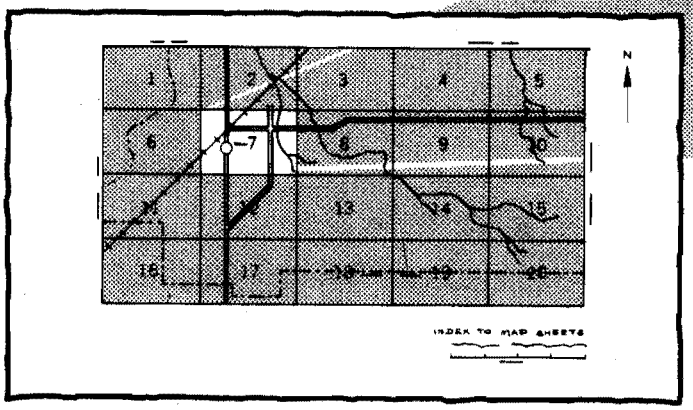
Soil Survey of

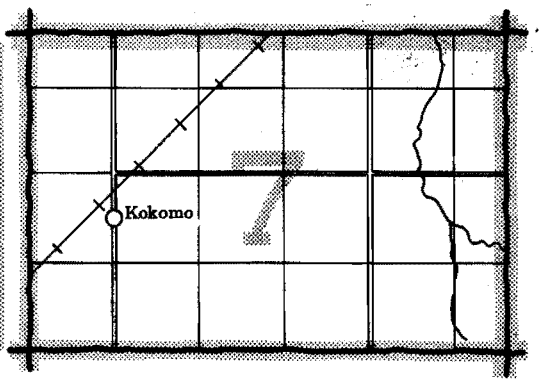
Belmont County, Ohio

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

HOW TO USE

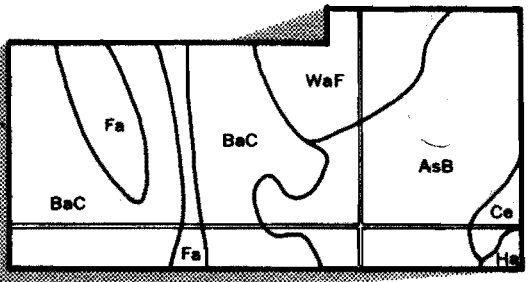
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).



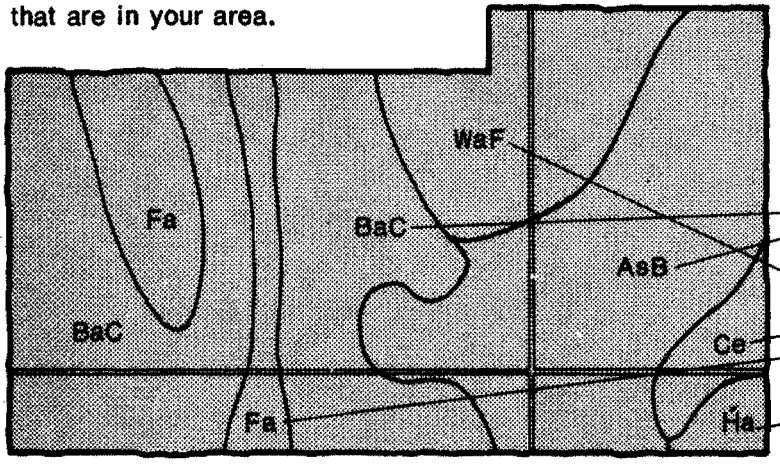


2. Note the number of the map sheet and turn to that sheet.

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



4. List the map unit symbols that are in your area.



Symbols

AsB
BaC
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Fa
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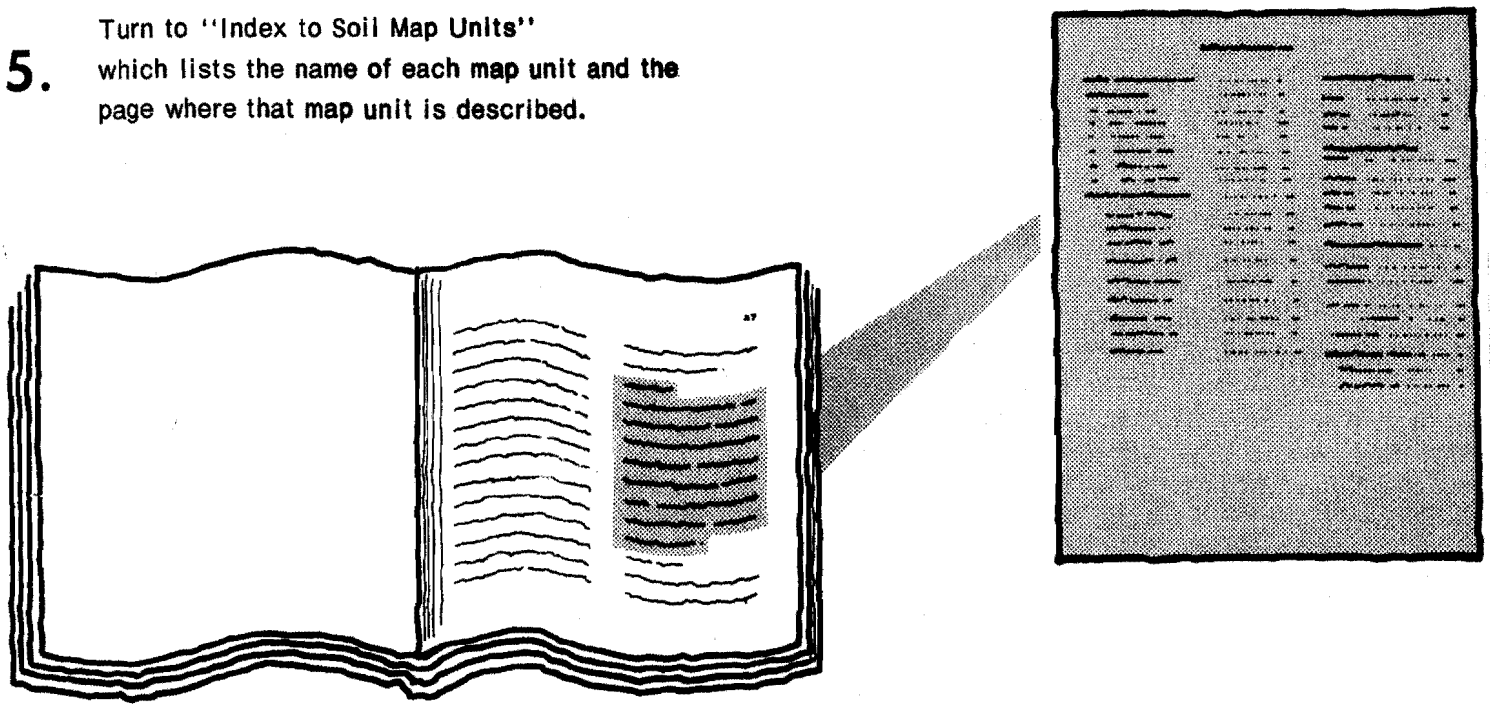
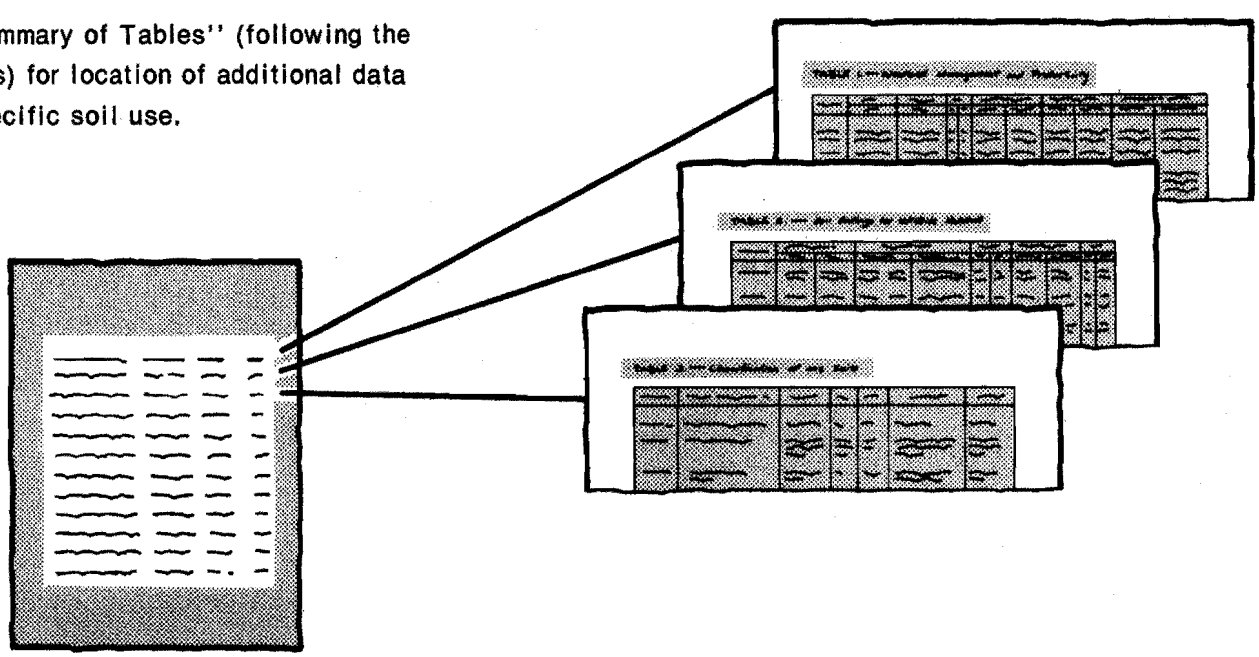
THIS SOIL SURVEY

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 performed in the period 1972-77. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Belmont Soil and Water Conservation District. The survey was funded in part by the Belmont County Commissioners.

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: Typical landscape in a stream valley. Otwell soils are on the terrace in the foreground. Lowell and Westmoreland soils are on the very steep hillsides in the background.

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soil series

Issued July 1981

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foreword

This soil survey contains information that can be used in land-planning programs in Belmont County, Ohio. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

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

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

Robert R. Shaw
State Conservationist
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soil survey of
Belmont County, Ohio

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and Development Center

general nature of the survey area

BELMONT COUNTY, in the southeastern part of Ohio (fig. 1), has an area of 341,952 acres, or 535 square miles. The population was 80,917 in 1970. The population of St. Clairsville, the county seat, was 5,197 in 1976.

The eastern boundary of the county is the Ohio River. The largest cities, Martins Ferry and Bellaire, are along the river. Smaller towns along the river are Bridgeport, Shadyside, and Powhatan Point. The largest town in the western part of the county is Barnesville.

The most industrialized and most densely populated part of the county is along the river. Deep coal mining and metal fabricating and other light manufacturing are the main industries. In the northern and western parts of the county, surface mining is a major activity.

Raising livestock is the main agricultural enterprise. Fruits, vegetables, hay, and grain are also grown.

Figure 1.—Location of Belmont County in Ohio.

climate

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

Belmont County has a continental climate with wide annual and daily ranges in temperature. Winters are cold, snowy, and cloudy. Summers are fairly warm and humid.

Occasionally, days are very hot. Rainfall is well distributed throughout the year. Fall is the driest season. Normal annual precipitation is adequate for all of the commonly grown crops. Summer temperatures and growing season dates in valleys differ slightly from those at higher elevations. The latest freezes in spring and the earliest freeze in fall generally occur in valleys because cool air flows down the slopes into the valleys on nights with clear skies and light winds.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Barnesville, Ohio, in the period 1951 to 1976. 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 28 degrees F, and the average daily minimum temperature is 18 degrees. The lowest temperature on record for the period, which occurred at Barnesville on January 29, 1963, is -25 degrees. In summer the average temperature is 68 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred at Barnesville on August 4, 1955, is 102 degrees.

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

Of the total annual precipitation, 23 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 3.39 inches at Barnesville on June 27, 1970. Thunderstorms occur on about 40 days each year, and most occur in summer. Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

Average seasonal snowfall is 32 inches. The greatest snow depth at any one time during the period of record was 15 inches. On an average of 22 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent.

physiography, relief, and drainage

Belmont County is in the unglaciated Allegheny Plateau Region (*4*). The area has been extensively dissected by drainageways. The topography can be divided into four general sections.

The eastern fourth of the county is the most rugged. Ridgetops and valleys are narrow. Side slopes are steep and very steep.

The area to the west, also about one-fourth of the county, is not quite so rugged. In this area ridgetops are slightly wider and more gently sloping, and there are not so many very steep side slopes and valleys. The western fourth of the county is similar to this section but has been extensively strip mined.

The fourth of the county between these two areas is more gently sloping. The ridgetops are wider, and there are fewer steep and very steep hillsides.

The eastern three-fourths of the county drains into the Ohio River. The three main tributaries are Wheeling, McMahon, and Captina Creeks. Some small streams drain directly into the Ohio River. The western fourth of the county is drained by Leatherwood and Stillwater Creeks, part of the Muskingum River Watershed.

The highest elevation in the county is 1,397 feet at Galloway's Knob south of St. Clairsville. The lowest elevation, at Powhatan Point, is about 625 feet, which is normal pool elevation of the Ohio River.

geology

The bedrock in Belmont County is sedimentary rock. The exposed strata consist of two geologic formations and one geologic group (*4*). These are the upper 350 feet of the Conemaugh Formation, the Monongahela Formation, and the lower 470 feet of the Dunkard Group. The Conemaugh and Monongahela Formations are part of the Pennsylvania System. The Dunkard Group is part of the Permian System. The rocks in these formations are shale, sandstone, siltstone, limestone, and coal. The layers of rock are nearly horizontally bedded but dip generally to the southeast at an average of 18 feet per mile.

The Conemaugh Formation crops out only in the western part of the county and in the valleys of the northeastern part. It is the least exposed of the formations.

The Dunkard Group is the most extensively exposed bedrock. It occurs mostly in the eastern half of the county.

The Monongahela Formation is less extensive than the Dunkard Group but more extensive than the Conemaugh Formation. It is exposed mostly in the western part of the county but also in the main valleys that drain to the Ohio River.

The Pittsburgh number 8 coalbed, the Sewickley number 9, the Uniontown number 10, and the Waynesburg number 11 are in the Monongahela Formation. The Washington number 12 coalbed is in the Dunkard Group.

farming

About 35 percent of the land in Belmont County is in farms according to the 1974 Census of Agriculture (*12*).

The main source of farm income is the sale of livestock and livestock products, mainly dairy products and beef. Poultry, hogs, and sheep are also marketed (*5*). Fruits and vegetables are the leading income-producing crops. Oats and hay are second. Smaller amounts of corn and nursery stock are marketed.

Nearly all of the soils have good surface drainage. Approximately 50 percent of the land, however, is moderately steep to very steep. The hazard of erosion is a major concern if the soils on the uplands are farmed.

Many areas that were farmed in the past have been taken out of production by surface mining. Other areas have been taken out of production by urbanization. Some steeper areas that were in poor quality pasture are reverting to brush and woodland.

natural resources

Coal mining is a very important part of the local economy. The Pittsburgh number 8 coalbed is extensively deep mined. This bed and the Sewickley number 9, the Uniontown number 10, the Waynesburg number 11, and the Washington number 12 coalbeds are all surface mined. Most surface mining is in the northern half of the county, but scattered areas in the southern half are surface mined.

Four active limestone quarries are in the county. The limestone is used mainly for road base and to lesser extent for agricultural use.

industry

The main industries in Belmont County are coal mining and steel stamping and other light manufacturing. The deep coal mines and most other industry are concentrated along the Ohio River. Surface mining is in the more rural areas of the county.

Industry is served by a transportation system that includes Interstate Highway 70, U.S. Highway 250, State Route 7, the Chessie Railroad System, the Consolidated Rail Corporation, and the Ohio River.

settlement

Belmont County was established by a proclamation of the governor of the Northwest Territory (*6*). St. Clairsville became the county seat in 1804. Bridgeport, originally called Canton, was laid out in 1806; Bellaire, in 1834; and Martins Ferry, in 1835.

The Zane Trace or National Road was finished in 1825. Interstate 70 follows approximately the same route. The National Road and the Ohio River made the county a natural crossroads.

The population of the county was 600 in 1800. It had grown to 20,556 by 1820 and to 41,021 by 1870. In 1970, the population was 80,917.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit, or 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 other associations 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

gently sloping soils on wide ridgetops and strongly sloping and moderately steep soils on hillsides

These soils make up about 30 percent of the county. The maximum difference in local relief is about 200 feet. These moderately well drained and well drained, moderately deep and deep, gently sloping to moderately steep soils are on ridgetops and hillsides on uplands. They are the best upland soils in the county for farming. They are used mainly for cultivated crops, hay, and pasture. The erosion hazard, moderately steep slopes, bedrock at a depth of 20 to 40 inches, and moderately slow or slow permeability are the main limitations.

