wavy boundary.

R—29 inches; fractured sandstone.

Solum thickness ranges from 20 to 30 inches, and the depth to bedrock ranges from 20 to 40 inches. The content of sandstone fragments increases with depth and ranges from 10 to 50 percent in the B horizon.

The A or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Some pedons have an E horizon. The B horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is loam or sandy loam and their channery or very channery analogs. Average clay content in the B horizon dominantly ranges from 10 to 18 percent. Reaction is extremely acid to strongly acid. Some pedons have a C horizon with hue of 10YR, value of 5 or 6, and chroma of 4 to 6. Content of coarse fragments ranges from 40 to 50 percent.

Doles Series

The Doles series consists of deep, somewhat poorly drained, slowly permeable soils formed in loess or silty colluvium or old alluvium in preglacial Teays Valley and associated tributary valleys. Slope ranges from 0 to 3 percent.

Doles soils are similar to Fitchville soils and are commonly adjacent to Omulga soils. Fitchville soils are on terraces along streams and do not have a fragipan. Omulga soils are commonly on knolls and side slopes. They are moderately well drained and are not as gray immediately under the surface layer.

Typical pedon of Doles silt loam, 0 to 3 percent slopes, about 4 miles northwest of Albany, Lee Township, 1,980 feet south and 1,782 feet east of the northwest corner of sec. 17, T. 10 N., R. 15 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium and fine granular structure; friable; common roots; neutral; abrupt smooth boundary.

Eg—9 to 15 inches; light brownish gray (10YR 6/2) silt loam; moderate medium subangular blocky structure; friable; few roots; common yellowish brown (10YR 5/4) and black (N 2/0) concretions; neutral; clear wavy boundary.

BE—15 to 19 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; thin light brownish gray (10YR 6/2) silt coatings on faces of peds; common black (N 2/0) concretions; strongly acid; clear wavy boundary.

Bt1—19 to 25 inches; yellowish brown (10YR 5/6) and pale brown (10YR 6/3) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; medium continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; common black (N 2/0) soft nodular concretions; strongly acid; clear wavy boundary.

Btx1—25 to 37 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct pale brown (10YR 6/3) and common medium faint yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak thick platy; firm and brittle; thin patchy gray (10YR 5/1) clay films on faces of peds; medium continuous light brownish

gray (2.5Y 6/2) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Btx2—37 to 52 inches; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) silty clay loam; common medium distinct pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; firm and brittle; thin patchy gray (10YR 5/1) clay films on faces of peds; light brownish gray (10YR 6/2) coatings on faces of peds; strongly acid; clear wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct pale brown (10YR 6/3) mottles; massive; firm; medium acid.

The solum is typically 52 to 81 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The E horizon has a hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The A horizon typically is medium acid or strongly acid but ranges to neutral, where limed. The B horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 to 6. The Bt and Btx horizons are typically silt loam or silty clay loam. The C horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 6. It is usually stratified with textures of silty clay loam, silt loam, silty clay, sandy clay loam, or clay loam. It is strongly acid or medium acid.

Elba Series

The Elba series consists of deep, well drained, slowly permeable soils formed in residuum from limestone, calcareous clay shale, and siltstone on ridgetops and side slopes. Slope ranges from 8 to 70 percent.

Elba soils are similar to Brookside and Guernsey soils and are commonly adjacent to Berks, Brookside, and Upshur soils. Brookside and Guernsey soils do not have carbonates within 30 inches of the surface. Brookside soils are commonly on foot slopes and benches. Guernsey soils are moderately well drained and have low-chroma mottles in the upper 10 inches of the argillic horizon. Berks soils are on shoulder slopes and side slopes. They have less clay and more coarse fragments in the subsoil and do not have an argillic horizon. Upshur soils are on the lower parts of slopes and have a redder subsoil.

Typical pedon of Elba silty clay loam from an area of Upshur-Elba silty clay loams, 15 to 25 percent slopes, about 2 miles northeast of Athens, Athens Township, 1,715 feet southwest of the intersection of Township Road 213 and Township Road 635 along Township Road 213, then 790 feet south, T. 9 N., R. 14 W.

Ap—0 to 4 inches; dark brown (7.5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; moderate fine angular blocky structure; firm; many roots; neutral; abrupt smooth boundary.

Bt1—4 to 10 inches; dark brown (7.5YR 4/4) silty clay; strong medium angular blocky structure; firm; common roots; thin patchy clay films on faces of peds; dark grayish brown (10YR 4/2) organic stains; mildly alkaline; clear wavy boundary.

Bt2—10 to 21 inches; light olive brown (2.5Y 5/4) silty clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; thin patchy dark brown (10YR 4/3) clay films on faces of peds; 2 percent coarse fragments; yellow (2.5Y 7/8) stains; slight effervescence; moderately alkaline; clear wavy boundary.

Bt3—21 to 25 inches; light yellowish brown (2.5Y 6/4) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; relict platy structure; firm; few roots; thin patchy clay films on vertical faces of peds; 3 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

BC—25 to 38 inches; light yellowish brown (2.5Y 6/4) silty clay loam; common medium distinct pale olive (5Y 6/3) and few fine distinct yellowish brown (10YR 5/8) mottles; relict platy structure; firm; 5 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C—38 to 42 inches; pale olive (5Y 6/3) silty clay loam; common medium faint light yellowish brown (2.5Y 6/4) mottles; massive; firm; 5 percent coarse fragments; violent effervescence; moderately alkaline; clear wavy boundary.

R—42 inches; limestone.

Solum thickness ranges from 24 to 40 inches. Depth to carbonates ranges from 10 to 18 inches. The depth to paralithic or lithic contact ranges from 40 to 53 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is commonly silty clay loam but is silty clay in some pedons. Some pedons have an A horizon. The B horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is dominantly silty clay loam or silty clay and their channery analogs, but subhorizons of clay or channery clay are in some pedons. Content of limestone and nonacid siltstone and shale fragments ranges from 0 to 15 percent in the Bt horizon. The C horizon has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 to 6. It is silty clay loam or channery or very channery analogs.

Fairpoint Series

The Fairpoint series consists of deep, well drained, moderately slowly permeable soils formed in a mixture of fine earth material and fragments of neutral or calcareous shale, sandstone, siltstone, and coal from surface mine operations. Slope ranges from 8 to 70 percent.

Typical pedon of Fairpoint shaly clay loam, 40 to 70 percent slopes, about 1/2 mile southeast of Buchtel, York Township, 2,905 feet west and 2,375 feet north of the southeast corner of sec. 6, T. 12 N., R. 15 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) shaly clay loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; common roots; 35 percent olive (5Y 4/4) siltstone fragments; neutral; abrupt smooth boundary.

C1—5 to 44 inches; variegated pale brown (10YR 6/3), gray (10YR 6/1), and yellowish brown (10YR 5/6) extremely shaly clay loam; massive; friable; few roots; 70 percent siltstone fragments and 5 percent sandstone fragments; neutral; clear wavy boundary.

C2—44 to 60 inches; variegated yellowish brown (10YR 5/4, 5/6, and 5/8), and light gray (10YR 7/1) very shaly clay loam; massive; friable; few gray (5YR 5/1) clay lenses; 50 percent siltstone fragments and 20 percent coal fragments; medium acid.

The soil ranges from medium acid to neutral throughout. The content of rock fragments in the C horizon ranges from 35 to 75 percent. The fragments are commonly less than 10 inches in diameter, but there are some larger stones and boulders.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly shaly clay loam or silt loam. Reclaimed areas have an A horizon of natural soil material 4 to 12 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 8. It is very or extremely shaly clay loam or silty clay loam.

Fitchville Series

The Fitchville series consists of deep, somewhat poorly drained, moderately slowly permeable soils formed in water-deposited materials on terraces along streams. Slope ranges from 0 to 3 percent.

The Fitchville soils are similar to Doles soils and are commonly adjacent to Glenford and McGary soils. Doles soils have a fragipan. Glenford soils are moderately well drained and are on slightly elevated terraces along streams. McGary soils are also on terraces along streams and have more clay in the subsoil.

Typical pedon of Fitchville silt loam, 0 to 3 percent slopes, about 3 miles southwest of Chauncey, York Township, 1,452 feet north and 2,904 feet west of the southeast corner of sec. 1, T. 12 N., R. 15 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; many roots; common black (N 2/0) and few yellowish red (5YR 5/8) concretions (Fe and Mn oxides); slightly acid; clear wavy boundary.

BE—7 to 10 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; common roots; grayish brown (10YR 5/2) coatings on faces of peds; few yellowish red (5YR 5/8) stains and many black (N 2/0) concretions (Fe and Mn oxides); strongly acid; clear wavy boundary.

Bt1—10 to 16 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) and many medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; many black (N 2/0) concretions; thin patchy clay films on faces of peds; medium continuous grayish brown (10YR 5/2) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt2—16 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; common medium faint yellowish brown (10YR 5/4) and many medium distinct grayish brown (10YR 5/2) mottles; moderate medium and coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; medium continuous grayish brown (10YR 5/2) silt coatings on faces of peds; many black (N 2/0) concretions (Mn oxides); strongly acid; clear wavy boundary.

Bt3—24 to 40 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; medium continuous grayish brown (10YR 5/2) silt coatings on faces of peds; many black (N 2/0) concretions and stains (Mn oxides); medium acid; clear wavy boundary.

Bt4—40 to 48 inches; yellowish brown (10YR 5/4) clay loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; medium continuous grayish brown (10YR 5/2) silt coatings on faces of peds; common black (N 2/0) concretions (Mn oxides) neutral; clear wavy boundary.