1. Westmoreland-Morristown-Lowell association

Deep, gently sloping to moderately steep, well drained and moderately well drained soils formed in residuum of sandstone, siltstone, limestone, and shale bedrock and in material mixed by surface mining; on uplands

This association consists of gently sloping and strongly sloping soils on wide dissected ridges and moderately steep soils on hillsides. Maximum difference in local relief is about 200 feet.

This association makes up about 9 percent of the county. It is about 30 percent Westmoreland soils, 20 percent Morristown soils, 20 percent Lowell soils, and 30 percent soils of minor extent.

The deep, well drained Westmoreland soils are on ridgetops, knolls, and hillsides. They have a silt loam surface layer and are moderately permeable. The deep, well drained Morristown soils are in areas that have been surface mined for coal. They have a stony clay loam and clay loam surface layer and are moderately slowly permeable. The deep, moderately well drained Lowell soils are on ridgetops, benches, and hillsides. They have a silt loam surface layer and are moderately slowly permeable.

Of minor extent in this association are Bethesda, Culleoka, and Wellston soils. Bethesda soils are on ridgetops and hillsides that have been surface mined for coal. Culleoka and Wellston soils are mainly on ridgetops. Also of minor extent are the steep and very steep Westmoreland, Morristown, and Lowell soils on hillsides.

The soils of this association are used mainly for cultivated crops, hay, and pasture. The Morristown soils, which are in areas that have been surface mined for coal, are used mostly for pasture and openland wildlife habitat. A small acreage of included steep and very steep soils is used for woodland. The potential for commonly grown cultivated crops, hay, and pasture is high on Lowell and Westmoreland soils and low to medium on Morristown soils. The potential for building sites and sanitary facilities is medium on the gently sloping and strongly sloping Westmoreland soils and medium to low on the Morristown and Lowell soils.

Erosion is the main hazard if these soils are used for cultivated crops. Sedimentation in drainageways and streams is a problem in watersheds containing a large acreage of Morristown soils. Grasses and legumes are commonly used to provide ground cover during the establishment of trees on these soils. The droughtiness, stoniness, and limited root zone of Morristown soils limit their use mainly to hay, pasture, and habitat for openland wildlife. Stripcropping, grassed waterways, and grasses and legumes in the cropping system are commonly used to reduce erosion. Westmoreland soils are better suited as sites for buildings and sanitary facilities than Lowell and Morristown soils. Moderately slow permeability in Morristown and Lowell soils and seasonal wetness and moderate shrink-swell potential in Lowell soils are limitations for sanitary facilities and buildings. Hillside slippage is a limitation on included steeper areas of Morristown and Lowell soils.

2. Westmoreland-Lowell-Fairpoint association

Deep, gently sloping to moderately steep, well drained and moderately well drained soils formed in residuum of sandstone, siltstone, shale, and limestone bedrock and in material mixed by surface mining; on uplands

This association consists of gently sloping and strongly sloping soils on wide dissected ridgetops and moderately steep soils on hillsides. Maximum difference in local relief is 100 to 200 feet.

This association makes up about 11 percent of the county. It is about 35 percent Westmoreland soils, 20 percent Lowell soils, 10 percent Fairpoint soils, and 35 percent soils of minor extent.

The deep, well drained Westmoreland soils are on ridgetops, knolls, and hillsides. They have a silt loam surface layer and are moderately slowly permeable. The deep, well drained Lowell soils are on ridgetops, benches, and hillsides. They have a silt loam surface layer and are moderately slowly permeable. The deep, well drained Fairpoint soils are in areas that have been surface mined for coal. They have a silty clay loam and gravelly clay loam surface layer and are moderately slowly permeable.

Of minor extent in this association are Dekalb, Morristown, Wellston, and Westmore soils. Dekalb, Wellston, and Westmore soils are mostly on ridgetops and the upper part of hillsides. Morristown soils are in areas that have been surface mined for coal. Also of minor extent are steep and very steep Westmoreland, Lowell, and Fairpoint soils on hillsides.

This association is used for cultivated crops, hay, and pasture. Surface mining is extensive and affects many land use decisions. Most of the acreage has been cleared of trees, but a small acreage of included steep and very steep soils is wooded. Potential for cultivated crops, hay, and pasture is high on Westmoreland and Lowell soils and is low to medium on Fairpoint soils because of droughtiness and the limited root zone. Potential for building sites and sanitary facilities is high to medium on the gently sloping and strongly sloping areas of Westmoreland soils and is medium to low on Lowell and Fairpoint soils.

Erosion is the main hazard if these soils are used for cultivated crops. In some areas sedimentation is a major problem in drainageways on foot slopes and in streams below areas of Fairpoint soils. Droughtiness is a hazard on Fairpoint soils. The soils of this association are suited to coutour stripcropping. The cropping system should include grasses and legumes. Natural channels where water concentrates are commonly grassed.

The Westmoreland soils are better suited as sites for buildings than the other soils of the association. Moderately slow permeability in the Lowell and Fairpoint soils limits use for septic tank absorption fields.

3. Westmoreland-Dekalb-Lowell association

Deep and moderately deep, gently sloping to moderately steep, well drained and moderately well drained soils formed in residuum of siltstone, sandstone, shale, and limestone bedrock; on uplands

This association is in dissected areas. It consists of gently sloping and strongly sloping soils on wide ridgetops and moderately steep soils on hillsides (fig. 2). Maximum difference in local relief is about 200 feet.

This association makes up about 7 percent of the county. It is about 35 percent Westmoreland soils, 20 percent Dekalb soils, 20 percent Lowell soils, and 25 percent soils of minor extent.

The three major soils are on ridges and hillsides. The deep, well drained Westmoreland soils have a silt loam surface layer and are moderately permeable. The moderately deep, well drained Dekalb soils have a loam surface layer and are rapidly or very rapidly permeable. The deep, moderately well drained Lowell soils have a silt loam surface layer and are moderately slowly permeable.

Of minor extent in this association are Culleoka, Elba, and Wellston soils on ridgetops, Hartshorn soils on narrow flood plains, and Richland soils on foot slopes. Also of minor extent are steep and very steep Westmoreland, Dekalb, and Lowell soils on hillsides.

The soils of this association are mainly used for cultivated crops, hay, and pasture. The potential is medium to high for these uses. On a small acreage of included steep and very steep soils, which are wooded, the potential is medium to high for woodland and woodland wildlife habitat. In the gently sloping and strongly sloping Westmoreland soils the potential is high to medium for building site development and sanitary facilities. In Dekalb and Lowell soils it is low to medium for these uses.

The Westmoreland and Lowell soils are better suited to most uses than the Dekalb soils. The erosion hazard on all soils and the droughtiness and depth to bedrock in the Dekalb soils are limitations. The cropping system should include meadow crops. Contour stripcropping and grassed waterways are commonly used to reduce erosion. The hard sandstone at a depth of 20 to 40 inches is a severe limitation to the use of the Dekalb soils for houses with basements and for septic tank absorption fields. Even though the moderate shrink-swell potential and some seasonal wetness are limitations, the Lowell soils are suited as sites for buildings, especially buildings without basements. Cover should be maintained on the site as much as possible during construction to reduce erosion.

4. Westmoreland-Culleoka-Zanesville association

Deep and moderately deep, gently sloping to moderately steep, well drained and moderately well drained soils formed in loess and residuum of sandstone, siltstone, and shale bedrock; on uplands

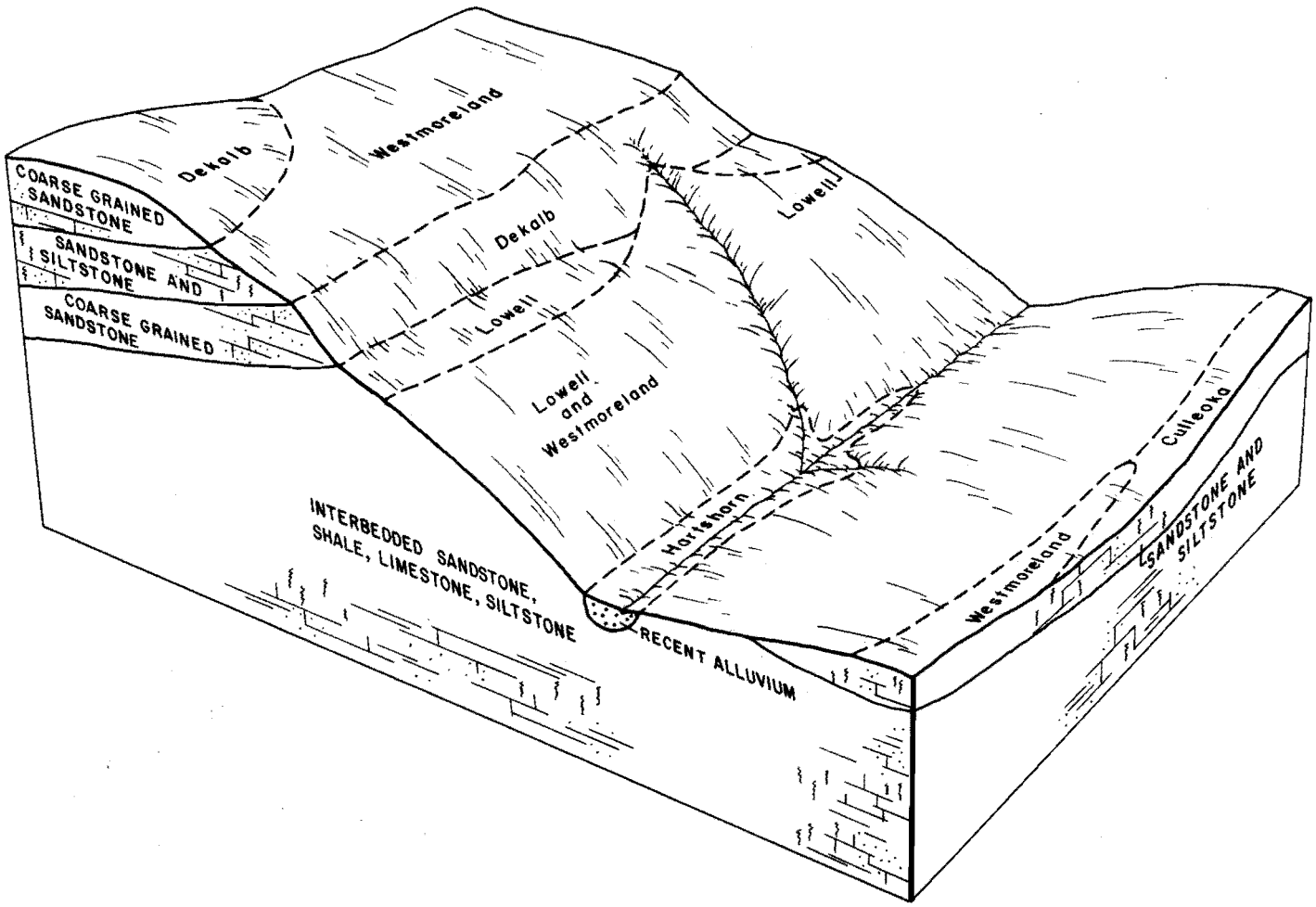

Figure 2.—Typical pattern of soils in the Westmoreland-Dekalb-Lowell association.

This association consists of gently sloping and strongly sloping soils on wide dissected ridgetops and moderately steep soils on hillsides. Maximum difference in local relief is about 200 feet.

This association makes up about 3 percent of the county. It is about 40 percent Westmoreland soils, 15 percent Culleoka soils, 10 percent Zanesville soils, and 35 percent soils of minor extent.

The deep, well drained Westmoreland soils are on hillsides and ridgetops. Permeability is moderate. The moderately deep, gently sloping and strongly sloping, well drained Culleoka soils are on ridgetops. Permeability is moderate. The deep, gently sloping and strongly sloping, moderately well drained Zanesville soils, which have a fragipan, are on wide ridgetops. Permeability is moderate above the compact pan and moderately slow or slow in the pan. All of these soils have a silt loam surface layer.

Of minor extent in this association are Wellston soils on ridgetops, Dekalb soils on ridgetops and hillsides, Lowell soils on hillsides, and Hartshorn soils on narrow flood plains along small streams. Also of minor extent are steep and very steep Westmoreland soils on hillsides.

The soils of this association are mainly used for cultivated crops, hay, and pasture. A smaller acreage of steep and very steep soils on hillsides is used for woodland and pasture. The potential for cultivated crops, hay, and pasture is high in Westmoreland and Zanesville soils and medium in Culleoka soils.

The potential for most building site development and sanitary facilities is medium in gently sloping and strongly sloping Westmoreland soils, low in the moderately steep Westmoreland soils, and low to medium in Culleoka and Zanesville soils.

Westmoreland and Zanesville soils are better suited to farming than Culleoka soils. The erosion hazard on all these soils and the droughtiness, depth to bedrock in the Culleoka soils, and fragipan in the Zanesville soils are limitations. The soils have a medium to high lime

requirement. The cropping system should include meadow crops. Contour stripcropping and grassed waterways are commonly used to reduce erosion. Westmoreland soils are better suited as sites for buildings than Culleoka and Zanesville soils. Culleoka and Zanesville soils are suited to buildings without basements. Footing drains and exterior wall coatings are commonly used for buildings with basements in the Zanesville soils because of seasonal wetness and lateral movement of water above the fragipan. Cover should be maintained on the site as much as possible during construction to reduce erosion.

strongly sloping soils on rounded ridgetops and moderately steep and steep soils on hillsides

These soils make up about 42 percent of the county. They are on dissected uplands. Maximum difference in local relief is about 400 feet. These deep, moderately well drained and well drained, strongly sloping to steep soils are on ridgetops, knolls, and hillsides on uplands. They are used for cultivated crops, hay, pasture, woodland, and wildlife habitat. Erosion, moderately steep and steep slopes, susceptibility to hillside slippage, high shrink-swell potential, and moderately slow and slow permeability are the major limitations.

5. Westmoreland-Lowell-Morristown association

Deep, strongly sloping to steep, well drained and moderately well drained soils formed in residuum of sandstone, siltstone, shale, and limestone bedrock and in material mixed by surface mining; on uplands

This association consists of strongly sloping soils on narrow ridgetops and moderately steep and steep soils on hillsides. Valleys are wide with sluggish streams. The maximum difference in local relief is about 300 feet.

This association makes up about 21 percent of the county. It is about 25 percent Westmoreland soils, 20 percent Lowell soils, 15 percent Morristown soils, and 40 percent soils of minor extent.

The deep, well drained Westmoreland soils are on hillsides, knolls, and ridgetops. They have a silt loam surface layer and are moderately permeable. The deep, well drained and moderately well drained Lowell soils are on ridgetops, benches, and hillsides. They have a silt loam surface layer and are moderately slowly permeable. The deep, well drained Morristown soils are in areas that have been surface mined for coal. They have clay loam and stony clay loam surface layers and are moderately slowly permeable.

Of minor extent in this association are Dekalb soils on ridgetops and hillsides, Bethesda, Fairpoint, and Barkcamp soils in surface-mined areas, and Richland soils on foot slopes. Also of minor extent are areas of very steep Westmoreland, Lowell, and Morristown soils on hillsides.

The soils of this association are used for cultivated crops, hay, pasture, woodland, and openland and woodland wildlife habitat. Areas have been extensively surface mined for coal. Morristown soils in these strip-mined areas are used mainly for pasture and wildlife habitat. In the strongly sloping and moderately steep Westmoreland and Lowell soils, the potential is high for hay and pasture and high to medium for cultivated crops. In the steep soils, the potential is low for cultivated crops. The potential for building site development is medium in the strongly sloping Lowell and Westmoreland soils and low in the other soils.

The erosion hazard and moderately steep and steep slopes of all the soils and the surface stones and droughtiness of the Morristown soils are the main limitations. The strongly sloping and moderately steep Lowell and Westmoreland soils are suited to cropping systems that include meadow crops. Reseeding by the trash mulch or no-till method or with cover crops or companion crops reduces erosion. Contour stripcropping and grassed waterways are commonly used to reduce erosion. The strongly sloping Westmoreland and Lowell soils are better suited as sites for buildings than the other soils. The steeper areas of the Morristown soils are subject to hillside slippage.

6. Lowell-Westmoreland-Elba association

Deep, strongly sloping to steep, well drained and moderately well drained soils formed in residuum of limestone, shale, siltstone, and sandstone bedrock; on uplands

This association consists of strongly sloping soils on narrow ridgetops and knolls and moderately steep and steep soils on hillsides. The maximum difference in local relief is about 400 feet.

This association makes up about 3 percent of the county. It is about 45 percent Lowell soils, 25 percent Westmoreland soils, 10 percent Elba soils, and 20 percent soils of minor extent.

These soils are on ridgetops, knolls, and hillsides. The deep, well drained and moderately well drained, moderately slowly permeable Lowell soils have a silt loam surface layer. The deep, well drained, moderately permeable Westmoreland soils have a silt loam surface layer. The deep, well drained, slowly permeable Elba soils have a silty clay loam surface layer.

Of minor extent in this association are the Dekalb soils on ridgetops and hillsides and the Morristown and Fairpoint soils in surface-mined areas. Also of minor extent are areas of very steep Lowell and Westmoreland soils on hillsides.

The soils of this association are used for cultivated crops, hay, pasture, woodland, and openland and woodland wildlife habitat. In the strongly sloping and moderately steep soils, the potential is high for hay and pasture and high to medium for cultivated crops. The potential for cultivated crops is low in the steep soils. The potential is higher for building site development and sanitary facilities in the strongly sloping soils than in the steeper soils.

The erosion hazard, moderately steep and steep slopes, moderately slow and slow permeability, susceptibility to hillside slippage of all these soils, and the high shrink-swell potential of the Elba soils are limitations. The strongly sloping and moderately steep soils are suited to cropping systems that include meadow crops. Contour stripcropping and grassed waterways are commonly used to reduce erosion. The Elba soils are poorly suited as a site for sanitary facilities. If they are used as sites for buildings, foundations and footings should be designed to prevent structural damage caused by shrinking and swelling of the soil. Cover should be maintained on the site as much as possible during construction to reduce erosion.

7. Westmoreland-Lowell association

Deep, strongly sloping to steep, well drained and moderately well drained soils formed in residuum of siltstone, sandstone, shale, and limestone bedrock; on uplands

This association consists of strongly sloping soils on narrow ridgetops and moderately steep and steep soils on hillsides (fig. 3). The hillsides are commonly benched or have irregular slopes. The stream valleys are narrow. The maximum difference in local relief is about 400 feet.

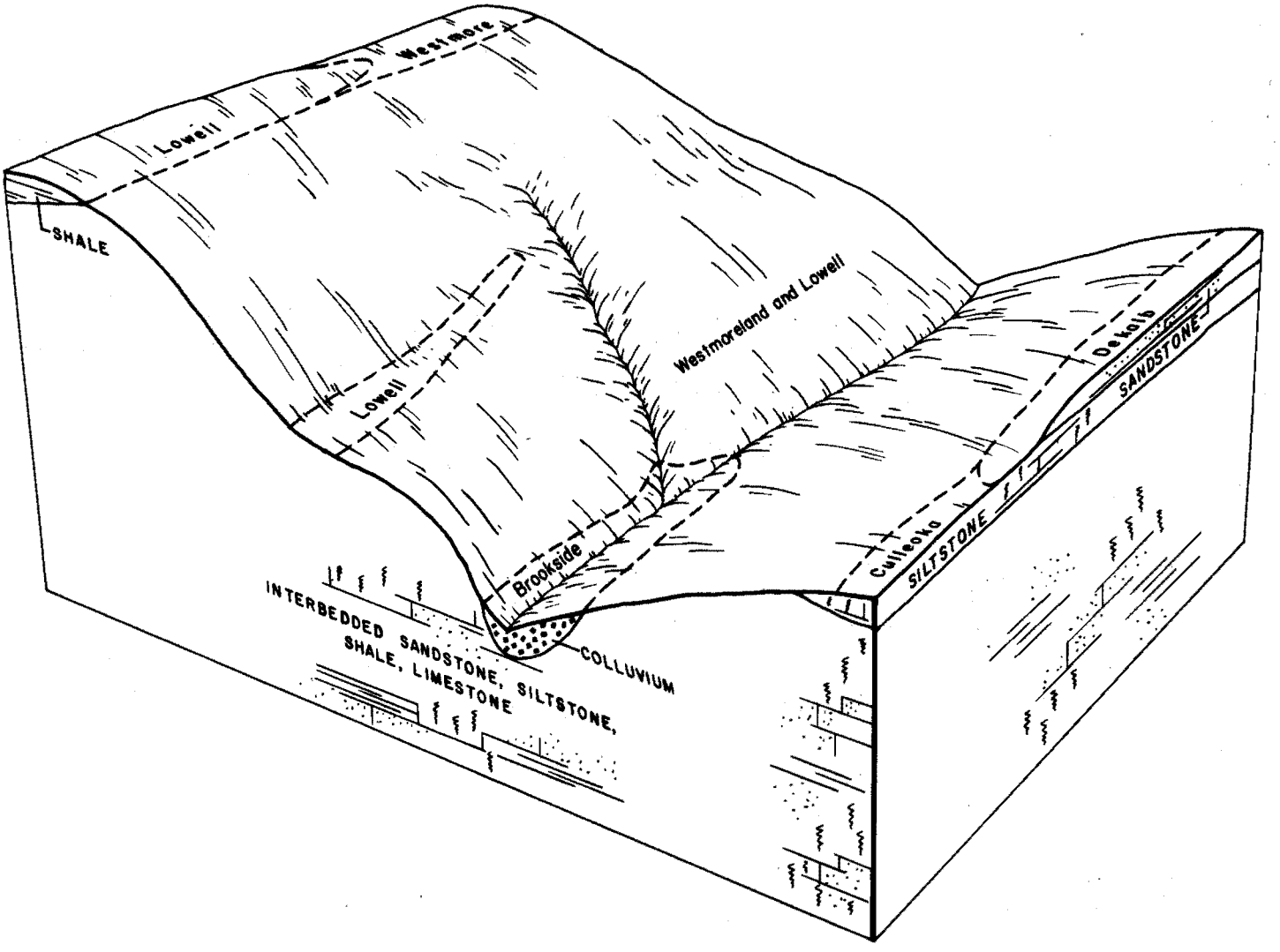

Figure 3.—Typical pattern of soils in the Westmoreland-Lowell association.

This association makes up about 18 percent of the county. It is about 35 percent Westmoreland soils, 30 percent Lowell soils, and 35 percent soils of minor extent.

Westmoreland and Lowell soils are on ridgetops and hillsides. Westmoreland soils are deep, well drained, and moderately permeable. Lowell soils are deep, moderately well drained and well drained, and moderately slowly permeable. Both soils have a silt loam surface layer.

Of minor extent in this association are Brookside soils on colluvial foot slopes, Culleoka and Westmore soils on ridgetops, and Dekalb soils on hillsides. Also of minor extent are areas of very steep Westmoreland and Lowell soils on hillsides.

The soils of this association are used for cultivated crops, hay, pasture, and woodland and for openland and woodland wildlife habitat. In the strongly sloping and moderately steep soils, the potential is high for hay and pasture and high to medium for cultivated crops. In the steep soils, the potential is low for cultivated crops. The potential for building site development and sanitary facilities is higher in the strongly sloping soils than in the steeper soils.

The erosion hazard, moderately steep and steep slopes, and susceptibility to hillside slippage are the main limitations. The strongly sloping and moderately steep soils are suited to cropping systems that include meadow crops. Contour stripcropping and grassed waterways are commonly used to reduce erosion. Reseeding by the trash mulch or no-till method or with cover crops or companion crops reduces the erosion hazard. The soils have a moderate to high lime requirement. Cover should be maintained on the site as much as possible during construction. Trails in recreation areas should be protected against erosion and laid out on the contour if possible.

steep and very steep soils on hillsides

These soils make up about 26 percent of the county. They are steep and very steep soils in deeply dissected areas along or near the larger streams. Maximum difference in local relief is about 700 feet. Ridgetops are narrow and rounded. The soils are used for woodland, wildlife habitat, hay, pasture, and cropland. The steep and very steep slopes limit use.

8. Lowell-Westmoreland association

Deep, steep and very steep, well drained soils formed in residuum of shale, limestone, sandstone, and siltstone bedrock; on uplands

This association is in deeply dissected areas along or near the larger streams. Most soils are steep and very steep and occupy long hillsides. Ridgetops are narrow or rounded with knolls and saddles. Valleys are very narrow and V-shaped near the headwaters of small streams. The upper part of hillsides is steep, and the middle and lower parts are very steep and rough and are broken by narrow discontinuous benches. Flood plains are narrow and are bounded by uneven foot slopes. The maximum difference in local relief is about 700 feet.

This association makes up about 26 percent of the county. It is about 45 percent Lowell soils, 25 percent Westmoreland soils, and 30 percent soils of minor extent.

Both soils are on hillsides and have a silt loam surface layer. Lowell soils are deep, well drained, and moderately slowly permeable. Westmoreland soils are deep, well drained, and moderately permeable.

Of minor extent in this association are Brookside soils on foot slopes, Elba soils on ridgetops, and Morristown soils on hillsides in areas that have been surface mined for coal. Also of minor extent are areas of moderately steep soils on ridgetops.

The soils of this association are used mainly for woodland and woodland wildlife habitat. In some areas on hillsides and ridgetops and in valleys they are used for cultivated crops, hay, and pasture. The potential is high and medium for woodland, medium and low for hay and pasture, and low for cultivated crops, small grain, sanitary facilities, and building site development.

The steep and very steep slopes limit the use of equipment. Erosion is a very severe hazard if the plant cover is removed. Coves and north- and east-facing slopes are the best woodland sites. Locating logging roads and skid trails on the contour reduces the hazard of erosion. Reseeding by the trash mulch or no-till methods or with a companion crop reduces the hazard of erosion. Lowell soils and the included Brookside soils are subject to hillside slippage.

nearly level soils on flood plains, gently sloping to moderately steep soils on terraces, and gently sloping to steep soils on foot slopes

These soils make up about 2 percent of the county. They are well drained and moderately well drained, nearly level to steep soils on flood plains, terraces, and foot slopes. Maximum difference in local relief is about 100 feet. The soils are used for urban development, cultivated crops, hay, pasture, woodland, and wildlife habitat. The hazards of flooding and erosion, the moderately slow permeability, high shrink-swell potential, and susceptibility to hillside slippage are the major limitations.

9. Elkinsville-Nolin Variant-Brookside association

Deep, nearly level to steep, well drained and moderately well drained soils formed in alluvium and colluvium; on terraces, flood plains, foot slopes, and alluvial fans

This association is in valleys. It consists characteristically of flats with short slope breaks and

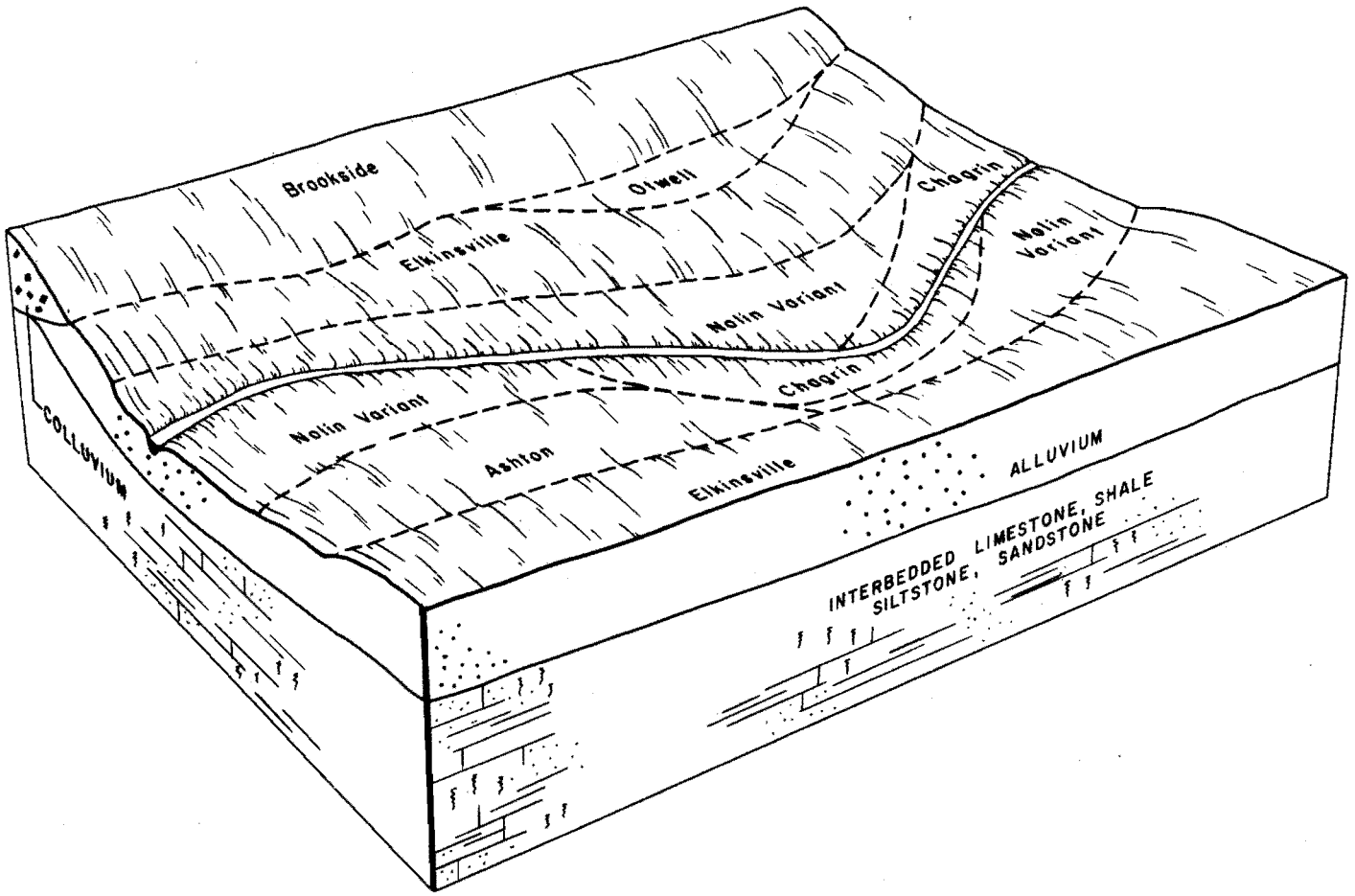

Figure 4.—Typical pattern of soils in the Elkinsville-Nolin Variant-Brookside association.

includes gently sloping to steep soils on foot slopes (fig. 4). Maximum difference in local relief is about 100 feet.

This association makes up about 2 percent of the county. It is about 20 percent Elkinsville soils, 15 percent Nolin Variant soils, 15 percent Brookside soils, and 50 percent soils of minor extent.

The deep, gently sloping to moderately steep, well drained, moderately permeable Elkinsville soils are on terraces. They have a silt loam surface layer. The deep, nearly level, well drained, moderately permeable Nolin Variant soils are on flood plains. They are subject to occasional flooding. They have a silt loam surface layer. The deep, gently sloping to steep, moderately well drained, moderately slowly permeable Brookside soils are on foot slopes. They have a silty clay loam surface layer.

Of minor extent in this association are Chagrin soils on flood plains and Ashton, Chili, and Otwell soils on terraces.

The soils of this association are used for building sites, parking lots, roads, cultivated crops, hay, and pasture. The steep soils are used for pasture and woodland for which they have medium and high potential. The potential for cultivated crops and pasture is higher in the Elkinsville and Nolin Variant soils than in the Brookside soils.

The flooding hazard on the Nolin Variant soils, the erosion hazard on the Elkinsville and Brookside soils, and the moderately slow permeability, susceptibility to hillside slippage, and high shrink-swell potential of the Brookside soils are the major limitations. The Nolin Variant soils and the gently sloping and strongly sloping Elkinsville soils are well suited to cultivated crops, hay, and pasture. The Elkinsville soils are better suited to building site development and sanitary facilities than the Nolin Variant and Brookside soils. Cover should be maintained on the site as much as possible during construction to reduce erosion. Local roads can be improved by providing a suitable base material.

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, salinity, 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, Richland silt loam, 3 to 8 percent slopes, is one of several phases in the Richland 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. Lowell-Westmoreland silt loams, 3 to 8 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. Dumps 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

AeC—Allegheny Variant loam, 8 to 15 percent slopes. This strongly sloping, deep, moderately well drained soil is mainly on high positions in coves and on benches near the head of drainageways. Most areas are dissected by one or more small drainageways and have steeper slopes adjacent to the watercourses. Other areas are on ridgetops near the Ohio River. Slopes are dominantly smooth and even or convex. Most areas range from 5 to 10 acres.