C—48 to 60 inches; dark yellowish brown (10YR 4/4) loam; few fine distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few black (N 2/0) concretions (Mn oxides); neutral.

Solum thickness ranges from 39 to 48 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It is strongly acid or medium acid, unless the soil has been limed. The B horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. Clay content ranges from 28 to 35 percent. Reaction is strongly acid or medium acid in the upper part, and with depth there is a gradual transition to neutral in the lower part. The C

horizon has hue of 10YR, value of 4 or 5, and chroma of 4. It is neutral or mildly alkaline.

Gallia Series

The Gallia series consists of deep, well drained, moderately permeable soils formed in stratified old alluvium on high terraces in preglacial valleys. Slope ranges from 8 to 15 percent.

Gallia soils are similar to Negley soils and are commonly adjacent to Omulga and Vincent soils. Negley soils have a higher content of gravel in the solum and substratum and have a mixed mineralogy. Omulga and Vincent soils are moderately well drained. Omulga soils are in preglacial valleys and have a fragipan. Vincent soils have more clay and less sand in the subsoil and are on high lacustrine terraces on ridgetops.

Typical pedon of Gallia loam, 8 to 15 percent slopes, about two miles south-southwest of Coolville, Troy Township, 990 feet south and 460 feet east of the northwest corner of sec. 25, T. 5 N., R. 11 W.

A—0 to 4 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; neutral; clear wavy boundary.

EB—4 to 9 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; common roots; dark brown (10YR 3/3) coatings in old root channels; neutral; clear wavy boundary.

Bt1—9 to 17 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films and brown (7.5YR 5/4) coatings on faces of peds; strongly acid; clear wavy boundary.

Bt2—17 to 24 inches; yellowish red (5YR 5/6) loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—24 to 36 inches; yellowish red (5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

Bt4—36 to 44 inches; reddish brown (5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; common black (N 2/0) concretions; strongly acid; clear wavy boundary.

BC—44 to 60 inches; yellowish red (5YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; thin patchy pale brown (10YR 6/3) silt coatings; 3 percent pebbles; medium acid.

The lower part of the B horizon is up to 20 percent weathered pebbles of sandstone, shale, and crystalline rocks.

The A horizon is 1 to 4 inches thick. It has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The EB horizon is 4 to 9 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 4. A brown or dark brown (10YR 4/3) Ap horizon is in cultivated areas. The A horizon is dominantly loam but is silt loam in some pedons. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is loam, clay loam, or sandy clay loam gravelly analogs in the lower part. Thin subhorizons of silt loam are in the upper part of some pedons. The weighted average clay content of the upper 20 inches of the argillic horizon ranges from 20 to 35 percent. The BC horizon has hue of 5YR, value of 4 or 5, and chroma of 6. It is sandy loam or gravelly sandy loam and is medium acid or strongly acid.

Glenford Series

The Glenford series consists of deep, moderately well drained, moderately or moderately slowly permeable soils formed in water-deposited materials on terraces along streams. Slope ranges from 0 to 15 percent.

Glenford soils are similar to Licking and Omulga soils and are commonly adjacent to Fitchville and McGary soils. Fitchville and McGary soils are somewhat poorly drained soils on flats and slight rises. Licking and McGary soils have more clay in the upper part of the subsoil. Omulga soils have a fragipan.

Typical pedon of Glenford silt loam, 0 to 3 percent slopes, about 3 miles southeast of Nelsonville, York Township, 2,970 feet south, 1,450 feet east of the northwest corner of sec. 4, T. 12 N., R. 15 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

BA—10 to 16 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; strongly acid; clear wavy boundary.

Bt1—16 to 23 inches; brown (10YR 5/3) silt loam; few fine faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few roots; pale brown (10YR 6/3) silt coatings and thin patchy brown (10YR 5/3) clay films on faces of peds; few black (N 2/0) concretions (Fe and Mn oxides); strongly acid; clear wavy boundary.

Bt2—23 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium and coarse subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/4) clay films on faces of

peds; few black (N 2/0) concretions (Fe and Mn oxides); strongly acid; clear wavy boundary.

Bt3—34 to 45 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; few black (N 2/0) concretions (Fe and Mn oxides); strongly acid; clear wavy boundary.

C1—45 to 56 inches; yellowish brown (10YR 5/4) silty clay loam; few medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; medium acid; clear wavy boundary.

C2—56 to 60 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; medium acid.

Solum thickness ranges from 34 to 50 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. A very dark grayish brown (10YR 3/2) A horizon, 1 to 4 inches thick, is present in some pedons. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. A thin, slightly brittle layer occurs in the middle or lower part in some pedons. The B horizon ranges from very strongly acid to slightly acid. The C horizon is stratified with silt loam and silty clay loam, the dominant textures. Reaction ranges from strongly acid to slightly acid.

Guernsey Series

The Guernsey series consists of deep, moderately well drained, slowly or moderately slowly permeable soils on ridgetops and side slopes of uplands. The soils formed in residuum from interbedded shale, siltstone, and limestone and local colluvium from such materials. Slope ranges from 3 to 70 percent.

Guernsey soils are similar to Brookside, Elba, Licking, and Westmore soils and are commonly adjacent to Upshur and Westmoreland soils. Brookside, Elba, Upshur, Westmore, and Westmoreland soils do not have low-chroma mottles in the upper 10 inches of the argillic horizon. Areas of the Upshur soils are commonly intermixed with areas of the Guernsey soils. The Westmoreland soils are commonly on the steeper, more convex slopes. Elba soils are calcareous within 30 inches of the surface. Licking soils formed in lacustrine sediments and commonly have fewer coarse fragments in the subsoil and substratum. Westmore soils have more silt and less clay in the upper part of the subsoil. Westmoreland soils have less clay and more sand and coarse fragments throughout.

Typical pedon of Guernsey silt loam, 3 to 8 percent slopes, about 4 miles northwest of Albany, Lee Township, 1,700 feet north, 200 feet west of the southeast corner of sec. 18, T. 10 N., R. 15 W.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; friable; many roots; yellowish brown (10YR 5/4) coatings on faces of peds; slightly acid; abrupt smooth boundary.

BA—8 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; common roots; yellowish brown (10YR 5/4) coatings on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

Bt1—15 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few roots; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; pale brown (10YR 6/3) coatings on faces of peds; strongly acid; clear wavy boundary.

2Bt2—23 to 29 inches; dark yellowish brown (10YR 4/4) silty clay; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; thin patchy brown (10YR 5/3) clay films on faces of peds; 2 percent coarse fragments; medium acid; clear wavy boundary.

2Bt3—29 to 33 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin patchy light brownish gray (2.5Y 6/2) clay films on faces of peds; 2 percent coarse fragments; slightly acid; clear wavy boundary.

2Bt4—33 to 44 inches; yellowish brown (10YR 5/6) clay; weak coarse subangular blocky structure; very firm; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; light brownish gray (2.5Y 6/2) coatings; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

2C—44 to 50 inches; yellowish brown (10YR 5/4) clay; common medium faint yellowish brown (10YR 5/6) and common medium distinct strong brown (7.5YR 5/8) and light brownish gray (2.5Y 6/2) mottles; massive; very firm; common black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Cr—50 to 60 inches; light brownish gray (2.5Y 6/2) fractured siltstone; yellow (2.5Y 7/8) and gray (10YR 6/1) clay fillings in fractures.

Solum thickness ranges from 38 to 60 inches. Depth to bedrock is typically 50 to 72 inches. Depth to free carbonates is more than 30 inches. Content of coarse fragments ranges from 0 to 5 percent in the A horizon, 0 to 15 percent in the B and 2B horizons, and 0 to 20 percent in the 2C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is slightly acid to strongly acid, unless limed. The BA and Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are silt loam or silty clay loam and are slightly acid to

strongly acid. The 2B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam, silty clay, or clay and is strongly acid to mildly alkaline. The 2C horizon has hue of 10YR, value of 5, and chroma of 4 to 6. It is clay, silty clay, or silty clay loam and shaly analogs.

Hackers Series

The Hackers series consists of deep, well drained soils with moderate permeability. They formed in mixed alluvial sediments on alluvial fans and low terraces. Slope ranges from 0 to 3 percent.

Hackers soils are similar to Vincent soils. Vincent soils are on high lacustrine terraces and have more clay in the subsoil.

Typical pedon of Hackers silt loam, 0 to 3 percent slopes, about 4 miles northeast of Albany, Alexander Township, 5,000 feet south of the intersection of County Roads 17 and 17A along County Road 17, then 100 feet west, T. 8 N., R. 14 W.

Ap—0 to 10 inches; brown (7.5YR 4/4) silt loam, brown (7.5YR 5/4) dry; moderate medium and fine granular structure; friable; many roots; dark reddish brown (5YR 3/4) coatings on faces of peds; medium acid; abrupt smooth boundary.

Bt1—10 to 16 inches; yellowish red (5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few roots; thin patchy yellowish red (5YR 4/6) clay films on faces of peds; about 2 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—16 to 32 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium angular blocky structure; firm; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; about 2 percent coarse fragments; common black (N 2/0) stains; strongly acid; clear wavy boundary.

Bt3—32 to 40 inches; reddish brown (5YR 4/4) channery clay loam; weak coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; 18 percent coarse fragments; common black (N 2/0) stains; strongly acid; clear wavy boundary.

C—40 to 60 inches; reddish brown (5YR 4/4) channery clay loam; massive; firm; 30 percent light olive brown (2.5Y 5/4) siltstone coarse fragments; strongly acid.