Typically, the surface layer is very dark grayish brown and brown, very friable loam about 9 inches thick. The subsoil is about 49 inches thick. The upper part is yellowish brown, friable loam, and the middle and lower parts are yellowish brown, mottled, firm silt loam and loam. The substratum to about 70 inches is strong brown, friable loam with thin strata of clay loam and sandy loam.

Included with this soil in mapping are small areas of severely eroded soils, commonly near slope breaks and drainageways. In these eroded spots, the yellowish brown surface layer has fair tilth and a low organic matter content. About 10 percent of most areas is included soils.

Permeability is moderate in this Allegheny Variant soil, and the available water capacity is high. Depth to the seasonal high water table is 24 to 42 inches. Runoff is rapid in cultivated areas. The shrink-swell potential is low, and the potential frost action is high. Unless the soil has been limed, reaction in the root zone is strongly acid to extremely acid.

Most areas are used for hay, pasture, trees, and some cultivated crops. The potential is high for cultivated crops, hay, pasture, trees, and openland and woodland

wildlife habitat. It is medium to low for sanitary facilities and building site development.

This soil is well suited to corn and small grain and to grasses and legumes for hay and pasture. Stands of deep-rooted legumes, such as alfalfa, however, are difficult to maintain in most areas. Smooth, even slopes are better suited to cultivated crops than dissected, uneven slopes. If the soil is cultivated or the protective cover removed, the erosion hazard is severe. Controlling erosion and maintaining tilth and organic matter content are the main concerns of management. A cropping system that includes hay and pasture is effective in controlling the hazard of erosion. Conservation tillage, which leaves crop residue on the surface, contour stripcropping, cover crops, and grassed waterways are also effective. Tilling within the optimum range of moisture content helps to prevent soil compaction. Diversions are needed in some areas.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is well suited to trees and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible on this soil.

This soil is better suited as a site for buildings without basements than as a site for buildings with basements. Footing drains and exterior wall coatings are commonly used to help keep basements dry. Using a suitable base material under roads reduces the risk of damage caused by the high potential frost action and low strength. Wetness and slope are limitations for sanitary facilities. Leach lines in septic tank absorption fields should be constructed across the slope to reduce seepage to the soil surface. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IIIe. The woodland suitability subclass is 2o.

As—Ashton silt loam, occasionally flooded. This nearly level, deep, well drained soil is on low stream terraces and on alluvial fans. In most areas surfaces are even. Most areas range from 5 to 20 acres. The slope range is 0 to 3 percent.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The subsoil is dark yellowish brown and brown, friable and firm silt loam about 34 inches thick. The substratum to about 89 inches is yellowish brown, friable loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils in slight depressions or in narrow bands that receive runoff or underground seepage from adjacent soils on slope breaks to the uplands. Also included are small areas where slopes are 3 to 6 percent. Included soils make up 5 to 15 percent of most areas.

Permeability is moderate in this Ashton soil, and the available water capacity is high. Runoff is slow. The shrink-swell potential is low. Potential frost action is high. Reaction in the root zone is medium acid to neutral.

Most areas are cropland and building sites. The potential is high for cultivated crops, small grain, hay, pasture, and trees and low for sanitary facilities and building site development.

This soil is among the best soils in the county for farming and can be cropped intensively. It is well suited to corn, small grain, and many specialty crops. There is, however, a hazard of flooding and of frost damage because of poor air drainage. Water ponds in the areas of included somewhat poorly drained soils for short periods. Artificial drains are needed. The soil is well suited to irrigation. Maintaining tilth and the organic matter content are the major concerns of management. Conservation tillage, which leaves crop residue on the surface, reduces the erosion hazard. Tilling within the optimum range of moisture content helps to prevent soil compaction.

This soil is suited to pasture. Stands of legumes are easy to maintain. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is well suited to trees, but only a small acreage is used as woodland. Seedlings grow well if competing vegetation is controlled or removed.

The use of this soil as a site for buildings and sanitary facilities is severely limited by the hazard of flooding. The potential of the soil for such recreation uses as picnic areas, hiking trails, and golf fairways is good.

The capability subclass is IIw. The woodland suitability subclass is 1o.

BaB—Barkcamp gravelly sandy loam, 0 to 8 percent slopes. This nearly level to gently sloping, deep, well drained soil is on mine spoil ridges or benches in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments, mostly subrounded, are sandstone, carbonaceous shale, and coal. There are a few large stones and boulders at the surface and throughout the soil. Most areas are 3 to 10 acres.

Typically, the surface layer is pale brown, friable gravelly sandy loam about 5 inches thick. The substratum to a depth of about 60 inches is light yellowish brown, brown, and light brownish gray, friable and very friable very gravelly sandy loam.

Included with this soil in mapping are small areas of similar but finer textured soils, a few very bouldery areas,

and small areas of the less acid, fine textured Bethesda soils. Included soils make up 10 to 20 percent of most areas.

Permeability is moderately rapid or rapid, and runoff is slow or medium. The available water capacity is very low. Potential frost action is moderate. The shrink-swell potential is low. The risk of corrosion to uncoated steel and concrete is high. The root zone is extremely acid; pH is less than 3.6. Roots are restricted to the upper few inches of the soil.

In most areas the vegetation is sparse, consisting mainly of very poor or dead stands of black locust seedlings. The potential is low for crops, hay, pasture, and trees. It is medium for building site development and low to medium for most sanitary facilities.

This soil is too toxic to support most vegetation. In order to create a zone favorable for root development, it would be necessary to neutralize the extremely acid reaction, add plant nutrients, and blanket the soil with suitable soil material. Acid tolerant plants could grow if large amounts of sewage sludge, manure, fly ash, and natural soil materials present before mining were incorporated into the soil. In some places the movement of soluble salts into the reclaimed surface layer, however, could be toxic to the plants. Reclaimed areas would be suited to pasture and limited grazing and to trees and habitat for openland wildlife. A plant cover should be established as soon as possible after reclamation because of the erosion hazard.

This soil is very poorly suited to use as a reservoir site because of seepage. Once it has settled, it is suitable as a site for buildings. Onsite investigation is needed to determine suitability. The thickness of the soil over bedrock and the control of storm water runoff should be considered during the site investigation. Stones and sloughing of banks hinder excavation. Concrete and uncoated steel in foundations, floors, and buried utility lines are subject to severe corrosion. Sites for lawns should be blanketed with suitable soil material to provide a more favorable root zone, to increase the available water capacity, and to cover small stones that would interfere with mowing. The possible contamination of ground water seriously limits the use of this soil for such facilities as sewage lagoons and sanitary landfills.

The capability subclass is VIIIs. No woodland suitability subclass is assigned.

BaD—Barkcamp gravelly sandy loam, 8 to 40 percent slopes. This deep, strongly sloping to steep, well drained soil is on narrow, rounded mine spoil ridges and side slopes in areas surface mined for coal (fig. 5). It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments, mostly subrounded, are carbonaceous shale, coal, and medium and coarse grained sandstone. There are a few large stones and boulders at the soil surface and throughout the soil. Slopes are dominantly 8 to 20 percent. In most areas they are smooth. Some are cut by a few shallow gullies. Most areas are 5 to 20 acres.

Typically, the surface layer is pale brown, friable gravelly sandy loam about 5 inches thick. The substratum to about 60 inches is light yellowish brown, light brownish gray, pale brown, and red, friable and very friable very gravelly sandy loam.

Included with this soil in mapping are small areas of the less acid, finer textured Bethesda soils, small areas of extremely acid soils that have more clay in the surface layer, and a few very bouldery areas. Included soils make up about 10 to 20 percent of most areas.

Permeability is moderately rapid or rapid in this Barkcamp soil, and runoff is rapid. The available water capacity is very low. Potential frost action is moderate. The shrink-swell potential is low. The risk of corrosion to uncoated steel and concrete is high. The root zone is extremely acid; pH is less than 3.6. Roots are restricted to the upper few inches of the soil.

In most areas, vegetation is sparse, consisting mainly of black locust seedlings. The potential is low for crops, hay, pasture, and trees. It is low to medium for sanitary facilities and building site development.

This soil is too toxic to support most vegetation. In order to create a zone favorable for root development, it would be necessary to neutralize the extremely acid reaction, add plant nutrients, and blanket the soil with suitable soil material. Acid tolerant plants could grow if large amounts of sewage sludge, manure, fly ash, and natural soil materials present before mining were incorporated into the soil. The movement of soluble salts into the reclaimed surface layer, however, could be toxic to the plants. Reclaimed areas would be suited to trees and openland wildlife habitat. Reclaimed areas where slopes are 8 to 25 percent would be suited to pasture and limited grazing. A plant cover should be established as soon as possible after reclamation to reduce the hazards of erosion and contamination of water.

This soil is very poorly suited as a pond reservoir site because of seepage through the substratum. Areas where slopes are 15 to 40 percent are severely limited as sites for buildings. Areas where slopes are 8 to 15 percent are suitable after the soil has settled. Onsite investigation is needed to determine suitability. The thickness of the soil over bedrock and control of storm water runoff should be considered during the site investigation. Stones and sloughing of banks hinder excavation. Concrete and uncoated steel in foundations, floors, and buried utility lines are subject to severe corrosion. The possible contamination of ground water and, in some areas, slope severely limit use for such facilities as sanitary landfills and sewage lagoons. Sites for lawns should be blanketed with suitable soil material to provide a more favorable root zone, to increase the available water capacity, and to cover small stones that would interfere with mowing.

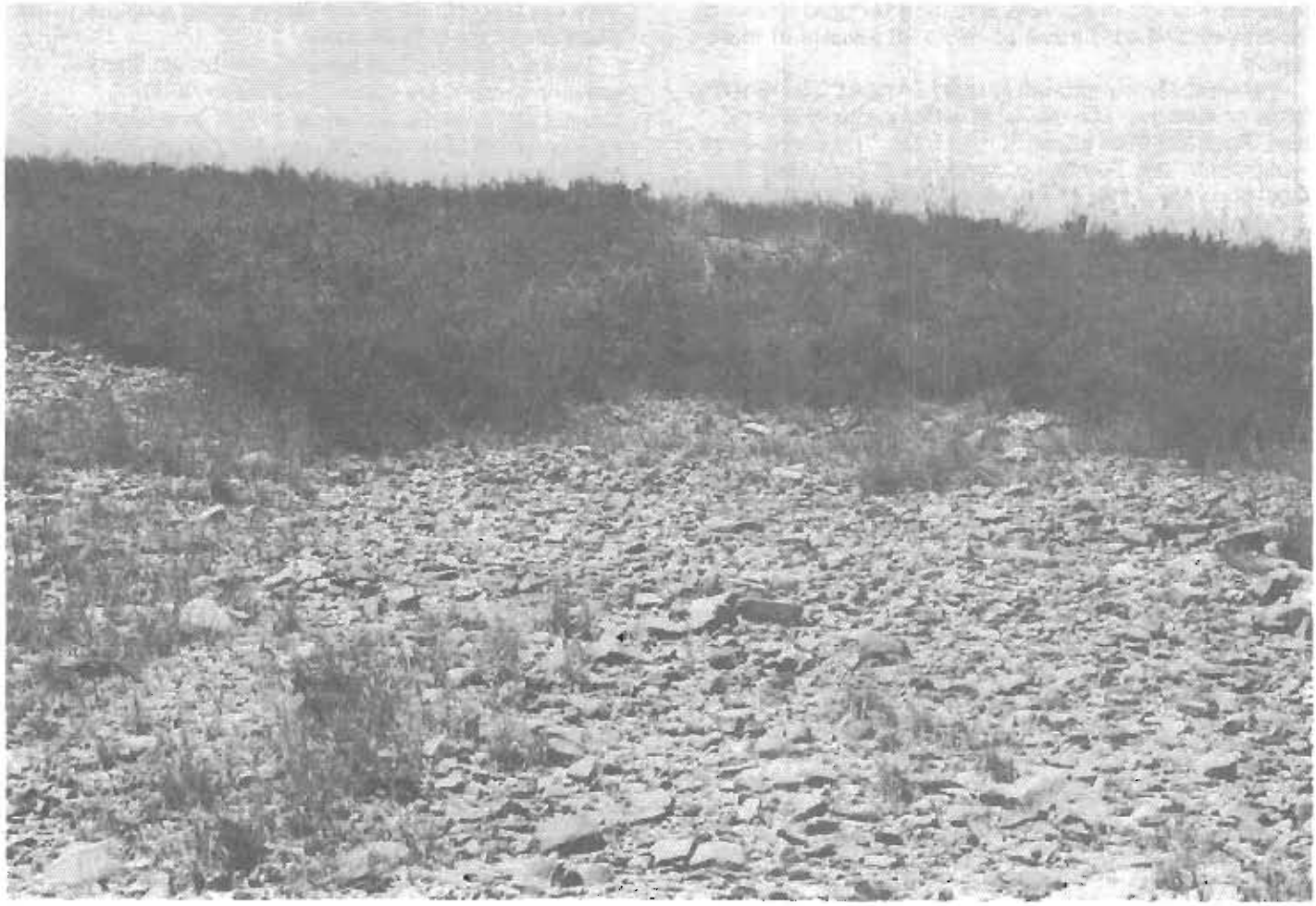

Figure 5.—Unreclaimed Barkcamp gravelly sandy loam, 8 to 40 percent slopes, is in the foreground, and vegetated Morristown stony clay loam, 25 to 40 percent slopes, is in the background. Vegetation is difficult to establish on unreclaimed Barkcamp soils because of the high content of rock fragments in the root zone and other limitations.

The capability subclass is VIIIs. No woodland suitability subclass is assigned.

BaF—Barkcamp very stony 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 surface mined for coal. Some areas are narrow spoil ridges adjacent and parallel to a highwall. Most areas have not been graded. The soil is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The coarse fragments, which are flat and round, are mainly carbonaceous (roof) shale, coal, and medium and coarse grained sandstone. Stones larger than 1 foot in diameter are 5 to 10 feet apart, and boulders are numerous in some places. Hillside slips occur, especially where this soil overlies steep, wet, or clayey soils. Most areas range from 10 to 100 acres.

Typically, the surface layer is pale brown, friable very stony sandy loam about 5 inches thick. The substratum to about 60 inches is light yellowish brown, light brownish gray, and pale brown, friable and very friable very gravelly sandy loam.

Included with this soil in mapping are small areas of the less acid, finer textured Bethesda soils. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid or rapid in this Barkcamp soil, and runoff is rapid. Potential frost action is moderate. The shrink-swell potential is low. The risk of corrosion to uncoated steel and concrete is high. The root zone is extremely acid; pH is less than 3.6.

In most areas vegetation is sparse, consisting mainly of very poor or dead stands of black locust seedlings. The potential is low for crops, hay, pasture, and trees. It is also low for sanitary facilities and building site development.

This soil is too toxic to support most vegetation. In order to create a zone favorable for root development, 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. Some of the lower parts of slopes have been covered with material from adjacent soils. Stones interfere with the use of equipment. Erosion and sedimentation in drainageways are severe problems. A plant cover is needed to reduce the hazards of erosion and water contamination.

The slope, stoniness, and susceptibility to hillside slippage severely limit use as sites for buildings and sanitary facilities. Sloughing is a hazard in excavations.

The capability subclass is VIIIs. No woodland suitability subclass is assigned.

BcB—Barkcamp clay loam, 0 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is mainly on mine spoil ridges and, to a lesser extent, on mine spoil benches in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material taken from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments, which are flat and round, are mostly carbonaceous (roof) shale, coal, and medium and coarse grained sandstone. Slopes are dominantly smooth. Most areas range from 3 to 30 acres.

Typically, the surface layer is mixed brown and yellowish brown, firm clay loam about 10 inches thick. The substratum to about 60 inches is light olive brown, friable very gravelly sandy loam and small masses of very gravelly sandy clay loam. In some areas the surface layer is channery clay loam.

Included with this soil in mapping are a few eroded areas where rills and small gullies have formed. The extremely acid substratum exposed in the gullies has sparse vegetation. Included soils make up 5 to 15 percent of most areas.

Permeability is moderately rapid or rapid in this Barkcamp soil. Runoff is slow or medium. The available water capacity is low. Potential frost action is moderate. The shrink-swell potential is low. The risk of corrosion to uncoated steel and concrete is high. The surface layer is slightly acid to strongly acid and the substratum is extremely acid. Roots are mainly restricted to the surface layer.

Most areas are in grass. The potential is low for cultivated crops, hay, and trees and low to medium for pasture. It is low to medium for sanitary facilities and medium for building site development.