Solum thickness ranges from 40 to 52 inches. Content of coarse fragments ranges up to 18 percent in the B horizon and up to 35 percent in the C horizon. The soil is strongly acid or medium acid throughout, unless limed.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. Uncultivated areas have a thin A horizon. An E horizon is in some pedons. The B horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The B horizon is commonly silty clay loam, but thin strata of channery clay loam are in the lower part in many pedons. The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Texture is dominantly channery clay loam, silty clay loam, clay loam, or sandy loam.

Licking Series

The Licking series consists of deep, moderately well drained, slowly permeable soils formed in a silt mantle and in the underlying fine textured lacustrine sediments on terraces along streams. Slope ranges from 3 to 15 percent.

Licking soils are similar to Glenford and Guernsey soils and are commonly adjacent to Glenford and McGary soils. Glenford soils have less clay and more silt in the subsoil. Guernsey soils formed in residuum from bedrock on uplands and commonly have more coarse fragments in the subsoil and substratum. McGary soils are somewhat poorly drained on flats and slight rises.

Typical pedon of Licking silt loam, 3 to 8 percent slopes, about 3.5 miles southwest of Athens, Athens Township, 1,300 feet south of the intersection of County Roads 19 and 10 along County Road 19, then 460 feet east, T. 9 N., R. 14 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

BE—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; dark grayish brown (10YR 4/2) coatings on faces of peds; slightly acid; clear wavy boundary.

2Bt1—13 to 22 inches; brown (7.5YR 5/4) silty clay; common medium faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; sticky and plastic when wet; few roots; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt2—22 to 29 inches; brown (7.5YR 5/4) silty clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm, sticky and plastic when wet; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt3—29 to 39 inches; brown (7.5YR 5/4) clay; few medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse subangular blocky structure; firm, sticky and plastic when wet; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; yellowish red (5YR 5/8) stains (Fe and Mn oxides); medium acid; clear wavy boundary.

2BC—39 to 45 inches; brown (7.5YR 5/4) clay; few medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse subangular blocky structure; firm, sticky

and plastic when wet; common very dark gray (N 3/0) concretions; yellowish red (5YR 5/8) stains (Fe and Mn oxides); medium acid; clear wavy boundary.

2C1—45 to 56 inches; brown (7.5YR 4/4) silty clay; few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm, sticky and plastic when wet; common black (N 2/0) concretions; medium acid; clear wavy boundary.

2C2—56 to 60 inches; brown (7.5YR 5/4) stratified clay and silty clay; common medium faint strong brown (7.5YR 5/6) and few medium distinct light olive brown (2.5Y 5/4) mottles; massive; firm, sticky and plastic when wet; slightly acid.

Solum thickness ranges from 36 to 60 inches. Thickness of the silt mantle ranges from 12 to 20 inches. Depth to low-chroma mottles ranges from 15 to 24 inches. Content of coarse fragments is 0 to 2 percent in the solum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is slightly acid to strongly acid, unless the soil has been limed. The B horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. It is silty clay or clay and is slightly acid to strongly acid. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay or clay and includes thin strata of silty clay loam. It is medium acid to mildly alkaline.

McGary Series

The McGary series consists of deep, somewhat poorly drained, slowly or very slowly permeable soils formed in lacustrine deposits on low terraces. Slope ranges from 0 to 3 percent.

In Athens County, these soils have higher chroma colors in the matrix throughout the soil and are more acid in the lower part of the solum and the substratum than is defined for the McGary series. These differences, however, do not alter the usefulness or behavior of the soils.

McGary soils are commonly adjacent to Glenford and Licking soils. Glenford and Licking soils are moderately well drained and are on slightly higher positions. Glenford soils also have less clay in the upper part of the subsoil.

Typical pedon of McGary silt loam, 0 to 3 percent slopes, about 1 mile north of Athens, Athens Township, 8,976 feet northeast of the intersection of State Route 682 and Township Road 404 along Township Road 404, then 390 feet south, T. 9 N., R. 14 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium and fine granular structure; friable; many roots; few black (N 2/0) concretions; medium acid; abrupt smooth boundary.

Bt1—8 to 14 inches; strong brown (7.5YR 5/8) silty clay; common fine distinct brown (10YR 5/3) and many fine distinct light gray (10YR 7/2) mottles; moderate medium angular blocky structure; firm; common roots; thin patchy brown (10YR 5/3) and light brownish gray (10YR 6/2) clay films on faces of peds; few black (N 2/0) concretions; strongly acid; clear smooth boundary.

Bt2—14 to 19 inches; strong brown (7.5YR 5/8) silty clay; many fine distinct dark yellowish brown (10YR 4/4) and light brownish gray (10YR 6/2) mottles; strong medium angular blocky structure; firm; few roots; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; common black (N 2/0) concretions 1/2 inch in size; medium acid; clear smooth boundary.

Bt3—19 to 26 inches; yellowish brown (10YR 5/6) silty clay; many fine distinct brown (7.5YR 4/4) and light brownish gray (10YR 6/2) mottles; strong medium angular blocky structure; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt4—26 to 38 inches; yellowish brown (10YR 5/6) clay; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt5—38 to 52 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; weak coarse angular blocky structure; firm; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; strongly acid; clear smooth boundary.

C—52 to 60 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; medium acid.

Solum thickness is typically 40 to 52 inches. Depth to carbonates is more than 60 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B horizon commonly has hue of 10YR or 7.5YR, value of 5, and chroma of 2 to 8. It is silty clay loam, silty clay, or clay. Reaction is commonly strongly acid or medium acid. The C horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6. It is silty clay or clay loam and is commonly stratified.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils on flood plains. These soils formed in recent alluvium along minor streams. Slope ranges from 0 to 3 percent.

Melvin soils are similar to and commonly adjacent to Newark and Orrville soils. Newark and Orrville soils are somewhat poorly drained and are not as gray in the

subsoil. They are on slightly higher areas. Orrville soils also have more sand in the subsoil.

Typical pedon of Melvin silt loam, frequently flooded, about 3 miles northwest of Athens, Athens Township, 2,000 feet northwest along U.S. Route 33 from the intersection of State Route 550 and U.S. Route 33, then 850 feet west, T. 9 N., R. 14 W.

A—0 to 4 inches; dark gray (10YR 4/1) silt loam, gray (10YR 5/1) dry; moderate medium and fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bg1—4 to 14 inches; grayish brown (10YR 5/2) silt loam; common medium distinct brown (7.5YR 5/4) and common medium prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; friable; common roots; many stains (Fe oxides); medium acid; clear wavy boundary.

Bg2—14 to 28 inches; light gray (10YR 6/1) silt loam; common medium distinct brown (7.5YR 5/4) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; many stains (Fe oxides); medium acid; clear wavy boundary.

Cg—28 to 60 inches; light gray (10YR 6/1) silty clay loam; common medium distinct brown (7.5YR 5/4) and strong brown (7.5YR 5/6) mottles; massive; friable; medium acid.

Solum thickness ranges from 20 to 32 inches. Depth to bedrock is greater than 5 feet. Content of coarse fragments, mostly rounded pebbles, ranges from 0 to 5 percent to a depth of 30 inches but ranges up to 20 percent in subhorizons below a depth of 30 inches. The soil is medium acid or slightly acid throughout. A few mica flakes occur in some pedons.

The A horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 1 or 2. Some pedons have an Ap horizon with hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 3. The B horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is silt loam or silty clay loam. Below a depth of 40 inches, some pedons have stratified layers of loams, clays, sands, or sand and gravel, and in some areas the matrix is brownish.

Moshannon Series

The Moshannon series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in recent reddish alluvium. Slope ranges from 0 to 3 percent.

Moshannon soils are similar to Chagrin and Nolin soils and are commonly adjacent to Hackers and Newark soils. Chagrin, Nolin, and Newark soils are on flood plains and are yellower throughout. Chagrin soils have more sand in the subsoil. Hackers soils are on alluvial fans and low terraces and have an argillic horizon. Newark soils are somewhat poorly drained and are in slightly lower positions.

Typical pedon of Moshannon silt loam, frequently flooded, about 5 miles south of Athens, Alexander Township, 4,600 feet directly south of the intersection of Township Roads 55 and 56, T. 8 N., R. 14 W.

Ap—0 to 10 inches; dark brown (7.5YR 4/2) silt loam, light brown (7.5YR 6/4) dry; moderate medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

Bw1—10 to 16 inches; yellowish red (5YR 4/6) silt loam; weak medium subangular blocky structure; friable; few roots; reddish brown (5YR 5/3) coatings on faces of peds; dark brown (7.5YR 4/2) fillings in old root channels; 2 percent coarse fragments; slightly acid; clear wavy boundary.

Bw2—16 to 26 inches; yellowish red (5YR 4/6) silt loam; weak medium angular blocky structure; friable; reddish brown (5YR 5/3) coatings on faces of peds; 2 percent coarse fragments; medium acid; clear wavy boundary.

Bw3—26 to 36 inches; reddish brown (5YR 4/3) silt loam; common medium faint brown (7.5YR 4/4) and few fine distinct yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; friable; 5 percent coarse fragments; medium acid; clear wavy boundary.

C—36 to 60 inches; reddish brown (5YR 4/3) gravelly clay loam; massive; firm; 20 percent coarse fragments; neutral.

Solum thickness ranges from 32 to 44 inches. Content of coarse fragments is less than 5 percent throughout the solum.

The Ap horizon has hue of 7.5YR, value of 4, and chroma of 2 to 4. The B horizon has hue of 5YR, value of 4 or 5, and chroma of 3 to 6. It is medium acid or slightly acid. The C horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. It is gravelly clay loam, silt loam, gravelly loam, or loam. Stratification is evident in most pedons. The C horizon is medium acid to neutral.