Most areas are not suited to cultivated crops and hay and are poorly suited to trees because the root zone is very shallow and droughty and the substratum is toxic to plants. Erosion control is most important. The soil should be kept in permanent, close-growing vegetation, such as grasses and shallow-rooted legumes. Maintaining stands and avoiding overgrazing are essential. The soil is very poorly suited to winter grazing. The surface layer is sticky when wet and compacts easily.

The soil is very poorly suited as a reservoir site because of seepage. Once it has settled, it is suitable as a site for buildings. Onsite investigation is needed to determine suitability. The thickness of the soil over bedrock and control of storm water runoff should be considered during site investigation. Stones and sloughing of banks hinder excavation. Concrete and uncoated steel in foundations, floors, and buried utility lines are subject to severe corrosion. The soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods. The hazard of contamination of ground water seriously limits use for such facilities as sewage lagoons and sanitary landfills.

The capability subclass is VIs. No woodland suitability subclass is assigned.

BcD—Barkcamp clay loam, 8 to 25 percent slopes. This strongly sloping to moderately steep, deep, well drained soil is on graded mine spoil side slopes and narrow rounded ridges in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments, which are flat and round, are mostly carbonaceous (roof) shale, coal, and medium and coarse grained sandstone. Slopes are dominantly 8 to 18 percent and mostly smooth. Most areas range from 10 to 100 acres.

Typically, the surface layer is mixed brown and yellowish brown, firm clay loam about 10 inches thick. The substratum to about 60 inches is light olive brown, friable very gravelly sandy loam and small masses of very gravelly sandy clay loam. In some areas the surface layer is channery clay loam.

Included with this soil in mapping are a few eroded areas where numerous rills and small gullies have formed. The extremely acid substratum exposed in the gullies has sparse vegetation. Water flowing through these gullies or seeping from the substratum to the surface is generally acid. Also included are a few areas where the surface layer is silt loam or loam and is easier to till than the surface layer of this Barkcamp soil. Included soils make up about 15 percent of most areas.

Permeability in this Barkcamp soil is moderately rapid or rapid. The available water capacity is low. Potential frost action is moderate. The shrink-swell potential is low. The risk of corrosion to uncoated steel and concrete is high. The surface layer is slightly acid to strongly acid, and the substratum is extremely acid. Roots are restricted mainly to the surface layer.

Most areas are in grass that is not mowed or grazed. The potential is low for cultivated crops, hay, and trees and low to medium for pasture. It is also low to medium for sanitary facilities and building site development.

Most areas are not suited to cultivated crops and hay and are poorly suited to trees because the very shallow

root zone is droughty and the substratum is toxic to plants. Erosion control is most important because the material beneath the surface layer is extremely acid. The soil should be kept in long term, close-growing vegetation, such as adapted grasses and shallow-rooted legumes. Maintaining pasture stands and avoiding overgrazing are essential. The soil is very poorly suited to winter grazing. The surface layer compacts easily and is sticky when wet.

This soil is very poorly suited as a reservoir site because of seepage. Areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings after the soil has settled. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff should be considered during site investigation. Stones, sloughing of banks, and slope hinder excavation. Concrete and uncoated steel in foundations, floors, and buried utility lines are subject to severe corrosion. The soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods. Areas where slopes are 15 to 25 percent are seriously limited as sites for buildings and sanitary facilities. Slippage is a hazard. The possible contamination of ground water seriously limits use for such facilities as sewage lagoons and sanitary landfills.

The capability subclass is VIs. No woodland suitability subclass is assigned.

BeB—Bethesda silt loam, 0 to 8 percent slopes. This deep, nearly level to gently sloping, well drained soil is on narrow and broad graded ridges of mine spoil in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Slopes are smooth and convex. Most areas are 3 to 20 acres.

Typically, the surface layer is mixed brown and yellowish brown, friable silt loam about 8 inches thick. The substratum to about 60 inches is yellowish brown and brown, firm and very firm shaly clay loam.

Included with this soil in mapping are areas where the surface layer is channery silt loam and a few eroded areas where rills and small gullies have formed. The thin flat stones interfere with tillage. In some areas, the surface has been covered with 18 to 30 inches of natural soil material. Those areas have a higher available water capacity and are more productive than areas of this Bethesda soil. Included soils make up about 15 percent of most areas.

Permeability is moderately slow, and runoff is slow and medium. The available water capacity is low. Potential frost action is moderate. The shrink-swell potential is low. Unless the soil has been limed, the root zone is extremely acid to strongly acid. The root zone is mainly moderately deep but may vary in depth within short distances because of changes in density of the material.

Most of the acreage is hayland. The potential is medium for cultivated crops, hay, pasture, and trees. It is also medium for most sanitary facilities and for building site development.

This soil is suited to corn but is better suited to small grain and to hay because it is droughty. In many areas, however, deep-rooted legumes, such as alfalfa, are difficult to maintain because of acidity and other limiting characteristics of the substratum.

In cultivated areas the hazard of erosion is moderate. This soil is well suited to no-till management. It is suited to shallow tillage. In included areas where the surface layer is thick the soil can be plowed. Controlling erosion, conserving moisture, and improving tilth and organic matter content are concerns of management. Grasses and legumes in the cropping system, cover crops, contour stripcropping, and conservation tillage, which leaves crop residue on the surface, reduce erosion, improve tilth, and increase the organic matter content.

This soil is suited to pasture. If it is overgrazed or cultivated for reseeding, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and frequent applications of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and to openland and woodland wildlife habitat. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting and mowing reduce plant competition.

Once it has settled, this soil is suitable as a site for buildings and some sanitary facilities. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff should be considered during site investigation. Stones in the substratum hinder excavation. Moderately slow permeability is a severe limitation for septic tank absorption fields. Droughtiness is a hazard for lawns during dry periods.

The capability subclass is IIIs. No woodland suitability subclass is assigned.

BeD—Bethesda silt loam, 8 to 25 percent slopes. This deep, strongly sloping to moderately steep, well drained soil is on narrow graded mine spoil ridges, knolls, and side slopes in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Slopes are smooth and are dominantly 8 to 18 percent. They are irregular along a few drainageways. Areas range from about 3 to 20 acres.

Typically, the surface layer is mixed brown and yellowish brown, friable silt loam about 8 inches thick.

The substratum to about 60 inches is yellowish brown and brown, firm and very firm shaly clay loam.

Included with this soil in mapping are areas where the surface layer is channery silt loam and a few eroded areas where rills and small gullies have formed. The thin flat stones interfere with tillage. In some areas the surface has been covered with 18 to 30 inches of natural soil material. These areas have a higher available water capacity and are more productive than this Bethesda soil. Included soils make up about 15 percent of most areas.

Permeability is moderately slow, and runoff is rapid or very rapid. The available water capacity is low. Potential frost action is moderate. The shrink-swell potential is low. Unless the soil has been limed, the root zone is extremely acid to strongly acid. The root zone is mainly moderately deep but may vary in depth within short distances because of changes in density of the material.

Most of the acreage is hayland. The potential is medium for cultivated crops, hay, pasture, and trees. It is medium to low for most sanitary facilities and building site development.

This soil is suited to corn grown under no-till management, but it is better suited to small grain and hay because it is droughty. Stands of deep-rooted legumes, such as alfalfa, are difficult to maintain in most areas because of acidity and other limiting characteristics of the substratum. If the soil is cultivated, the hazard of erosion is severe or very severe. The soil is suited to no-till management or only shallow tillage. Included areas where the surface has been covered with 18 to 30 inches of soil material are suited to plowing and discing and other fieldwork needed in preparing the seedbed. Controlling erosion, conserving moisture, improving tilth, and increasing the organic matter content are concerns of management. Grasses and legumes in the cropping system and cover crops reduce erosion, improve tilth, and increase the organic matter content.

This soil is suited to pasture but is droughty during periods of low rainfall. Reseeding by using companion crops or cover crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and frequent applications of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Grasses and legumes provide ground cover and reduce erosion during the establishment of trees. Locating skid trails and logging roads on the contour helps to control runoff and the hazard of erosion. 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. Onsite investigation is needed to determine suitability. Thickness 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 severely limited as sites for buildings and sanitary facilities. Slippage is a hazard. Moderately slow permeability is a limitation for septic tank absorption fields. Droughtiness is a limitation for lawns. Stones in the substratum hinder shallow excavation.

The capability subclass is IVs. No woodland suitability subclass is assigned.

BhB—Bethesda shaly silty clay loam, 0 to 8 percent slopes. This deep, nearly level to gently sloping, well drained soil is on mine spoil ridges and benches and in basin-like areas between spoil ridges in areas surface mined for coal. Ridge crests are commonly rounded and have smooth slopes. Rills and small gullies have formed on some ridges. Most basins are drained by a small waterway, but some do not have drainage outlets and contain intermittent pools of water. This soil is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments, mostly flat and 1 to 5 inches long, are mainly shale, siltstone, and fine grained sandstone plus smaller amounts of coal and carbonaceous (roof) shale. There are a few stones at the surface and throughout the soil. Most areas are 3 to 15 acres.

Typically, the surface layer is dark grayish brown, friable shaly silty clay loam about 5 inches thick. The substratum to about 60 inches is yellowish brown and brown, firm and very firm shaly clay loam.

Included with this soil in mapping are small areas of the extremely acid, coarser textured Barkcamp soils. In places, the surface layer of these included soils appears moist because of high concentrations of salts. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in this Bethesda soil, and runoff is slow and medium. The available water capacity is low. Potential frost action is moderate. The shrink-swell potential is low. The organic matter content is very low. Unless the soil has been limed, the root zone is strongly acid to extremely acid. Depth of the root zone varies within short distances because of changes in density of the material.

Most of the acreage is in grasses and trees. The potential is low for crops, pasture, and trees. It is medium for most building site development and sanitary facilities.

This soil is poorly suited to hay and to the commonly grown field crops because rock fragments in the surface layer interfere with tillage. It is droughty, low in fertility, and very low in organic matter content. The surface layer has weak structure. It puddles and crusts easily. Erosion is a moderate hazard in cultivated areas.

It is possible that this soil could be used for production of specialty crops, such as blueberries. In many areas there are potential sites for reservoirs to provide water for irrigation.

This soil is poorly suited to pasture. Areas that have not been limed and fertilized generally support thin stands of grasses and have barren spots. The soil is generally low in nitrogen and phosphorus and medium in potassium. Fertilizer should be applied according to the results of soil tests. The acidity, low fertility, shaly surface layer, and droughtiness are major concerns of management. Much of the rainfall runs off because of the poor soil structure and plant cover. Plant cover and surface mulch reduce runoff and erosion and increase water intake. Proper stocking and rotation grazing are needed. Overgrazing reduces the stand and increases runoff and erosion. Limiting grazing in winter and other wet periods helps to prevent soil compaction. A few large stones interfere with mowing and reseeding. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow best on this soil. Water for livestock is not available in many areas, but potential reservoir sites are available.

This soil is suited to trees that tolerate strongly acid to extremely acid conditions and droughtiness. Mechanical planting is not practical in many areas because of rock fragments in the surface layer. Mowing for weed control is possible in most areas.

Once it has settled, this soil is suitable as sites for buildings and some sanitary facilities. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff should also be considered during site investigation. Moderately slow permeability severely limits use for septic tank absorption fields. Stones hinder shallow excavation. Sites for lawns should be blanketed with suitable soil material to provide a more favorable root zone, to increase the available water capacity, and to cover small stones that would interfere with mowing.

The capability subclass is VIs. No woodland suitability subclass is assigned.

BhD—Bethesda shaly silty clay loam, 8 to 25 percent slopes. This strongly sloping to moderately steep, deep, well drained soil is on mine spoil side slopes and, to a lesser extent, on mine spoil benches and narrow ridgetops in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments, mostly flat and 1 to 5 inches long, are mainly shale, siltstone, and fine grained sandstone and smaller amounts of coal and carbonaceous (roof) shale. There are a few large stones at the surface in most areas. Slopes are dominantly 8 to 18 percent and are mostly smooth. Most areas range from 3 to 25 acres.

Typically, the surface layer is dark grayish brown, friable shaly silty clay loam about 5 inches thick. The substratum to about 60 inches is yellowish brown and brown, firm and very firm shaly clay loam.

Included with this soil in mapping are small areas of the extremely acid, coarser textured Barkcamp soils that have moist spots of soluble salts on the surface in some places. Also included are a few extremely stony and bouldery areas and narrow, very steep escarpments. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in this Bethesda soil, and runoff from unprotected areas is rapid or very rapid. The available water capacity is low because of the high content of coarse fragments and the compactness in the root zone. The organic matter content is very low. Potential frost action is moderate. The shrink-swell potential is low. Unless the soil has been limed, the root zone is strongly acid to extremely acid. Depth of the root zone varies within short distances because of changes in density of the material.

Most of the acreage is in grasses. A few areas are wooded. The potential is low for crops, pasture, and trees. It is medium to low for most building site development and sanitary facilities.

This soil is very poorly suited to commonly grown field crops and hay and poorly suited to pasture because it is a poor medium for root development. It is droughty, low in fertility, and very low in organic matter content. The surface layer is shaly, has weak structure, and puddles and crusts easily. Much of the rainfall runs off because of the poor structure and lack of plant cover. Erosion is a severe or very severe hazard in cultivated areas. Rock fragments in the surface layer interfere with tillage, and a few large stones interfere with pasture management. Areas that have not been limed and fertilized generally support only thin stands of grasses and are interspersed with barren spots. The soil is generally low in nitrogen and phosphorus and medium in potassium. Soil tests are needed to determine specific nutrient needs. Ground cover and surface mulch reduce runoff and erosion and increase water intake. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow best on this soil. Proper stocking and rotation grazing are needed. Overgrazing reduces the stand and increases runoff and erosion. Water for livestock is not available in many areas, but potential reservoir sites are available.

This soil could be used for production of specialty crops, such as blueberries. Many areas have potential sites for reservoirs to provide water for irrigation. Irrigation, however, is limited by slope and slow water intake rate.

This soil is suited to trees that can tolerate the strongly acid to extremely acid, droughty conditions. Mechanical planting is not practical in many areas because of rock fragments in the surface layer. Mowing for weed control is possible in most areas.

Once the soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings. Onsite investigation is needed to determine suitability. Thickness 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 severely limited

as sites for buildings and sanitary facilities. Slippage is a hazard. Moderately slow permeability limits use for septic tank absorption fields. Stones hinder shallow excavation. Because the root zone is limited, droughtiness is a hazard for lawns. Rock fragments interfere with mowing.

The capability subclass is VIs. No woodland suitability subclass is assigned.

BhE—Bethesda shaly silty clay loam, 25 to 40 percent slopes. This deep, well drained, steep soil is mainly on mine spoil side slopes in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly flat and 1 to 5 inches long. In most places, there are a few large stones 50 to 150 feet apart on the surface. Most areas are 3 to 25 acres.

Typically, the surface layer is dark grayish brown, friable shaly silty clay loam about 5 inches thick. The substratum to about 60 inches is yellowish brown and brown, firm and very firm shaly clay loam.

Included with this soil in mapping are small areas of the extremely acid, coarser textured Barkcamp soils. These soils appear moist in a few spots because of soluble salts. Also included are spots of extremely stony and bouldery soils and narrow, very steep escarpments. Included soils make up 15 to 25 percent of most areas.

Permeability is moderately slow in this Bethesda soil, and runoff is very rapid. The available water capacity is low. Potential frost action is moderate. The shrink-swell potential is low. Unless the soil has been limed, the root zone is strongly acid to extremely acid. Depth of the root zone varies within short distances because of changes in density of the material.

Most of the acreage is in grasses and small trees. The potential is low for cultivated crops, pasture, and trees. It is also low for building site development and sanitary facilities.

This soil is poorly suited to hay, pasture, and commonly grown field crops because of steep slopes, droughtiness, low fertility, and very low organic matter content. In most places, the high content of coarse fragments in the surface layer prevents tillage. Because the surface layer has very weak structure and crusts easily, seedings should be mulched. Erosion is a very severe hazard in cultivated areas. No-till management or minimum tillage on the contour and diversions reduces erosion and conserves moisture. Proper stocking, pasture rotation, and timely application of lime and fertilizer are essential in maintaining a stand of key forage plants. Mowing to control weeds is difficult on the steep slopes and is not practical on the stony included areas. On included areas of the extremely acid Barkcamp soils, special reclamation is needed to establish vegetation. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees that tolerate acid droughty conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting is not practical because of steep slopes and the rock fragments throughout the soil.

This soil is very poorly suited to sanitary facilities and building site development because of steep slopes, the possibility of hillside slippage, and the moderately slow permeability.

The capability subclass is VIIe. No woodland suitability subclass is assigned.