Negley Series

The Negley series consists of deep, well drained, moderately or moderately rapidly permeable soils formed in loamy outwash material on outwash terraces. Slope ranges from 8 to 40 percent.

Negley soils are similar to Gallia soils and are commonly adjacent to Parke soils. Gallia soils have less gravel in the solum and substratum and have siliceous mineralogy. Parke soils have a silt mantle.

Typical pedon of Negley loam, 8 to 15 percent slopes, about 3 miles northwest of Athens, Athens Township, 825 feet northwest of the intersection of U.S. Route 33

and County Road 7 along U.S. Route 33, then 495 feet south, T. 9 N., R. 14 W.

Ap—0 to 4 inches; brown (10YR 4/3) loam, very pale brown (10YR 7/3) dry; moderate medium and fine granular structure; friable; many roots; 1 percent pebbles; strongly acid; abrupt smooth boundary.

BE—4 to 11 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; common roots; dark yellowish brown (10YR 4/4) silt coatings on faces of peds; brown (10YR 4/3) fillings in old root channels; 5 percent pebbles; strongly acid; clear wavy boundary.

Bt1—11 to 18 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 10 percent pebbles; strongly acid; clear wavy boundary.

Bt2—18 to 25 inches; strong brown (7.5YR 5/6) gravelly loam; weak coarse subangular blocky structure; friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (N 2/0) manganese and iron concretions and stains; 30 percent pebbles; strongly acid; clear wavy boundary.

Bt3—25 to 38 inches; strong brown (7.5YR 5/6) gravelly sandy loam; weak coarse subangular blocky structure; friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds and clay bridging between sand grains; black (N 2/0) concretions and stains (Fe and Mn oxides); 20 percent pebbles; strongly acid; clear wavy boundary.

Bt4—38 to 55 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam; weak coarse subangular blocky structure; very friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds and clay bridging between sand grains; 35 percent pebbles; strongly acid; clear wavy boundary.

Bt5—55 to 60 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam; few fine distinct yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; very friable; thin patchy yellowish red (5YR 4/6) clay films on faces of peds and clay bridging between sand grains; 35 percent pebbles; strongly acid.

Solum thickness ranges from 80 to 100 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. It is loam or gravelly loam and is strongly acid to slightly acid. The B horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8. It is loam, sandy loam, clay loam, or sandy clay loam and their gravelly analogs. Sand content is more than 20 percent, and medium and coarse sand are generally dominant. The B horizon is medium acid or strongly acid. Some pedons have a C horizon that is stratified gravel and sand with lenses of finer textured material.

Newark Series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in recent alluvium along minor streams. Slope ranges from 0 to 3 percent.

Newark soils are similar to Orrville and Melvin soils and are commonly adjacent to Melvin, Moshannon, and Nolin soils. Orrville soils have more sand in the subsoil. Melvin soils are poorly drained and have a dominant chroma of 2 or less in all subhorizons between the Ap horizon and a depth of 30 inches. They are in the lowest positions on the flood plains. Moshannon and Nolin soils are better drained and are on slightly higher positions on flood plains.

Typical pedon of Newark silt loam, frequently flooded, about 5 miles southwest of Athens, Athens Township, 2,245 feet west of the intersection of County Road 10 and Township Road 29 along County Road 10, then 70 feet south, T. 9 N., R. 14 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium and fine granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

Bw1—6 to 10 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; weak medium and fine subangular blocky structure; friable; common roots; pale brown (10YR 5/3) silt coatings on faces of peds; black (N 2/0) concretions (Fe and Mn oxides); medium acid; clear wavy boundary.

Bw2—10 to 16 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; few roots; grayish brown (10YR 5/2) silt coatings on faces of peds; black (N 2/0) concretions (Fe and Mn oxides); medium acid; clear wavy boundary.

Bg—16 to 25 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; dark gray (10YR 4/1) silt coatings on faces of peds; many black (N 2/0) and brown (7.5YR 4/4) concretions (Fe and Mn oxides); medium acid; clear wavy boundary.

BC—25 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; grayish brown (10YR 5/2) silt coatings on faces of peds; few black (N 2/0) concretions (Fe and Mn oxides); medium acid; clear wavy boundary.

C1—33 to 49 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct gray (10YR 5/1) and few fine faint yellowish brown (10YR 5/4) mottles; massive; firm; few black (N 2/0) concretions (Fe and Mn oxides); medium acid; clear wavy boundary.

C2—49 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/6) mottles; massive; firm; few black (N 2/0) concretions (Fe and Mn oxides); 10 percent coarse fragments; slightly acid.

Solum thickness ranges from 22 to 38 inches. Content of coarse fragments, mostly pebbles, ranges from 0 to about 5 percent to a depth of 30 inches. Below that it ranges up to 15 percent, and below a depth of 50 inches it ranges to 35 percent. Reaction ranges from medium acid to neutral throughout the soil.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. It is silt loam or silty clay loam. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils formed in recent alluvium on flood plains. Slope ranges from 0 to 3 percent.

Nolin soils are similar to Chagrin and Moshannon soils and are commonly adjacent to Newark soils. All of these soils are on flood plains. Chagrin soils contain more sand in the subsoil. Moshannon soils are redder throughout. Newark soils are somewhat poorly drained and have a dominantly low chroma in one subhorizon within 30 inches of the surface. They are in slightly lower positions on the flood plains.

Typical pedon of Nolin silt loam, frequently flooded, about 1 mile north of Coolville, Troy Township, 4,360 feet northwest of the intersection of U.S. Route 50 and State Route 144 along State Route 144, then 400 feet east, T. 5 N., R. 11 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many roots; neutral; abrupt smooth boundary.

Bw1—6 to 10 inches; dark brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; common roots; neutral; clear wavy boundary.

Bw2—10 to 31 inches; dark brown (10YR 4/3) silty clay loam; weak medium and coarse subangular blocky structure; firm; few roots; neutral; clear wavy boundary.

BC—31 to 43 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; neutral; clear wavy boundary.

C—43 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; neutral.

Solum thickness is 40 inches or more. Thickness of alluvial deposits ranges from 40 inches to many feet. Clay content in the 10- to 40-inch control section is 18 to 30 percent.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is medium acid to neutral. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The B and BC horizons are typically free of mottles, but a few pedons have mottles with chroma of 2 or more below a depth of 24 inches. These horizons are silt loam or silty clay loam and medium acid to neutral. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam, silt loam, loam, or fine sandy loam and gravelly analogs. It is stratified in many pedons.

Omulga Series

The Omulga series consists of deep, moderately well drained, slowly permeable soils in the preglacial Teays Valley and associated tributary valleys. They formed in loess and the underlying lacustrine sediments or old alluvium. Slope ranges from 3 to 15 percent.

Omulga soils are similar to Glenford and Zanesville soils and are commonly adjacent to Doles and Gallia soils. Doles soils are somewhat poorly drained and are grayer immediately under the surface layer. They are on flats and slight rises. Gallia and Glenford soils do not have a fragipan. Gallia soils have more sand in the subsoil and are on higher positions in preglacial valleys. Zanesville soils have bedrock between depths of 40 and 80 inches.

Typical pedon of Omulga silt loam, 3 to 8 percent slopes, about 4 miles west of Athens, Waterloo Township, 1,585 feet south and 1,850 feet west of the northeast corner of sec. 4, T. 11 N., R. 15 W.

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; common roots; medium acid; abrupt smooth boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films on the faces of peds; yellowish brown (10YR 5/4) coatings on faces of peds; strongly acid; clear wavy boundary.

Bt2—15 to 23 inches; yellowish brown (10YR 5/6) silt loam; common medium faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; thin patchy yellowish brown (10YR

5/6) clay films on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Btx1—23 to 27 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/8) mottles; moderate coarse subangular blocky structure; firm and brittle; grayish brown (10YR 5/2) silt coatings and thin patchy clay films on the faces of peds; strongly acid; clear wavy boundary.

2Btx2—27 to 43 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate coarse platy; firm and brittle; thin patchy clay films on the faces of peds; strongly acid; clear wavy boundary.

2BC—43 to 55 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; medium acid; clear wavy boundary.

2C—55 to 60 inches; brownish yellow (10YR 6/6) silty clay loam; massive, but has weak bedding planes; firm; thin strata of silt loam; grayish brown (10YR 5/2) coatings on fissures; medium acid.

Solum thickness ranges from 40 to 80 inches. Depth to the top of the fragipan ranges from 18 to 30 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from medium acid to neutral depending on liming practices. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. Reaction is strongly acid or very strongly acid. The 2Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is silty clay loam or clay loam and is very strongly acid or strongly acid. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. Some pedons have chroma of 8. It is usually stratified clay loam and silty clay loam with thin layers of very fine sand, loam, or silt loam. The C horizon is strongly acid to neutral.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils formed in recent alluvium on flood plains. Slope ranges from 0 to 3 percent.

Orrville soils are similar to Newark and Melvin soils and are commonly adjacent to Chagrin and Melvin soils. Chagrin soils are well drained and do not have gray mottles in the subsoil. They are on higher positions. Newark and Melvin soils have less sand and more silt in the subsoil. Melvin soils are poorly drained and have dominant chroma of 2 or less in all subhorizons between the Ap horizon and a depth of 30 inches. They are in lower positions.

Typical pedon of Orrville silt loam, frequently flooded, about 1.5 miles southwest of Nelsonville, York Township, 4,250 feet south, 10 feet east of the northwest corner of sec. 23, T. 12 N., R. 15 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium and fine granular structure; friable; common roots; strongly acid; clear wavy boundary.

Bw—4 to 10 inches; brown (10YR 5/3) loam; many medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; few roots; reddish brown (5YR 4/4) stains (Fe oxides); strongly acid; clear wavy boundary.

Bg1—10 to 18 inches; grayish brown (10YR 5/2) loam; common medium distinct brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; friable; few roots; medium acid; clear wavy boundary.

Bg2—18 to 31 inches; grayish brown (10YR 5/2) loam; few medium distinct yellowish brown (10YR 5/4) and common medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; friable; some weak bedding planes; medium acid; clear wavy boundary.

C1—31 to 50 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive, but has weak bedding planes; friable; medium acid; clear wavy boundary.

C2g—50 to 60 inches; gray (10YR 6/1) stratified loamy sand and silty clay loam; massive; friable; slightly acid.

Solum thickness ranges from 30 to 50 inches. Reaction ranges from slightly acid to strongly acid in the solum and from neutral to medium acid in the C horizon. Content of coarse fragments ranges from 0 to 2 percent in the solum.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 6. It is commonly silt loam or loam and less commonly clay loam. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6. It is commonly loam with strata of silty clay loam, sandy loam, loamy sand, and gravelly clay loam in the lower part.

Parke Series

The Parke series consists of deep, well drained soils with moderate permeability. The soils formed in loess and in the underlying Illinoian outwash on terraces. Slope ranges from 3 to 6 percent.

In Athens County, these soils are yellower in the matrix than is defined for the Parke series. This difference, however, does not alter the usefulness or behavior of the soils.

Parke soils are similar to Wheeling soils and are commonly adjacent to Negley soils. Negley and

Wheeling soils contain more sand in the upper part of the subsoil.

Typical pedon of Parke silt loam, 2 to 6 percent slopes, about 3 miles northwest of Athens, Athens Township, 2,640 feet south of the intersection of State Route 682 and County Road 7 along State Route 682, then 525 feet east, T. 9 N., R. 14 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

AB—8 to 15 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common roots; yellowish brown (10YR 5/4) silt coatings on faces of peds; medium acid; clear wavy boundary.

Bt1—15 to 35 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films and yellowish brown (10YR 5/4) coatings on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Bt2—35 to 41 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; thin patchy clay films and light yellowish brown (10YR 6/4) coatings on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Bt3—41 to 52 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; thin very patchy clay films on faces of peds; 3 percent gravel; strongly acid; clear wavy boundary.

2BC—52 to 60 inches; brown (7.5YR 4/4) loam; common medium distinct strong brown (7.5YR 5/8) mottles; massive; friable; 15 percent gravel; strongly acid.

Solum thickness ranges from 4 to 7 feet.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon commonly has hue of 10YR, 7.5YR, or 5YR; value of 4 or 5; and chroma of 4 to 6. It is loam or clay loam. The BC horizon is clay loam, loam, or sandy loam. The B horizon is strongly acid or very strongly acid.

Richland Series

The Richland series consists of deep, well drained, moderately permeable soils formed in loamy colluvium from sandstone and shale on foot slopes, toe slopes, and fans. Slope ranges from 8 to 35 percent.

Richland soils are similar to Westmoreland soils and are commonly adjacent to Brookside and Vandalia soils. Brookside and Vandalia soils are commonly on the lower parts of foot slopes and contain more clay in the subsoil. Vandalia soils have a redder subsoil. Westmoreland soils have a thinner solum and lower base saturation in the substratum.

Typical pedon of Richland loam, 15 to 25 percent slopes, about 3 miles west-southwest of Nelsonville, York Township, 2,000 feet south and 700 feet east of the northwest corner of sec. 35, T. 12 N., R. 15 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; many roots; 5 percent sandstone and coarse grained siltstone fragments; strongly acid; clear wavy boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films on the faces of peds; grayish brown (10YR 5/2) fillings in old root channels; 10 percent sandstone and coarse grained siltstone fragments; strongly acid; clear wavy boundary.

Bt2—13 to 28 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few roots; thin continuous clay films on faces of peds; 10 percent sandstone fragments; strongly acid; clear wavy boundary.

Bt3—28 to 43 inches; dark yellowish brown (10YR 4/4) channery silt loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; 25 percent sandstone fragments; strongly acid; clear wavy boundary.

C—43 to 60 inches; yellowish brown (10YR 5/4) channery clay loam; massive; firm; 30 percent sandstone fragments; strongly acid.

Solum thickness ranges from 40 to 60 inches. Content of gravel and stone-size coarse fragments ranges from 3 to 30 percent in the B horizon. They are dominantly of sandstone and siltstone origin. Reaction is strongly acid or medium acid throughout the soil.

The A horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly loam, but is silt loam in some pedons. An Ap horizon is present in some pedons. It has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, loam, or silt loam and channery or gravelly analogs. The C horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 3 to 6. It is channery or very channery silty clay loam or clay loam.

Steinsburg Series

The Steinsburg series consists of moderately deep, well drained soils with moderately rapid permeability. The soils formed in residuum from coarse grained sandstone on hillsides and ridgetops. Slope ranges from 15 to 70 percent.

Steinsburg soils are similar to Berks and Dekalb soils and are commonly adjacent to Clymer soils. Berks and Dekalb soils have more coarse fragments in the surface layer and subsoil. Clymer soils have an argillic horizon and are deeper over bedrock. They are on ridgetops and the upper part of side slopes.

Typical pedon of Steinsburg sandy loam, 40 to 70 percent slopes, about 1 mile east of Athens, Athens Township, 500 feet east of the intersection of U.S. Routes 33 and 50 along U.S. Route 50, then 2,000 feet south, T. 9 N., R. 14 W.

A—0 to 5 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; moderate medium and fine granular structure; loose; many roots; 2 percent sandstone fragments; strongly acid; clear wavy boundary.

BE—5 to 11 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; many roots; dark brown (10YR 4/3) coatings on faces of peds; 5 percent sandstone fragments; strongly acid; clear wavy boundary.

Bw—11 to 19 inches; yellowish brown (10YR 5/6) channery sandy loam; weak coarse subangular blocky structure; very friable; common roots; 20 percent sandstone fragments; strongly acid; clear wavy boundary.

C—19 to 37 inches; yellowish brown (10YR 5/4) channery sandy loam; weak coarse subangular blocky structure; very friable; few roots; 30 percent sandstone fragments; very strongly acid; clear wavy boundary.

R—37 inches; yellowish brown (10YR 5/4) weakly cemented, coarse grained sandstone; massive; very strongly acid.

Depth to bedrock ranges from 24 to 40 inches. Angular fragments of sandstone, 1 to about 6 inches in diameter, generally increase with depth and range from 2 to 20 percent in the B horizon and from 20 to 40 percent in the C horizon. Unless limed, the soil is very strongly acid or strongly acid throughout.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is commonly sandy loam, but is loam in some pedons. The B horizon has hue of 10YR to 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is loam or sandy loam and channery analogs. The C horizon has colors similar to those of the B horizon. It is channery or very channery sandy loam or loamy sand.

Upshur Series

The Upshur series consists of deep, well drained, slowly permeable soils formed in residuum from clay shale on uplands. Slope ranges from 8 to 70 percent.

In Athens County, these soils have more clay in the subsoil than is defined for the Upshur series. This difference, however, does not alter the usefulness or behavior of the soils.

The Upshur soils are similar to Vandalia, Vincent, and Woodsfield soils and are commonly adjacent to Elba, Guernsey, and Westmoreland soils. Elba, Guernsey, and Westmoreland soils are yellower in the subsoil and substratum. Elba and Westmoreland soils are on slightly higher positions than Upshur soils. Areas of Guernsey soils are very intermixed with areas of the Upshur soils. The Guernsey soils are moderately well drained and have mottles in the lower part of the subsoil. Vandalia soils have more siltstone coarse fragments in the subsoil. Vincent soils formed in lacustrine sediments and have very few or no coarse fragments in the solum. Westmoreland soils have more sand and coarse fragments in the subsoil and substratum. Woodsfield soils have a 14- to 26-inch thick silt mantle.

Typical pedon of Upshur silty clay loam, 8 to 15 percent slopes, about 4 miles southeast of Athens, Lodi Township, about 1,800 feet west and 1,056 feet south of the northeast corner of sec. 36, T. 4 N., R. 13 W.

Ap—0 to 6 inches; brown (7.5YR 4/4) silty clay loam, light brown (7.5YR 6/4) dry; moderate medium and fine granular structure; friable; many roots; dark brown (10YR 4/3) coatings on faces of peds; medium acid; abrupt smooth boundary.

Bt1—6 to 11 inches; reddish brown (5YR 4/4) silty clay; moderate medium subangular blocky structure; firm, very plastic, very sticky; common roots; thin patchy clay films and dark brown (10YR 4/3) coatings on faces of peds; medium acid; clear wavy boundary.

Bt2—11 to 16 inches; reddish brown (2.5Y 4/4) clay; moderate medium angular blocky structure; firm, very plastic, very sticky; few roots; thin continuous dark reddish brown (2.5YR 3/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—16 to 22 inches; reddish brown (2.5YR 4/4) clay; weak coarse prismatic structure parting to moderate medium angular blocky; firm, very plastic, very sticky; few roots; thin continuous dark reddish brown (2.5YR 3/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt4—22 to 29 inches; dark reddish brown (2.5YR 3/4) clay; weak coarse prismatic structure parting to moderate medium angular blocky; firm, very plastic, very sticky; few roots; thin continuous clay films on faces of peds; common black (N 2/0) stains (Fe and Mn oxides); strongly acid; clear wavy boundary.