BhF—Bethesda very cobbly silty clay loam, 40 to 70 percent slopes. This very steep, deep, well drained soil is on mine spoil side slopes in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mainly cobblestones, which are mostly rounded or blocky and range from 3 to 10 inches in diameter. Most areas have not been graded and smoothed. Slopes are generally rough and uneven. There are active hillside slips. Most areas are 10 to 100 acres.

Typically, the surface layer is dark grayish brown, firm very cobbly silty clay loam about 5 inches thick. The substratum to about 60 inches is yellowish brown and brown, firm shaly clay loam.

Included with this soil in mapping are small areas of the extremely acid, coarser textured Barkcamp soils. These soils appear moist in a few areas because of soluble salts. Also included are small areas that are extremely bouldery. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in this Bethesda soil, and runoff is very rapid. The available water capacity is very low in the root zone. Potential frost action is moderate. The shrink-swell potential is low. Unless the soil has been limed, the root zone is strongly acid to extremely acid. The root zone is mainly shallow, but the depth can vary within short distances because of changes in density of the material.

Most of the acreage is idle brushland or is woodland with short, low quality trees. The potential is low for cultivated crops, hay, pasture, and trees. It is also low for sanitary facilities and building site development.

This soil is not suited to crops, hay, or pasture because of the very steep uneven slopes, the cobblestones in the surface layer, the droughtiness, and the very severe hazard of erosion.

This soil is suited to trees that tolerate an acid, droughty, restricted root zone. Grasses and legumes provide cover during the establishment of trees. Mechanical planting is not possible because of the very steep slopes and the cobblestones in the surface layer.

This soil is not suitable as a site for buildings and sanitary facilities because of very steep slopes, the cobblestones in the surface layer, the risk of hillside slippage, and the moderately slow permeability.

The capability subclass is VIIs. No woodland suitability subclass is assigned.

BsC—Brookside silty clay loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on foot slopes, on benches on hillsides, and in coves at the head of drainageways below steep hillsides. A few areas are on alluvial fans. The bench-like areas are on the contour and are bounded above and below by steeper soils. The areas on foot slopes are at the base of long hillsides. Slopes are slightly uneven with irregularities along small drainageways. Most areas range from 5 to 50 acres.

Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is brown, friable silty clay loam, and the middle and lower parts are yellowish brown, firm clay with mottles below about 26 inches. The substratum to about 80 inches is light olive brown, mottled, firm silty clay and channery clay loam. In some areas, the surface layer is thicker and darker colored.

Included with this soil in mapping are areas of wetter soils in concave areas or below seep spots and springs. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in this Brookside soil. Depth to the seasonal high water table is 30 to 48 inches. Runoff in cultivated areas is rapid. The available water capacity is moderate. The shrink-swell potential is high. The potential frost action is moderate. Reaction is medium acid to neutral in the upper part of the root zone and medium acid to mildly alkaline in the lower part.

Most areas are used for pasture and hay. The potential is medium for cultivated crops and high for small grain, hay, pasture, trees, and openland and woodland wildlife habitat. It is low for sanitary facilities and building site development.

This soil is suited to cropping systems that include cultivated crops, small grain, and hay. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Controlling erosion, maintaining tilth and organic matter, and draining included wetter soils are concerns of management. The silty clay loam surface layer is sticky when wet and hard when dry. Conservation tillage which leaves crop residue on the surface; grasses and legumes in the cropping system; and contour tillage, contour stripcropping, grassed waterways, and cover crops reduce crusting after intense rains. In some areas, uneven slopes and irregularities along natural drainageways make contour stripcropping impractical. Tilling within the optimum moisture range helps to prevent soil compaction.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is well suited to trees and to woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible.

This soil is poorly suited as a site for most buildings and sanitary facilities because of the hazard of slippage, moderately slow permeability, clayey subsoil, and seasonal wetness. Diversions are needed. The surface layer is sticky when wet. Providing suitable base material improves local roads. Footing drains and exterior wall coatings help to prevent wet basements. Maintaining as much cover as possible on the site during construction reduces erosion.

The capability subclass is IIIe. The woodland suitability subclass is 1o.

BsD—Brookside silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, moderately well drained soil is on foot slopes, on benches on hillsides, and in coves at the head of drainageways below steep soils. The hillside benches are on the contour and are bounded above and below by steeper soils. The areas on foot slopes are at the base of long, very steep hillsides. The slopes are commonly uneven and are dissected along small drainageways. In some areas hillside slips are near seep spots and springs. Most areas range from 5 to 50 acres.

Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is brown and dark yellowish brown, friable silty clay loam, and the middle and lower parts are yellowish brown, firm clay with mottles below about 26 inches. The substratum to about 80 inches is yellowish brown, mottled, firm silty clay and channery clay loam. In some areas, the surface layer is thicker and darker colored.

Included with this soil in mapping are areas of wetter soils in concave areas or below seep spots and springs. Also included are narrow bands of stony soils near the upper part of foot slopes and coves. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in this Brookside soil, and the available water capacity is moderate. Depth to the seasonal high water table is 30 to 48 inches. Runoff from cultivated areas is very rapid. Reaction is medium acid to neutral in the upper part of the root zone and medium acid to mildly alkaline in the lower part. The shrink-swell potential is high. Potential frost action is moderate.

Most areas are used as pasture, woodland, and hayland. The potential is low for cultivated crops and small grain, medium for hay, and high for pasture, trees, and woodland wildlife habitat. It is low for building site development and sanitary facilities.

This soil is best suited to crops that provide cover. Cultivated crops, however, can be grown occasionally if the hazard of erosion is controlled. The uneven, moderately steep slopes and very severe erosion hazard

are severe limitations for cultivated crops. Most areas are unsuited to contour cultivation and contour stripcropping because the slopes are not uniform. Controlling erosion, maintaining tilth and organic matter content, and removing excess water from included wetter soils by subsurface drainage are concerns of management. Conservation tillage, which leaves crop residue on the surface; grasses and legumes in the cropping system; crop residue incorporated into the plow layer; and contour stripcropping, cover crops, and grassed waterways reduce the hazard of erosion and help to maintain tilth and organic matter content. Tilling within the optimum moisture range helps to prevent soil compaction.

This soil is suited to pasture. The moderately steep uneven slopes and the seep areas, however, limit the use of equipment, especially during spring. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding with cover crops or companion crops or by the trash mulch or no-till methods reduces erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer help to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Locating logging roads and skid trails on the contour reduces erosion. The silty clay loam surface layer and moderately steep uneven slopes limit the use of planting and mowing equipment. The surface layer is soft and slippery when wet. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

This soil is poorly suited to sanitary facilities and buildings because of moderately steep slopes, high shrink-swell potential of the middle and lower parts of the clayey subsoil, low strength, moderately slow permeability, some seasonal wetness, and susceptibility to hillside slippage. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 1r.

BsE—Brookside silty clay loam, 25 to 40 percent slopes. This deep, moderately well drained, steep soil is on foot slopes, or benches on hillsides, and in coves at the head of drainageways. Areas on foot slopes are at the base of long very steep hillsides. The hillside benches are on the contour and are bounded above and below by steeper soils. The slopes are typically uneven and are dissected along drainageways. Hillside slips are in many areas. Most areas range from 5 to 50 acres.

Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is brown, friable silty clay loam and yellowish brown, firm clay, and the lower part is yellowish brown, mottled, firm clay. The substratum to about 80 inches is light olive brown and yellowish brown, mottled, firm silty clay and channery clay loam. In some areas the surface layer is thicker and darker colored.

Included with this soil in mapping are areas of wetter soils in concave areas or below springs and seep spots. Also included on benches and on the upper part of foot slopes and coves are areas where the surface layer is stony. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in this Brookside soil, and runoff is very rapid. The available water capacity is moderate. Depth to the seasonal high water table is 30 to 48 inches. The shrink-swell potential is high. The potential frost action is moderate. Reaction is medium acid to neutral in the upper part of the root zone and medium acid to mildly alkaline in the lower part.

Most areas are woodland and pasture. The potential is low for hay, cultivated crops, and small grain, high for trees and for woodland wildlife habitat, medium for pasture, and low for building site development, sanitary facilities, and most recreation uses.

The steep, uneven slopes and the stones and seep spots in a few places limit equipment use. The silty clay loam surface layer is slippery when wet. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is very severe. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces erosion. Proper stocking, pasture rotation, and mowing for weed control are needed to maintain a good stand of key forage plants. Limiting grazing in winter months and other wet periods helps to prevent soil compaction.

This soil is suited to trees and for woodland wildlife habitat. Locating logging roads and skid trails on the contour reduces erosion. The steep, uneven slopes and silty clay loam surface layer limit the use of planting and mowing equipment. Coves and north- and east-facing slopes are the best woodland sites because they have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

Steep slopes, high shrink-swell potential of the middle and lower parts of the clayey subsoil, low strength, moderately slow permeability, some seasonal wetness, and susceptibility to hillside slippage severely limit the use of this soil as sites for buildings and sanitary facilities. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIe. The woodland suitability subclass is 1r.

BuB—Brookside-Urban land complex, 3 to 15 percent slopes. This map unit consists of deep, gently sloping and strongly sloping, moderately well drained Brookside soil and Urban land on alluvial fans and foot slopes. Most areas range from 5 to 50 acres.

Areas of this unit are about 45 percent Brookside silty clay loam and 40 percent Urban land. Areas of the Brookside soil and Urban land are so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Brookside soil is brown, friable silty clay loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is dark yellowish brown, friable silty clay loam and firm clay, and the lower part is yellowish brown, mottled, firm clay. The substratum to about 80 inches is yellowish brown, mottled, firm silty clay and channery clay loam. In some areas the surface layer is darker colored. The Brookside soil has been radically altered in some areas that have been cut, built up, or smoothed.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soil that identification is not feasible.

Included in mapping are areas of wetter soils below seep spots and drainageways. Included soils make up about 15 percent of most areas.

Permeability in the Brookside soil is moderately slow. Runoff is medium or rapid. The available water capacity is moderate. Potential frost action is moderate. The shrink-swell potential is high. Reaction is medium acid to neutral in the upper part of the root zone and medium acid to mildly alkaline in the lower part.

The Brookside soil, the open part of the map unit, is used for building sites, lawns, and gardens. The potential is high for lawns, trees, and shrubs, medium for vegetable and flower gardens, and low for sanitary facilities and building site development.

The Brookside soil is suited to vegetable and flower gardens if the risk of erosion is controlled and the organic matter content and tilth are maintained. Subsurface drains are needed in some areas to drain seep spots and included wetter soils. Diversions are needed in some areas. Incorporating plant residue and leaf litter into the surface layer and using cover crops help to maintain tilth and reduce erosion. Tilling within the optimum moisture range helps to prevent soil compaction and crusting of the surface layer after intense rains. Wet-tolerant trees and shrubs should be planted. The spots of cut and fill are not well suited to lawns and gardens. Tilth is very poor in exposed subsoil material, which is sticky when wet and hard when dry.

Moderately slow permeability, high shrink-swell potential in the clayey subsoil, and seasonal wetness are severe limitations for buildings and sanitary facilities. Areas on foot slopes are subject to hillside slippage. The silty clay loam surface layer of the Brookside soil is sticky when wet. Footing drains and exterior wall coatings help to prevent wet basements. Providing suitable base material improves local roads and streets. Basement excavations should be backfilled along the foundation with material containing less clay to reduce the hazard of damage caused by the shrinking and swelling of the soil. Sanitary facilities should be connected to central sewers and treatment facilities if possible.

The capability subclass is IIIe for the Brookside soil. No woodland suitability subclass is assigned. Urban land is not assigned to a capability subclass or woodland suitability subclass.

BuD—Brookside-Urban land complex, 15 to 40 percent slopes. This map unit consists of deep, moderately steep and steep, moderately well drained Brookside soil and Urban land on foot slopes below steep hillsides. Most areas range from 5 to 100 acres.

Areas of this unit are about 50 percent Brookside silty clay loam and 40 percent Urban land. Areas of the Brookside soil and Urban land are so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Brookside soil is brown, friable silty clay loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silty clay loam and firm clay, and the lower part is yellowish brown and brown, mottled, firm clay. The substratum to about 80 inches is light olive brown and yellowish brown, mottled, firm silty clay and channery clay loam. In some areas, the surface layer is darker colored. The Brookside soil has been radically altered in some areas that have been cut, built up, or smoothed.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soil that identification is not feasible.

Included in mapping are areas of wetter soils, mainly below seep spots and drainageways. Included soils make up about 15 percent of most areas.

Permeability in the Brookside soil is moderately slow. Runoff is very rapid. The available water capacity is moderate. Potential frost action is moderate. The shrink-swell potential is high. Reaction is medium acid to neutral in the upper part of the root zone and medium acid to mildly alkaline in the lower part.

The Brookside soil, the open part of the map unit, is used for building sites, lawns, and gardens. The potential is low for lawns, flower and vegetable gardens, sanitary facilities, and building site development and high for shrubs and trees.

The moderately steep and steep slopes and erosion hazard severely limit the use of the Brookside soil for lawns and vegetable and flower gardens. Some areas are in trees, vines, and ground cover, to which the soil is well suited. The silty clay loam surface layer is sticky when wet and hard when dry.

Moderately slow permeability, high shrink-swell potential in the clayey subsoil, moderately steep and steep slopes, and susceptibility to hillside slippage are severe limitations for buildings and sanitary facilities. Foundations and footings of dwellings and small buildings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Sanitary facilities should be connected to central sewers and treatment facilities if possible. Cover is needed during construction to reduce the risk of erosion. Providing suitable base material improves local roads.

The capability subclass is IVe for the Brookside soil. No woodland suitability subclass is assigned for the Brookside soil. No capability subclass or woodland suitability subclass is assigned for Urban land.

Cg—Chagrin silt loam, occasionally flooded. This nearly level, deep, well drained soil is on flood plains. It is subject to occasional flooding. The slope range is 0 to 3 percent. Most areas are 5 to 100 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is brown, friable silt loam and loam about 34 inches thick. The substratum to about 62 inches is stratified brown and dark yellowish brown, friable loam and sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Newark soils in slight depressions or in narrow bands adjacent to slope breaks to terraces or uplands. Those soils make up about 10 percent of most areas. Also included on alluvial fans at the base of hillside drainageways are small areas of soils that have a gravelly loam and channery loam surface layer. The pebbles and small flat stones reduce the available water capacity and may interfere with tillage. These soils make up about 15 percent of most areas.

Permeability is moderate in this Chagrin soil. Runoff is slow. The available water capacity is high. The surface layer is easily tilled. The shrink-swell potential is low, and potential frost action is moderate. Reaction in the root zone is neutral to medium acid.

Most areas are farmed. Corn and hay are the main crops. The potential is high for cultivated crops, pasture, and trees (fig. 6). It is medium for small grain and hay. It is low for building site development and sanitary facilities.

Figure 6.—Chagrin silt loam, occasionally flooded, is well suited to corn. The farm buildings are on Otwell soils.

This soil can be cropped intensively with continuous row crops under good management. In some years planting is delayed by flooding, and yields, especially of small grain and hay, are reduced by flooding and siltation. Water ponds on the included Newark soils for short periods following floods and heavy rainfall and reduces yields. This Chagrin soil is well suited to irrigation. Maintaining tilth and organic matter content and draining included wetter soils are major concerns of management. Controlling johnsongrass, foxtail, and other weeds is also a problem in some areas. Conservation tillage, which leaves crop residue on the surface, and incorporating crop residue into the plow layer increase organic matter content, improve tilth, and reduce runoff. Tilling within the optimum range of moisture content helps to prevent soil compaction and helps to maintain tilth.

This soil is suited to pasture. Proper stocking, pasture rotation, mowing to control weeds, and timely application of fertilizer are needed to maintain good stands of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction. This soil is well suited to trees, but only a very small acreage is used for woodland. Seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

The flood hazard is a severe limitation for buildings and sanitary facilities. The potential is good for such recreation uses as picnic areas, hiking trails, and golf fairways.

The capability subclass is IIw. The woodland suitablility subclass is 1o.

ChB—Chili gravelly loam, 3 to 8 percent slopes. This gently sloping, deep, well drained soil is on well defined stream terraces. Slopes are uniform to slightly convex. Areas are commonly oblong and parallel the stream. Most areas range from 10 to 50 acres.

Typically, the surface layer is brown, very friable gravelly loam about 9 inches thick. The subsoil is about 45 inches thick. The upper and middle parts are brown and dark yellowish brown, friable gravelly loam, and the lower part is brown, very friable very gravelly sandy loam. The substratum to about 60 inches is brown, loose very gravelly sand.