Bt5—29 to 38 inches; dark reddish brown (2.5YR 3/4) clay; weak medium and coarse subangular blocky structure; firm, very plastic, very sticky; thin patchy clay films on faces of peds; few very dark gray (N 3/0) stains (Fe and Mn oxides); neutral; clear wavy boundary.

C1—38 to 49 inches; dark reddish brown (2.5YR 3/4) silty clay; massive; firm; very dark gray (N 3/0)

stains; 5 percent small soft shale fragments; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—49 to 60 inches; reddish brown (2.5YR 4/4) silty clay loam; massive; firm; very dark gray (N 3/0) stains (Fe and Mn oxides); 10 percent small soft shale fragments; strong effervescence; moderately alkaline.

Solum thickness ranges from 34 to 45 inches. Depth to paralithic or lithic contact ranges from 40 to 72 inches or more. Sand content ranges from 0 to 10 percent in the control section. Content of coarse fragments ranges from 0 to 5 percent in the solum.

The Ap horizon has hue of 10YR to 5YR, value of 3 or 4, and chroma of 2 to 4. It is commonly silty clay loam but is silt loam, silty clay, or clay in some pedons. The B horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. It is silty clay or clay. It is very strongly acid to medium acid in the upper part and strongly acid to moderately alkaline in the lower part. The C horizon has colors like those of the B horizon, but some pedons have variegated shades of olive, olive brown, or yellow. It is dominantly silty clay loam, silty clay, or clay, but it is clay loam in some pedons. It is medium acid to moderately alkaline.

Vandalia Series

The Vandalia series consists of deep, well drained, slowly or moderately slowly permeable soils formed in deep colluvium on foot slopes, toe slopes, and benches. Slope ranges from 8 to 40 percent.

Vandalia soils are similar to Brookside, Upshur, and Vincent soils and are commonly adjacent to Brookside and Richland soils. Brookside soils are commonly in lower positions than Vandalia soils. Brookside and Richland soils are yellower in the subsoil. Richland soils have more sand and less clay in the subsoil and are on slightly higher positions. Upshur soils have fewer coarse fragments in the subsoil, and Vincent soils do not have coarse fragments in the subsoil.

Typical pedon of Vandalia silty clay loam, from an area of Vandalia-Richland complex, 15 to 25 percent slopes, about 6 miles east-southeast of Albany, Alexander Township, 400 feet northwest of the intersection of County Road 17 and Township Road 416 along Township Road 416, then 132 feet south, T. 8 N., R. 14 W.

Ap—0 to 5 inches; reddish brown (5YR 4/4) silty clay loam, light reddish brown (5YR 6/4) dry; moderate coarse granular structure; firm; many roots; dark brown (7.5YR 4/2) coatings on faces of peds; 2 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—5 to 12 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; many roots; thin very patchy clay films on faces of peds; 2 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—12 to 20 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; common roots; thin patchy reddish brown (5YR 4/4) clay films on faces of peds; 7 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—20 to 32 inches; dark red (2.5YR 3/6) silty clay; moderate medium subangular blocky structure; firm; few roots; thin patchy clay films on faces of peds; 15 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—32 to 39 inches; reddish brown (2.5YR 4/4) clay; moderate medium subangular blocky structure; firm; few roots; thin patchy clay films on faces of peds; 15 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt5—39 to 48 inches; reddish brown (2.5YR 4/4) channery silty clay; weak coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; 30 percent coarse fragments; very strongly acid; clear wavy boundary.

C—48 to 60 inches; dark red (2.5YR 3/6) channery silty clay; massive; very firm; 20 percent coarse fragments; very strongly acid.

Solum thickness ranges from 30 to 60 inches. Content of coarse fragments ranges from 2 to 15 percent in the A horizon and upper part of the B horizon and 2 to 40 percent in the lower part of the B horizon and in the C horizon.

The Ap horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 or 4. It is typically silty clay loam but is silt loam in some pedons. The upper part of the B horizon has hue of 5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or silty clay loam. The lower part of the B horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 4 to 6. It is mottled in some pedons. It is clay or silty clay and their channery or very channery analogs. The B horizon is very strongly acid to medium acid. The C horizon has hue of 7.5YR or 2.5YR, value of 3 or 4, and chroma of 2 to 6. It is clay loam, silty clay, clay, or silty clay loam and their channery or very channery analogs. The C horizon is very strongly acid to neutral.

Vincent Series

The Vincent series consists of deep, moderately well drained, slowly permeable soils formed in silty alluvium or loess and in the underlying lacustrine sediments on high lacustrine terraces on ridgetops. Slope ranges from 6 to 12 percent.

The Vincent soils are similar to Hackers, Upshur, Vandalia, and Woodsfield soils and are commonly

adjacent to Gallia soils. Gallia soils are on high terraces in the preglacial valleys and have more sand and less clay in the subsoil. Hackers soils have more silt and less clay in the subsoil. Vandalia and Woodsfield soils do not have lacustrine sediments in the lower part of the soil and commonly have more coarse fragments in the lower part of the soil.

Typical pedon of Vincent silt loam, 6 to 12 percent slopes, about 2 miles south-southwest of Coolville, Troy Township, 1,980 feet south and 130 feet east of the northwest corner of sec. 25, T. 5 N., R. 11 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; many roots; dark grayish brown (10YR 4/2) silt coatings on faces of peds; slightly acid; abrupt smooth boundary.

BE—7 to 13 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common roots; dark brown (10YR 4/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—13 to 20 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium angular blocky structure; firm; few roots; thin continuous clay films on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Bt2—20 to 27 inches; yellowish red (5YR 5/6) silty clay loam; moderate medium and fine angular blocky structure; firm; thin continuous yellowish red (5YR 4/6) clay films on faces of peds; common black (N 2/0) concretions; very strongly acid; clear wavy boundary.

2Bt3—27 to 38 inches; yellowish red (5YR 4/6) silty clay; few medium faint red (2.5YR 4/6) mottles; moderate medium angular blocky structure; firm; thin patchy clay films on faces of peds; common black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Bt4—38 to 52 inches; red (2.5YR 4/6) silty clay; few medium distinct light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; firm; thin patchy yellowish red (5YR 4/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

2C—52 to 60 inches; yellowish red (5YR 4/6) silty clay; massive, with weak bedding planes; firm; thin lenses of sandy clay loam; common black (N 2/0) concretions; medium acid.

Solum thickness ranges from 40 to 70 inches. Up to 20 inches of silty alluvium or loess overlies the lacustrine material. The solum has a very low sand content. The reaction is slightly acid or neutral in the surface horizon, very strongly acid to medium acid in the Bt horizon, and medium acid to mildly alkaline in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is commonly silt loam but is silty clay loam in some pedons. The B horizon has dominant hue of 5YR or 2.5YR but also includes hue of 7.5YR in the upper part. It has value of 4 or 5 and chroma of 6. It is silty clay loam, silty clay, or clay. The C horizon has hue of 5YR, value of 4, and chroma of 4 to 6. It is dominantly silty clay or silty clay loam and includes thin strata of sandy clay loam.

Wellston Series

The Wellston series consists of deep, well drained, moderately permeable soils formed in silty material and in residuum from siltstone and fine grained sandstone on uplands. Slope ranges from 3 to 15 percent.

Wellston soils are similar to Westmore, Westmoreland, and Zanesville soils and are commonly adjacent to Clymer and Zanesville soils. Westmore soils have higher base saturation in the substratum and more clay in the lower part of the solum and in the substratum. Clymer and Westmoreland soils contain more sand in the upper part of the subsoil. Zanesville soils have a fragipan and are moderately well drained.

Typical pedon of Wellston silt loam, 8 to 15 percent slopes, about 5 miles northwest of Albany, Lee Township, 725 feet east and 25 feet south of the northwest corner of sec. 18, T. 10 N., R. 15 W.

Ap—0 to 8 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and fine granular structure; friable; many roots; neutral; abrupt smooth boundary.

Bt1—8 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—18 to 26 inches; yellowish brown (10YR 5/6) silt loam; common medium faint brownish yellow (10YR 6/8) mottles; moderate medium blocky structure; friable; thin continuous clay films on faces of peds; 2 percent siltstone fragments; medium acid; clear wavy boundary.

2Bt3—26 to 36 inches; yellowish brown (10YR 5/6) clay loam; weak coarse subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; 10 percent siltstone and fine grained sandstone fragments; strongly acid; clear wavy boundary.

2C—36 to 48 inches; yellowish brown (10YR 5/8) channery loam; massive; friable; 20 percent light brownish gray (10YR 6/2) siltstone and fine grained sandstone fragments; strongly acid; clear wavy boundary.

2R—48 inches; yellowish brown (10YR 5/8) siltstone and fine grained sandstone.

Solum thickness ranges from 32 to 50 inches. Depth to bedrock ranges from 40 to 60 inches. The reaction in unlimed soils is medium acid or strongly acid throughout the solum. Content of coarse fragments ranges from none in the upper part of the B horizon to 20 percent in the lower part of the B horizon with an average of less than 10 percent.

The Ap horizon has a hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The 2C horizon has hue of 10YR, value of 5, and chroma of 4 to 8. It is gravelly loam, channery loam, or channery sandy clay loam.

Westmore Series

The Westmore series consists of deep, well drained soils formed in a silty mantle and in the underlying residuum from interbedded shale, siltstone, and some limestone on upland ridgetops. Permeability is moderate in the upper part of the profile and moderately slow or slow in the lower part. Slope ranges from 3 to 15 percent.

Westmore soils are similar to Guernsey and Wellston soils and are commonly adjacent to Wellston and Woodsfield soils. Guernsey and Woodsfield soils have more clay in the upper part of the subsoil. Woodsfield soils also are redder in the lower part of the subsoil and in the substratum. Wellston soils have a lower base saturation and less clay in the lower part of the subsoil and in the substratum.

Typical pedon of Westmore silt loam, 3 to 8 percent slopes, about 4 miles north of Albany, Lee Township, 1,320 feet north and 1,056 feet east of the southwest corner of sec. 6, T. 10 N., R. 15 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

BA—6 to 11 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; dark brown (10YR 4/3) coatings in old root channels; slightly acid; clear wavy boundary.

Bt1—11 to 19 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common roots; few very dark gray (N 3/0) coatings (Fe and Mn oxides); thin patchy brown (7.5YR 5/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—19 to 28 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium and coarse subangular blocky structure; firm; few roots; yellowish brown (10YR 5/4) coatings; many very dark gray (N 3/0) coatings (Fe and Mn oxides); thin patchy brown (7.5YR 5/4) clay films on faces of peds; medium acid; clear wavy boundary.

2Bt3—28 to 40 inches; strong brown (7.5YR 5/6) silty clay loam; few medium faint yellowish red (5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few roots; light yellowish brown (10YR 6/4) coatings; many very dark gray (N 3/0) coatings (Fe and Mn oxides); thin patchy brown (7.5YR 5/4) clay films on faces of peds; medium acid; clear wavy boundary.

2Bt4—40 to 47 inches; strong brown (7.5YR 5/6) silty clay loam; common medium faint yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin patchy brown (7.5YR 5/4) clay films on faces of peds; grayish brown (10YR 5/2) clay seams; few very dark gray (N 3/0) coatings (Fe and Mn oxides); medium acid; clear wavy boundary.

2Bt5—47 to 59 inches; strong brown (7.5YR 5/6) silty clay; few medium faint yellowish red (5YR 5/6) and common medium distinct light olive gray (5Y 6/2) mottles from weathered shale; weak coarse subangular blocky structure; firm; thick continuous reddish brown (5YR 5/4) clay films on faces of peds; many dark gray (N 4/0) clay seams; medium acid; clear wavy boundary.

2C—59 to 60 inches; strong brown (7.5YR 5/6) silty clay; many medium distinct light brownish gray (2.5Y 6/2) and many medium faint yellowish red (5YR 5/6) mottles from weathered shale; massive; firm; light brownish gray (2.5Y 6/2) and brown (7.5YR 5/4) clay seams; 1 percent coarse fragments; neutral.

Solum thickness ranges from 42 to 60 inches. Depth to bedrock is more than 48 inches. Thickness of the silty mantle ranges from 25 to 36 inches. Content of coarse fragments ranges from 0 to 10 percent in the lower part of the B horizon and in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The A horizon is strongly acid to slightly acid. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam and is medium acid or strongly acid. The 2Bt horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 3 to 6. It is silty clay loam or silty clay. It is strongly acid or medium acid in the upper part and medium acid to neutral in the lower part. The 2C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 6. It is commonly clay or silty clay and less commonly silty clay loam. It is medium acid to mildly alkaline.

Westmoreland Series

The Westmoreland series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in residuum from interbedded shale, siltstone, sandstone, and thin beds of limestone. Slope ranges from 8 to 70 percent.

Westmoreland soils are similar to Richland and Wellston soils and are commonly adjacent to Berks, Dekalb, Guernsey, and Upshur soils. Berks and Dekalb soils have bedrock between depths of 20 and 40 inches and contain more coarse fragments throughout the soil. They are on shoulder slopes and steeper parts of side slopes. They do not have an argillic horizon. Guernsey and Upshur soils are on lower positions on hillsides and on foot slopes. They have more clay in the subsoil. Guernsey soils are moderately well drained with gray mottles in the lower part of the subsoil. Upshur soils are redder in the subsoil and substratum. Richland soils have a thicker solum and a higher base saturation in the substratum. Wellston soils have more silt, less sand, and fewer coarse fragments in the upper part of the solum.

Typical pedon of Westmoreland silt loam, from an area of Westmoreland-Guernsey silt loams, 15 to 25 percent slopes, about 2 miles north of Albany, Lee Township, 410 feet west and 1,800 feet south of the northeast corner of sec. 4, T. 10 N., R. 15 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many roots; 2 percent coarse fragments; strongly acid; abrupt smooth boundary.

EB—5 to 9 inches; brown (10YR 5/3) silt loam; moderate medium subangular blocky structure; friable; many roots; 2 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—9 to 15 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; common roots; thin very patchy clay films on faces of peds; 5 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—15 to 22 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 15 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—22 to 29 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few roots; thin continuous brown (7.5YR 5/4) clay films on faces of peds; 25 percent coarse fragments; strongly acid; clear wavy boundary.

C—29 to 45 inches; strong brown (7.5YR 5/6) extremely channery silty clay loam; massive; firm; 70 percent coarse fragments; strongly acid; clear wavy boundary.

R—45 inches; light brownish gray (2.5Y 6/2) siltstone.

Solum thickness ranges from 29 to 40 inches. Depth to bedrock is 45 to 70 inches or more. Content of coarse fragments, mostly siltstone and sandstone, ranges from 2 to 20 percent in the Ap horizon, 2 to 30 percent in the B horizon, and 45 to 75 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is dominantly silt loam but is loam or silty clay loam in some pedons. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly silty clay loam or loam and channery analogs but ranges from silt loam to clay loam and channery analogs. Reaction is very strongly acid to medium acid. The C horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is very channery or extremely channery silty clay loam or clay loam.

Wheeling Series

The Wheeling series consists of deep, well drained, moderately permeable soils formed in loamy material on high terraces. Slope ranges from 3 to 10 percent.

Wheeling soils are similar to Parke soils. Parke soils have more silt and less sand in the upper part of the subsoil.

Typical pedon of Wheeling loam, 3 to 10 percent slopes, about 3 miles southeast of Coolville, Troy Township, 330 feet east and 875 feet south of the northwest corner of sec. 1, T. 5 N., R. 11 W.

Ap—0 to 11 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common roots; dark yellowish brown (10YR 4/4) coatings on faces of peds; strongly acid; abrupt smooth boundary.

Bt1—11 to 20 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—20 to 28 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—28 to 43 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

BC—43 to 60 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; yellowish brown (10YR 5/4) coatings on faces of peds; strongly acid.

Solum thickness ranges from 44 to 60 inches. The weighted average content of coarse fragments within a depth of 40 inches is 0 to 15 percent. Reaction is strongly acid throughout the soil except where limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is commonly loam, but is fine sandy loam in some pedons. The B horizon has hue of 10YR or

7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam or silt loam. Some pedons have a loamy sand C horizon.

Woodsfield Series

The Woodsfield series consists of deep, well drained soils formed in silty materials and the underlying reddish residuum from clay shales on uplands. Permeability is moderate in the upper part of the profile and moderately slow or slow in the lower part. Slope ranges from 3 to 15 percent.

The Woodsfield soils are similar to Upshur and Vincent soils and are commonly adjacent to Westmore soils. Upshur soils have more clay and less silt in the upper part of the subsoil. Vincent soils formed in lacustrine sediments in the lower part of the soil and commonly have fewer coarse fragments in the lower part of the soil. Westmore soils have more silt in the upper part of the subsoil and are yellower in the lower part of the soil.

Typical pedon of Woodsfield silt loam, 3 to 8 percent slopes, about 3 miles east of Athens, Canaan Township, 1,520 feet west and 725 feet north of the southeast corner of sec. 33, T. 5 N., R. 13 W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and fine granular structure; friable; common roots; dark brown (10YR 4/3) coatings on faces of peds; neutral; abrupt smooth boundary.

BE—7 to 12 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few roots; dark yellowish brown (10YR 4/4) coatings on faces of peds; dark brown (10YR 4/3) krotovinas; slightly acid; clear wavy boundary.

Bt1—12 to 18 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few roots; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—18 to 25 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; common black (N 2/0) stains; strongly acid; clear wavy boundary.

2Bt3—25 to 31 inches; reddish brown (2.5YR 4/4) clay; weak coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt4—31 to 49 inches; dark reddish brown (2.5YR 3/4) clay; weak coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; few black (N 2/0) concretions; strongly acid; clear wavy boundary.

2Bt5—49 to 56 inches; dark reddish brown (2.5YR 3/4) clay; common medium distinct grayish brown (2.5Y 5/2) and few fine distinct weak red (10R 4/2) mottles; weak coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; slightly acid; clear wavy boundary.

2BC—56 to 60 inches; weak red (10R 4/4) silty clay; common medium distinct grayish brown (2.5Y 5/2) mottles; weak coarse subangular blocky structure; firm; strong effervescence; mildly alkaline.

Solum thickness ranges from 45 to more than 60 inches. The silty mantle ranges in thickness from 14 to 26 inches. Except where the soil has been limed, reaction is slightly acid to strongly acid in the upper part of the solum and medium acid to mildly alkaline in the lower part. Content of coarse fragments, which are mostly shale and siltstone, is typically less than 5 percent but ranges to 15 percent in the lower part of the solum.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 4 to 6. It is clay or silty clay.

Zanesville Series

The Zanesville series consists of deep, moderately well drained soils on ridgetops. The soils formed in loess and in the underlying loamy or silty residuum from acid sandstone and siltstone. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slope ranges from 3 to 8 percent.