Included with this soil in mapping are narrow bands of more sandy soils that have a low available water capacity and are droughty in most years. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the subsoil and rapid in the substratum. The available water capacity is moderate. Runoff from cultivated areas is medium. The shrink-swell potential is low. Potential frost action is moderate. In unlimed areas, reaction in the root zone is medium acid to very strongly acid.

Most areas are idle or are used for urban or industrial development. The potential is medium for cultivated crops, hay, and pasture and high for building site development and trees.

This soil is suited to corn and small grain and to grasses and legumes for hay. Deep-rooted legumes are difficult to maintain in some areas. Cultivated crops can be grown year after year if the hazard of erosion is controlled. The soil warms and dries early in spring and is well suited to early season specialty crops, but frost is a hazard because of poor air drainage. The soil is well suited to irrigation. Droughtiness and erosion control are the main management concerns. Conservation tillage, which leaves crop residue on the surface; incorporating crop residue into the plow layer; grasses and legumes in the cropping system; and contour tillage, cover crops, and contour stripcropping on the longer slopes reduce the erosion hazard.

This soil is suited to pasture and is well suited to grazing early in spring. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants.

This soil is well suited to trees, but only a small acreage is used for woodland. Most idle areas are reverting to low quality species. Mechanical planting and mowing to reduce plant competition are possible.

This soil is well suited as a site for buildings and for septic tank absorption fields. Sloughing is a hazard in excavations. Local roads can be improved by replacing the surface layer and subsoil with a suitable base material. The soil is droughty for lawns. It is well suited to extensive recreation uses. The pebbles in the surface layer interfere with such uses as ball diamonds. The soil is a good source of gravel.

The capability subclass is IIe. The woodland suitability subclass is 2o.

CmB—Chili-Urban land complex, 0 to 8 percent slopes. This map unit consists of deep, nearly level and gently sloping, well drained Chili soil and Urban land on stream terraces. Most areas range from 10 to 100 acres.

Areas of this unit are about 50 percent Chili gravelly loam and about 40 percent Urban land. Areas of the Chili soil and Urban land are so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Chili soil is brown, very friable gravelly loam about 9 inches thick. The subsoil is about 45 inches thick. The upper and middle parts are brown and yellowish brown, friable gravelly loam, and the lower part is brown, very friable very gravelly sandy loam. The substratum to about 60 inches is brown, loose very gravelly sand. The soil has been radically altered in some small areas that have been cut, built up, or smoothed.

The Urban land consists of streets, railroads, parking lots, buildings, and other structures that so obscure or alter the soil that identification is not feasible.

Included in mapping are areas of more sandy soils that have a low available water capacity and are

droughty. Included soils make up about 10 percent of most areas.

Permeability is moderately rapid in the subsoil and rapid in the substratum of this Chili soil. Surface runoff is slow or medium. The available water capacity is moderate. The shrink-swell potential is low. Potential frost action is moderate. Unless the soil has been limed, reaction in the root zone is medium acid to very strongly acid.

The Chili soil, the open part of the map unit, is used for lawns and gardens. The potential is high for lawns, vegetable and flower gardens, shrubs, trees, building site development, and recreation uses.

The Chili soil is suited to lawns, vegetable and flower gardens, shrubs, and trees. It warms and dries early in spring and is well suited to early gardening. The soil is droughty during dry periods but is well suited to irrigation. Incorporating plant residue into the surface layer increases the organic matter content and the available water capacity. The included spots of cut and fill land are not well suited to lawns and gardens because exposed subsoil material has very poor tilth.

The Chili soil is well suited as a site for buildings, septic tank absorption fields, and extensive recreation uses. The gravel in the surface layer interferes with such intensive recreation uses as ball diamonds. Sloughing is a hazard in excavations. Local roads can be improved by replacing the surface layer and subsoil with a suitable base material.

The capability subclass is IIe for the Chili soil. No woodland suitability subclass is assigned for the Chili soil. No capability subclass or woodland suitability subclass is assigned for Urban land.

CuB—Culleoka silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is mainly on ridgetops. A few areas are on the crests of knolls. Most areas are smooth and slightly convex and range from 3 to 60 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The brown, friable subsoil is about 17 inches thick. It is silt loam in the upper part and channery loam in the lower part. The substratum is yellowish brown, friable very channery loam. Fine grained sandstone bedrock is at about 33 inches.

Included with this soil in mapping are small areas of the deep Wellston and Westmoreland soils near the center of the wider ridgetops. Severely eroded soils that are shallow over bedrock are included near slope breaks and narrow ridge crests. Those soils have a channery silt loam surface layer. Also included are areas underlain by hard bedrock. Included soils make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in this Culleoka soil, and the available water capacity is low. Runoff is medium in cultivated areas. A few hard siltstone and sandstone fragments are in the surface layer, and the content of fragments increases with increasing depth in the subsoil. The shrink-swell potential is low. Potential frost action is moderate. The root zone is moderately deep over sandstone bedrock. In unlimed areas, reaction in the root zone is medium acid or strongly acid in the topsoil and subsoil and strongly acid to slightly acid in the substratum.

Most of the acreage is farmed. A small acreage is wooded. The potential is medium for cultivated crops, hay, pasture, and building site development, low to medium for sanitary facilities, and high for trees.

This soil is suited to corn and small grain and to grasses and legumes for hay, but it is droughty. In cultivated areas, the hazard of erosion is moderate. Deep-rooted legumes are difficult to maintain in many areas. Controlling erosion, maintaining tilth and organic matter content and conserving moisture are concerns of management. Conservation tillage, which leaves crop residue on the surface; grasses and legumes; incorporating crop residue into the plow layer; and cover crops, contour tillage, and stripcropping reduce the hazard of erosion. Tilling within the optimum range of moisture content helps to prevent soil compaction.

This soil is suited to pasture. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Mechanical planting and mowing to reduce plant competition are possible. Species selected for planting should be somewhat tolerant of droughtiness.

This soil is suitable as a site for buildings without basements. Depth to bedrock is a limitation for houses with basements. Depth to bedrock and the possible contamination of ground water are severe limitations for sanitary facilities. Local roads can be improved by using a suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 2o.

CuC—Culleoka silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on narrow ridgetops and on the crests of knolls. Slopes are smooth with a few shallow drainageways near the edge of some ridgetops. Areas range from 3 to 60 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The brown, friable subsoil is about 17 inches thick. It is silt loam in the upper part and channery loam in the lower part. The substratum is yellowish brown, friable very channery loam. Fine grained sandstone bedrock is at about 33 inches.

Included with this soil in mapping are small areas of the deep Wellston and Westmoreland soils, commonly near the center of wide ridgetops. A few narrow bands of

the more droughty Dekalb soils are included near slope breaks on some ridgetops. Also included are areas underlain by hard bedrock. Included soils make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in this Culleoka soil, and available water capacity is low. Runoff is rapid in cultivated areas. The shrink-swell potential is low. Potential frost action is moderate. The root zone is moderately deep over sandstone bedrock. Unless the soil has been limed, reaction in the root zone is medium acid or strongly acid in the topsoil and subsoil and strongly acid to slightly acid in the substratum.

Most areas are used for hay, pasture, or cultivated crops. The potential is medium for cultivated crops, hay, pasture, and building site development, low to medium for sanitary facilities, and high for trees and for openland and woodland wildlife habitat.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay, but it is droughty. If it is cultivated or the protective cover is removed, the erosion hazard is severe. Controlling erosion, conserving moisture, and maintaining tilth and organic matter content are concerns of management. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, grasses and legumes, cover crops, and contour stripcropping reduce the hazard of erosion. Tilling within the optimum moisture range helps to prevent soil compaction.

This soil is suited to pasture. Deep-rooted legumes are difficult to maintain in many areas. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Locating skid trails and logging roads on the contour helps to control runoff and erosion. Mechanical planting and mowing to reduce plant competition are possible.

This soil is suitable as a site for buildings even though the slope and depth to bedrock are limitations, especially for houses with basements. Local roads can be improved by using a suitable base material. Locating driveways across the slope reduces the angle of incline and erosion. The slope, bedrock, and possible contamination of ground water are severe limitations for sanitary facilities.

The capability subclass is IIIe. The woodland suitability subclass is 2o.

DkB—Dekalb loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is mainly on narrow ridgetops and low knolls. A few areas are near slope breaks on broad ridgetops. Slopes are smooth and even to convex. Most areas are 2 to 20 acres.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 17 inches thick. The substratum is yellowish brown, very friable very channery sandy loam. Hard, brown and olive brown fine and medium grained sandstone is at a depth of about 28 inches.

Included with this soil in mapping are small areas of the more silty Culleoka soils and the deep, more silty Westmoreland soils at the center of ridgetops. Both of those soils have a lower content of coarse fragments in the subsoil and higher available water capacity than this Dekalb soil. Included soils make up about 20 percent of most areas.

Permeability is rapid or moderately rapid, and the available water capacity is very low. Runoff is slow from cultivated areas. The soil dries rapidly after rains. Sandstone fragments are common in the surface layer, and the content generally increases with increasing depth to about 80 percent by volume in the substratum. Potential frost action and the shrink-swell potential are low. The root zone is moderately deep over sandstone bedrock. In unlimed areas, reaction in the root zone is very strongly acid or strongly acid.

Most of the acreage is farmed. The potential is medium for building site development, medium or low for sanitary facilities, and medium for cultivated crops, hay, pasture, and trees.

This soil is suited to cultivated crops, small grain, and hay. The hazard of droughtiness, however, is severe. The soil warms and dries early in spring and is well suited to early spring planting. Yields of corn and late cuttings of hay are generally reduced because of the very low available water capacity. Deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas. In cultivated areas, the hazard of erosion is moderate. Controlling erosion, maintaining tilth and organic matter content, and conserving moisture are concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, incorporating crop residue into the plow layer, and cover crops, contour tillage, and stripcropping reduce the hazard of erosion and improve tilth and organic matter content. The soil dries and warms early in spring and is especially well suited to early season crops. Because nutrients are rapidly leached, the soil generally responds better to smaller but more frequent or timely applications of fertilizer than to one large application.

This soil is suited to pasture and is especially well suited to grazing early in spring. Because the very low available water capacity results in droughtiness in summer, early spring seeding is best. Seeding with companion crops or cover crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and

fertilizer are needed to maintain a good stand of key forage plants.

This soil is suited to trees. Mechanical planting and mowing to reduce plant competition are possible on this soil. Drought-tolerant species should be planted.

This soil is suitable as a site for buildings even though hard bedrock at a depth of 20 to 40 inches is a limitation, especially for houses with basements. Blasting of bedrock is generally required for basements. The bedrock and the possible contamination of ground water are severe limitations for sanitary facilities.

The capability subclass is IIe. The woodland suitability subclass is 3f.

DkC—Dekalb loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on narrow ridgetops, near slope breaks of broad ridgetops, and on knolls. Slopes are generally smooth and convex. Most areas are 3 to 20 acres.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 17 inches thick. The substratum is yellowish brown, very friable very channery sandy loam. Hard fine and medium grained sandstone bedrock is at about 28 inches.

Included with this soil in mapping are small areas of the more silty Culleoka soils and the more silty, deep Westmoreland soils, commonly near the center of ridgetops. Both of these included soils have a lower content of coarse fragments in the subsoil and higher available water capacity and are more productive than this Dekalb soil. Included soils make up about 20 percent of most areas.

Permeability is rapid or moderately rapid in this Dekalb soil, and the available water capacity is very low. Runoff is medium from cultivated areas. The potential frost action is low. The shrink-swell potential is low. The root zone is moderately deep over sandstone bedrock. Unless the soil has been limed, reaction in the root zone is strongly acid or very strongly acid.

Most areas are used for hay, pasture, trees, and some cultivated crops. The potential is medium for cultivated crops, hay, pasture, trees, and building site development and medium or low for sanitary facilities.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay and pasture. Droughtiness generally reduces yields of corn and late cuttings of hay. Controlling erosion, conserving moisture, and increasing the organic matter content are concerns of management. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, grasses and legumes, crop residue for mulch, cover crops, and contour stripcropping reduce the hazard of erosion and increase organic matter content.

This soil dries and warms early in spring and is well suited to tillage and grazing early in spring. Because of droughtiness in summer, seeding early in spring is best. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Because nutrients are rapidly leached, the soil generally responds better to smaller but more frequent or timely applications of fertilizer than to one large application. Deep-rooted legumes are difficult to maintain in many areas. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants.

This soil is suited to trees. Locating skid trails and logging roads on the contour reduces erosion. Mowing reduces plant competition. Drought-tolerant species should be selected for planting.

This soil is suitable as a site for buildings even though the depth to hard bedrock and the slope are limitations, especially for houses with basements. The depth to bedrock, slope, and possible contamination of ground water are severe limitations for sanitary facilities. Blasting of bedrock is generally required for basements. Locating driveways across the slope reduces the angle of incline and erosion. Leach lines in septic tank effluent fields should be constructed across the slope to reduce seepage to the surface. Maintaining as much cover as possible on the site during construction reduces erosion.

The capability subclass is IIIe. The woodland suitability subclass is 3f.

DkD—Dekalb loam, 15 to 25 percent slopes. This moderately deep, well drained, moderately steep soil is in narrow bands around the upper part of hillsides, on knolls, and along drainageways. Most areas have smooth or convex slopes and range from 5 to 40 acres.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 17 inches thick. The substratum is yellowish brown, very friable very channery sandy loam. Hard, fine and medium grained sandstone bedrock is at a depth of about 28 inches.

Included with this soil in mapping are a few areas of the deeper, more productive Richland soils on the lower parts of hillsides and in coves. Also included are a few areas of severely eroded soils, shallow soils, very stony soils, and rock outcrop near slope breaks. Included soils make up about 15 percent of most areas.

Permeability is rapid or moderately rapid in this Dekalb soil. The available water capacity is very low, and the soil is droughty. Runoff is rapid from cultivated areas. The soil dries rapidly after rains. Sandstone fragments are common in the surface layer, and the content generally increases with increasing depth to about 80 percent by volume in the substratum. Potential frost action and the shrink-swell potential are low. The root zone is moderately deep over sandstone bedrock. In unlimed areas, reaction in the root zone is strongly acid or very strongly acid.

Most of the acreage is pasture and cropland. A smaller acreage is wooded. The soil potential is medium for cultivated crops, small grain, hay, pasture, trees, and woodland and openland wildlife habitat and low for building site development and sanitary facilites.

This soil is suited to pasture and long-term hay crops and to small grain and occasional cultivated crops if the hazard of erosion is controlled and careful management is used. A commonly used rotation includes sod crops about three-fourths of the time. Deep-rooted legumes are difficult to maintain in many areas. In summer the very low available water capacity results in droughtiness, which reduces yields of corn, pasture, and late cuttings of hay. Seeding early in spring avoids summer droughtiness. The soil is especially well suited to grazing and planting early in spring. If the soil is plowed for reseeding, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Plowing or other deep tillage is difficult on included areas of shallow and very stony soils. Conserving moisture and controlling erosion are the major concerns of management. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Because nutrients are rapidly leached, the soil generally responds better to smaller but more frequent or timely additions of fertilizer than to one large application.

This soil is suited to trees. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting is difficult on included very stony areas because of rock fragments in and on the surface. Mowing reduces plant competition. Drought-tolerant species should be planted.

The moderately steep slope, bedrock at a depth of 20 to 40 inches, and possible pollution of ground water are severe limitations for buildings and sanitary facilities. Maintaining as much cover as possible on the site during construction reduces erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 3f.

DkE—Dekalb loam, 25 to 40 percent slopes. This moderately deep, steep, well drained soil is on hillsides, on knolls, and along small drainageways. Most areas have smooth slopes and range from 10 to 50 acres.

Typically, the surface layer is very dark grayish brown, very friable loam about 2 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 17 inches thick. The substratum is yellowish brown, very friable very channery sandy loam. Hard fine and medium grained sandstone bedrock is at about 28 inches.

Included with this soil in mapping are small areas of the deeper Richland soils on the lower part of hillsides and in coves. Also included are a few rock outcrops and areas of stony soils. Included soils make up about 20 percent of most areas.

Permeability is moderately rapid or rapid in this Dekalb soil. The available water capacity is very low. The soil is droughty. Runoff is very rapid when the plant cover is removed. The root zone is moderately deep over sandstone bedrock. The potential frost action and shrink-swell potential are low. Unless the soil has been limed, reaction in the root zone is very strongly acid or strongly acid.

Most areas are pasture and woodland. The potential is medium for pasture, trees, and woodland wildlife habitat. It is low for cultivated crops, small grain, hay, sanitary facilities, and building site development.