Zanesville soils are similar to Omulga and Wellston soils and are commonly adjacent to Clymer soils. Clymer soils are on ridgetops and the upper part of side slopes. They have more sand and less silt in the upper part of the soil. Clymer and Wellston soils are well drained and do not have a fragipan. Omulga soils are stratified in the lower part of the soil.

Typical pedon of Zanesville silt loam, 3 to 8 percent slopes, about 3 miles northeast of Coolville, Troy Township, 600 feet north and 2,400 feet west of the southeast corner of sec. 18, T. 5 N., R. 11 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; many roots; dark reddish brown (5YR 3/3) concretions (Fe and Mn oxides); slightly acid; abrupt smooth boundary.

BE—8 to 13 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; common roots; dark brown (10YR 4/3) fillings in root and krotovina channels; yellowish brown (10YR 5/4) silt coatings on faces of peds; medium acid; clear wavy boundary.

Bt1—13 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium angular blocky

structure; firm; few roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; yellowish brown (10YR 5/4) coatings; strongly acid; clear wavy boundary.

Bt2—18 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; weak thick platy structure parting to moderate medium subangular blocky; firm; few roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; pale brown (10YR 6/3) coatings; black (N 2/0) concretions; strongly acid; clear wavy boundary.

Btx1—27 to 32 inches; yellowish brown (10YR 5/6) silty clay loam; moderate coarse and very coarse prismatic structure parting to weak thick platy; firm; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of secondary peds; gray (10YR 5/1) silt coatings on vertical faces of prisms; few black (N 2/0) concretions; common stains (iron oxides); strongly acid; clear wavy boundary.

2Btx2—32 to 52 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate coarse and very coarse prismatic structure parting to weak thick platy; very firm; thin patchy yellowish brown (10YR 5/4) clay films on faces of secondary peds; gray (10YR 6/1) clay films on vertical faces of prisms; 7 percent coarse fragments; many black (N 2/0) manganese stains; many yellowish brown (10YR 5/6) stains (iron oxides); strongly acid; clear wavy boundary.

2BC—52 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint yellowish brown (10YR 5/8 and 5/4) mottles; weak thick platy structure; firm; grayish brown (10YR 5/2) coatings on vertical faces of peds; 5 percent coarse grained siltstone fragments; strongly acid.

Solum thickness ranges from 40 to 70 inches. The depth to bedrock ranges from 40 to 80 inches, and depth to the top of the fragipan ranges from 23 to 32 inches. Except where limed, these soils are medium acid to very strongly acid throughout.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 10YR, value of 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR, value of 5, and chroma of 4 to 6. It is silty clay loam to sandy loam with 0 to 15 percent coarse fragments.

A C horizon is present in some pedons. It has the same color and fine earth texture ranges as does the Bt horizon. It is 5 to 35 percent coarse fragments.

Formation of the Soils

This section describes the factors of soil formation as they relate to the soils in Athens County and explains some of the processes of soil formation.

Factors of Soil Formation

The major factors in soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on parent material is modified by relief and the length of time the parent material has been acted upon. The relative importance of each factor differs, however, from place to place. One factor may dominate and, in extreme cases, determine most of the soil properties, but normally the interaction of all five factors determines what kind of soil forms.

Parent Material

Parent material is the unconsolidated mass from which the soil has formed. In Athens County, this material can be divided into four groups: residual materials that have developed in place by weathering of the underlying bedrock; colluvial materials that have weathered from bedrock at higher elevations and been transported by water and gravity to the lower base slopes; alluvium, lacustrine sediments, and glacial outwash deposited by water; and a silt mantle deposited by wind.

Most soils in the county formed in residual materials that were derived from different kinds of rock. The bedrock strata are nearly horizontal and vary in thickness. Consequently, several different rock strata were exposed to weathering within short distances, and most of the soils that formed on sloping landscapes have layers that formed in mixed residuum from two or more kinds of rock.

Sandstone, siltstone, shale, and limestone are the dominant kinds of bedrock in the county. Westmoreland soils formed in residuum from interbedded shale, siltstone, sandstone, and thin beds of limestone. Guernsey soils formed mainly in residuum from interbedded shale, siltstone, and limestone.

Some of the soils, however, formed mainly in only one kind of bedrock. Clymer, Dekalb, and Steinsburg soils formed in residuum from sandstone. Upshur soils formed in residuum from clay shale.

The colluvial deposits in the county are of various thicknesses and are at the foot of steep or very steep slopes. These deposits consist of sediment washed or rolled downslope from the soils and the weathering bedrock above. They are mixtures of materials found on slopes above them. Vandalia, Brookside, and Richland soils formed in such deposits.

Several soils formed in unconsolidated parent material transported by water, gravity, or wind. Most low valley areas have thick layers of silt, sand, gravel, and clay deposited by glacial meltwater or more recent floodwaters. Chagrin, Moshannon, Melvin, Nolin, and Newark soils formed in material deposited by floodwater or the more recent alluvium.

Glenford, Fitchville, and Licking soils formed in lacustrine deposits on terraces along streams. Negley soils formed in outwash material on outwash terraces. Gallia soils formed in stratified old alluvium on high terraces in preglacial valleys.

Some of the soils in the county formed in more than one type of parent material. The upper layers of Parke soils, for example, formed in loess, and the lower part formed in glacial outwash.

Climate

The climate throughout Athens County has been relatively uniform, and differences in climate have not greatly contributed to differences between the soils. During the formation of the soils, the climate has been favorable to both physical and chemical weathering of parent material and to biological activity.

Rainfall has been adequate for the percolation of water, which contributes to the translocation of clay minerals and the development of soil structure as has happened in the Upshur, Wellston, and Brookside soils. Freezing and thawing have also aided in the formation of soil structure. The warm summer temperatures have favored chemical reactions in the weathering of primary minerals. Both the rainfall and the temperature have been favorable to plant growth and the subsequent accumulation of organic matter in all the soils.

Relief

Because of the relief, different soils can form in the same kind of parent material. A comparison of the Omulga and Doles soils, both of which formed in similar

material, shows how relief has affected their formation. Omulga soils are moderately well drained and formed where water could run off. Doles soils are somewhat poorly drained because they formed in nearly level areas where runoff was slow.

Living Organisms

All living organisms—vegetation, animals, bacteria, and fungi—play a role in soil formation. When Athens County was settled, the vegetation was dominantly hardwood forest—beech, maple, oak, yellow-poplar, and ash. Soils that formed in these forested areas are generally acid and are moderate or low in natural fertility.

Small animals, insects, earthworms, and burrowing animals make channels in the soil that make the soil more permeable to water. Animals also mix soil materials and contribute organic matter. Worm channels or casts are most common in the surface layer of soils that have been limed or in soils on flood plains such as Nolin and Chagrin soils. Crayfish channels are found in the poorly drained Melvin soils.

Civilization also affects soil formation. Man plows the soil, plants seeds, and introduces vegetation. He drains some areas, irrigates some, floods some, and adds or removes soil material from others for construction or surface mining. He adds lime and fertilizer, which neutralizes the acid soil reaction and changes the chemical composition.

Time

Time is needed for the other soil-forming factors to produce their effects. The age of a soil is indicated, to some extent, by the degree of development of its profile. In many places, however, other factors—such as parent material that weathers slowly or relief that is steep—affect profile development.

The oldest parent material is the residuum that was derived from sedimentary bedrock. The soils that formed in this material show various degrees of development because of the influence of parent material, hilly topography, and other soil-forming factors. The Berks, Dekalb, Elba, and Steinsburg soils are examples.

The youngest parent material in the county is the alluvium on flood plains that are periodically flooded. The Chagrin, Nolin, and other alluvial soils are so young that they show little or no differentiation of horizons.

Processes of Soil Formation

Most of the soils in Athens County have a relatively strong profile development. The processes of soil formation have produced distinct changes in the material in which most of the soils formed. These soils are on uplands and on terraces along the major valleys. A few soils, however, are only slightly modified from the parent material. These are mainly on flood plains.

The transfer of clay from the A horizon to the ped surfaces in the B horizon takes place because of the seasonal wetting and drying of the soil profile. The fine clay becomes suspended in percolating water as it moves through the surface layer and is carried downward to the subsoil. There the fine clay is deposited on the ped surfaces by drying or by precipitation resulting from free carbonates. Because of this transfer of fine clay, there are patchy to nearly continuous clay films on ped surfaces in the B horizon of Upshur, Westmoreland, and other soils.

The transformation of mineral compounds takes place in most soils. The results are most apparent if the development of horizons is not affected by rapid erosion or by accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly those of the layer-lattice silicate clays. Most of the layer-lattice clays remain in the subsoil.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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.

Aspect. The direction toward which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches 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 vegetation. 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.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, 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 constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil 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 are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

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. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

Curtain drain. A perimeter drain placed entirely around a septic tank absorption field to lower the water table.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods.

Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

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 the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

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 textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

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.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

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 up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 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 (geology). Water filling all the unblocked pores of underlying 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.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

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. 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, any plowed or disturbed surface layer.

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 O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon 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) granular, 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 horizon. 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, the Arabic numeral 2 precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but 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-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

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.

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.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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. Mottling generally indicates poor aeration and impeded drainage. 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).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

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.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

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 affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 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. For example, slope, stoniness, and thickness.

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 plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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 degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly 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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

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.

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-size 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 or of the underlying material. 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.

Shrink-swell. 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.

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.

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 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

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 of separates recognized in the United States are as follows:

	Millimeters
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 underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded and 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind 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 grained* (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. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

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."

Surface soil. The A, E, AB, and EB horizons, including all subdivisions of these horizons.

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.

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.

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 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.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

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 melt water streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and reduce erosion.

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.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.