This soil is suited to permanent pasture. Areas where slopes are smooth are suited to hay. Early in spring the soil dries and is well suited to grazing. The slope limits the use of equipment. If the soil is plowed for reseeding, the hazard of erosion is very severe. Conserving moisture and controlling erosion are major concerns of management. Reseeding by trash mulch or no-till seeding or with companion crops or cover crops reduces the hazard of erosion. Deep-rooted legumes are difficult to maintain in many areas. Proper stocking, pasture rotation, and mowing for weed control are needed to maintain a good stand of key forage plants. Because nutrients are rapidly leached, the soil generally responds better to smaller but more frequent or timely applications of fertilizer than to one large application.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces the hazard of erosion. Mechanical planting and mowing to reduce plant competition are very difficult because of the steep slopes and the included stony areas and sandstone rock outcrops. Coves and north- and east-facing slopes are the best woodland sites. They have cooler temperatures and more water available for growth because they have less exposure to the sun and the prevailing winds. Drought-tolerant species should be planted.

The steep slope, bedrock at a depth of 20 to 40 inches, and possible pollution of ground water are severe limitations for buildings and sanitary facilities. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIe. The woodland suitability subclass is 3f.

DmF—Dekalb moderately channery loam, 40 to 70 percent slopes. This moderately deep, very steep, well drained soil is mainly in long narrow bands around hillsides. A few areas are wide. High massive sandstone bedrock escarpments are generally at the midslope or near the uppermost part of slopes. Boulders are below these escarpments. The surface layer contains 15 to 30 percent flat sandstone fragments. Considerable mixing of rock and soil material through downslope movement

occurs on long slopes. Most areas range from 5 to 100 acres.

Typically, the surface layer is very dark grayish brown and brown, friable moderately channery loam about 5 inches thick. The subsoil is yellowish brown, friable channery loam and very channery loam about 16 inches thick. The substratum is yellowish brown, very friable very channery sandy loam. Hard, fine and medium grained sandstone bedrock is at a depth of about 25 inches.

Included with this soil in mapping are a few areas of the deeper Richland soils, generally in coves, on narrow benches, and on the lower part of long slopes. Also included are high massive sandstone bedrock escarpments and areas of very bouldery soils. Included areas make up about 20 percent of most areas.

Permeability is rapid or moderately rapid in this Dekalb soil, and available water capacity is very low. The soil is droughty. Runoff is very rapid. Potential frost action and shrink-swell potential are low. The root zone is moderately deep over sandstone bedrock. Unless the soil has been limed, reaction in the root zone is strongly acid or very strongly acid.

Most areas are used for woodland and woodland wildlife habitat. Some areas that were cleared pasture are reverting to woodland. The potential is medium for trees and woodland wildlife habitat. It is low for crops, pasture, sanitary facilities, and building site development.

The very steep slope, droughtiness, and included areas of bedrock escarpments and boulders severely limit use for pasture and hay.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and more water available for growth because they have less exposure to the prevailing winds and the sun. The very steep slope severely limits equipment use. Drought-tolerant species should be planted.

This soil is very poorly suited as a site for buildings and sanitary facilities. Many areas are scenic lookout points and have potential for some kinds of recreation use. Trails should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIIe. The woodland suitability subclass is 3f.

Dp—Dumps. This unit consists of nonsoil fill materials that include bricks, concrete, cinders, gravel, industrial wastes, rocks, stones, and trash. A few areas near coal-fired electric generating plants are almost entirely fly ash. This unit is nearly level to very steep. It is barren in most places, but a few reclaimed areas where a 12- to 18-inch blanket of soil material is on the surface support some vegetation. Most areas are 2 to 10 acres.

This unit commonly has poor physical characteristics for plant growth. The organic matter content and available water capacity are very low. Fly ash, however, has a low or moderate available water capacity and is neutral to moderately alkaline.

Areas, especially on fly ash, should be reclaimed with a blanket of suitable soil material to reduce the hazards of ground water pollution and erosion. Soil material used for cover should be seeded with grasses or planted to trees that can tolerate a very low available water capacity.

Some areas could be developed for such uses as recreation, parking lots, and openland wildlife habitat. Onsite investigation, however, is needed to determine suitability.

No capability subclass or woodland suitability subclass is assigned.

Ds—Dumps, mine. This unit consists mostly of steep and very steep ridges or cone-shaped piles of waste material from deep coal mining. The material is quite variable but is mostly soft, impure coal and black, carbonaceous (roof) shale that originally contained a relatively high content of sulfur compounds. The material is locally referred to as mine gob, gob, or gob piles. Some areas have burned or have oxidized with time and consist of hard, red to gray, shaly or gravelly material referred to locally as "red dog." Slopes are mostly steep or very steep but in a few areas have graded tops that are nearly level to strongly sloping.

This material was acid when mined. Oxidized material, or red dog, is medium acid to neutral. Both burned and unburned material has poor physical properties for plant growth, and most areas are barren. A few of the larger areas have been covered with soil material and support plants. Mine gob has a high content of organic carbon but is very low in the type of organic matter characteristic of natural soils. Oxidized material is very low in organic carbon and does not have organic matter. Both materials have a low or very low available water capacity. Water percolating through the extremely acid material is a source of local stream pollution in many areas.

Abandoned areas should be reclaimed to prevent erosion, sedimentation, and acid drainage. Soil material used to cover these areas should be seeded with grasses or planted with trees that tolerate a fairly low available water capacity and acid conditions.

Some areas could be developed as openland habitat. Red dog is a source of surface material for many township roads and private driveways.

No capability subclass or woodland suitability subclass is assigned.

DuB—Duncannon-Urban land complex, 0 to 15 percent slopes. This map unit consists of deep, nearly level to strongly sloping, well drained Duncannon soil and Urban land on stream terraces. Slopes are dominantly 0 to 8 percent. Most areas range from 5 to 100 acres.

Areas of this unit are about 55 percent Duncannon silt loam and 40 percent Urban land. Areas of Duncannon soil and Urban land are so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Duncannon soil is brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown and brown, friable silt loam about 39 inches thick. The substratum to about 95 inches is yellowish brown, friable silt loam. In some places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soil that identification is not feasible.

Included in mapping are areas of moderately well drained Otwell soils that have a perched seasonal high water table above a compact fragipan in the lower part of the subsoil. Also included are a few moderately steep, short slope breaks between terrace levels. A few areas of nearly level Duncannon soils are not mixed with areas of Urban land. Included soils make up 5 to 10 percent of most areas.

Permeability in the Duncannon soil is moderate. Depth to the seasonal high water table is 36 to 72 inches. Runoff is slow to rapid, depending on the slope. Available water capacity is moderate or high. Potential frost action is high. The shrink-swell potential is low. Unless the soil has been limed, reaction in the topsoil and subsoil is medium acid or strongly acid.

The Duncannon soil is used for building sites, lawns, and gardens. The potential is high for lawns, vegetable and flower gardens, shrubs, trees, most recreation uses, sanitary facilities, and building site development.

This Duncannon soil is well suited to lawns, vegetable and flower gardens, shrubs, and trees. Erosion is a hazard on slopes of 3 to 15 percent. The surface layer is easy to till but crusts after hard rains. Adding organic material and using cover crops increase the rate of water infiltration and reduce crusting and the risk of erosion. The included spots of cut and fill land are not well suited to lawns and gardens because subsoil material that is exposed is very low in organic matter.

Even though some seasonal wetness and, in some areas, slope are limitations, the Duncannon soil is well suited as a site for buildings, most sanitary facilities, lawns, and recreation. Local roads and streets can be improved by providing a suitable base material to overcome the risk of damage from frost action.

The capability subclass is IIIe for the Duncannon soil. No woodland suitability subclass is assigned for the Duncannon soil. No capability subclass or woodland suitability subclass is assigned for Urban land.

EbB—Elba silty clay loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on smoothly rounded ridgetops and knolls. Most areas on ridgetops are long and about 75 to 200 feet wide. Individual areas range from 3 to 20 acres.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable silty clay loam, the middle part is yellowish brown and brown, firm silty clay, clay, and channery silty clay, and the lower part is light yellowish brown, friable silty clay loam. The substratum is dark gray, firm channery silty clay loam and very channery silty clay loam. Hard gray limestone bedrock is at about 54 inches. The zone immediately above the bedrock is mottled.

Included with this soil in mapping are areas of the moderately well drained Lowell soils, which are more acid in the upper part of the subsoil than this Elba soil. Included soils make up about 15 percent of most areas.

Permeability is slow, and the available water capacity is moderate. Runoff is medium in cultivated areas. The shrink-swell potential is high. Potential frost action is moderate. Reaction is medium acid to mildly alkaline in the upper part of the subsoil and neutral to moderately alkaline in the lower part.

Most areas are used for cultivated crops, small grain, hay, and pasture. The potential is high for all these uses. The potential is medium for trees and for building site development, and it is low for most sanitary facilities.

This soil is suited to cultivated crops and small grains and to grasses and legumes for hay and pasture. It is well suited to deep-rooted legumes, such as alfalfa. Controlling erosion and maintaining tilth and organic matter content are concerns of management. The silty clay loam surface layer is sticky when wet and hard when dry. It crusts after hard rains. Conservation tillage, which leaves crop residue on the surface; grasses and legumes in the cropping system; incorporating crop residue into the plow layer; and cover crops, contour tillage, and stripcropping reduce the hazard of erosion and help to maintain tilth and organic matter content. Tilling within the optimum moisture range helps to prevent compaction and clodding.

This soil is suited to pasture. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding methods reduces erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and openland and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible on this soil. Use of equipment is moderately limited by the silty clay loam surface layer, which is soft and slippery when wet.

This soil can be used as a site for buildings if foundations and footings are designed to prevent structural damage caused by the shrinking and swelling of the soil. Foundations and footings should be backfilled with material lower in clay content than the subsoil of this soil. The hard bedrock at a depth of 40 to 80 inches

hinders excavation for basements in some areas. Local roads can be improved by providing a suitable base material. The slow permeability, high clay content in the subsoil, and depth to bedrock are severe limitations for most sanitary facilities.

The capability subclass is IIe. The woodland suitability subclass is 3c.

EbC—Elba silty clay loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on rounded ridgetops, knolls on hilltops, and benches on hillsides. The ridges are commonly smoothly rounded, and areas on hillsides are generally even and uniform. Most areas range from 3 to 30 acres.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is yellowish brown and brown, firm silty clay loam, silty clay, and clay about 36 inches thick. The substratum is dark gray, firm channery silty clay loam. Hard, gray limestone bedrock is at about 54 inches.

Included with this soil in mapping are areas of the moderately well drained Lowell soils and Westmore soils, which have more silt and less clay in the upper part of the soil than this Elba soil has. Those soils are more acid in the upper part of the soil. They are in saddles and at the center of wide ridgetops. Included soils make up about 20 percent of most areas.

Permeability is slow in this Elba soil. Runoff from cultivated areas is rapid. The available water capacity is moderate. The shrink-swell potential is high, and potential frost action is moderate. Reaction is medium acid to mildly alkaline in the upper part of the subsoil and neutral to moderately alkaline in the lower part.

Most areas are used for cultivated crops, hay, and pasture. The potential is high for hay, pasture, and openland and woodland wildlife habitat and medium for cultivated crops, small grain, and trees. It is low for sanitary facilities and medium to low for building site development.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay and pasture. It is well suited to deep-rooted legumes, such as alfalfa. If it is cultivated or the protective cover removed, the erosion hazard is severe. Controlling erosion and maintaining tilth and organic matter content are concerns of management. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, cover crops, crop residue for mulch, contour stripcropping, and grassed waterways reduce the hazard of erosion and help to maintain tilth and organic matter content. The silty clay loam surface layer is sticky when wet and hard when dry. Tilling within the optimum moisture range helps to prevent compaction and clodding.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and to openland and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces runoff and erosion. Mechanical planting and mowing to reduce plant competition are possible even though the silty clay loam surface layer is soft and slippery when wet.

This soil is poorly suited as a site for sanitary facilities because of slow permeability, high clay content in the subsoil, and bedrock at a depth of 40 to 80 inches. The hard bedrock hinders excavation in some areas. The soil can be used as a site for buildings if foundations and footings are designed to prevent structural damage caused by the shrinking and swelling of the soil. Foundations and footings should be backfilled with material lower in clay content than the subsoil of this soil. Local roads can be improved by providing a suitable base material.

The capability subclass is IIIe. The woodland suitability subclass is 3c.

EbD—Elba silty clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on hillsides and on knolls on ridgetops. A few areas are on bench-like bands around hillsides bounded above and below by steeper soils. Areas are mainly long and narrow on benches and circular knolls on ridgetops. Most areas range from 10 to 100 acres.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is yellowish brown and brown, firm silty clay loam, silty clay, and clay about 36 inches thick. The substratum is dark gray, firm channery silty clay loam. Hard, gray limestone bedrock is at a depth of about 54 inches.

Included with this soil in mapping are areas of moderately well drained Lowell soils that are more acid in the upper part than this Elba soil. The moderately well drained Brookside soils are included in concave areas and in narrow bands near the lower portion of hillsides and benches. Included soils make up about 20 percent of most areas.

Permeability is slow in this Elba soil. Runoff from cultivated areas is very rapid. The available water capacity is moderate. Potential frost action is moderate. The shrink-swell potential is high. Reaction is medium acid to mildly alkaline in the upper part of the subsoil and neutral to moderately alkaline in the lower part.

Most areas are used for pasture and crops. The potential is high for pasture and hay and medium for crops and trees. It is low for sanitary facilities and building site development.

This soil is suited to occasional row crops in rotations with small grain and hay if no-till management is used. It

is also suited to long-term hay and is well suited to deep-rooted legumes, such as alfalfa. Controlling erosion and maintaining tilth and organic matter content are the concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, incorporating crop residue into the plow layer, grassed waterways, and cover crops reduce erosion and improve tilth. The silty clay loam surface layer is sticky when wet and hard when dry. Tilling within the optimum moisture range helps to prevent soil compaction and crusting.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is very severe. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limited grazing in winter and other wet periods helps to prevent soil compaction.

This soil is also suited to trees and woodland wildlife habitat. Locating logging roads and skid trails on the contour where practical reduces erosion. The use of equipment is severely limited because the silty clay loam surface layer is soft and slippery when wet. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for growth and cooler temperatures because they have less exposure to the prevailing winds and the sun. Mechanical planting and mowing to reduce plant competition are possible.

This soil is poorly suited as a site for sanitary facilities and buildings because of slow permeability, moderately steep slopes, high shrink-swell potential, and high clay content in the subsoil. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 3c.

EbE—Elba silty clay loam, 25 to 40 percent slopes. This deep, well drained, steep soil is mainly in bands on hillsides. A few areas are on rounded knolls on hilltops. The slopes are generally uniform. A few irregularities are at hillside slips in areas where the bedrock is calcareous shale. Most areas range from 5 to 100 acres.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is yellowish brown and brown, firm silty clay loam, silty clay, and clay about 34 inches thick. The substratum is dark gray, firm channery silty clay loam. Hard, gray limestone bedrock is at about 48 inches.

Included with this soil in mapping are areas of the moderately well drained Lowell soils, which are more acid in the upper part of the soil than this Elba soil. The moderately well drained Brookside soils are included in concave areas and in areas near the base of longer slopes. They are subject to hillside slippage. Included soils make up about 20 percent of most areas.

Permeability in this Elba soil is slow. Runoff is very rapid if the plant cover is removed. The available water capacity is moderate. Reaction is medium acid to mildly alkaline in the upper part of the subsoil and neutral to moderately alkaline in the lower part.

About half the acreage is used for pasture and hay. The rest is mostly woodland and woodland wildlife habitat. The potential is low for small grain, cultivated crops, sanitary facilities, and building site development. It is medium for trees and permanent hay and pasture.

This soil is suited to pasture. Smooth slopes are suited to perennial grasses and legumes for hay, but steep slopes limit the use of equipment. The soil is well suited to deep-rooted legumes, such as alfalfa. If the soil is overgrazed or cultivated for seedbed preparation, the hazard of erosion is very severe. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limited grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Laying out logging roads and skid trails on the contour where practical reduces erosion. Planting and mowing to reduce plant competition is generally not practical because of the steep slopes and silty clay loam surface layer. Coves and north- and east-facing slopes are the best woodland sites. These sites have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

The steep slopes, slow permeability, high shrink-swell potential, and high clay content in the subsoil are severe limitations for buildings and sanitary facilities. Areas where bedrock is calcareous shale are very poorly suited as sites for buildings because of the susceptibility to hillside slippage. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIe. The woodland suitability subclass is 3c.

ElB—Elkinsville silt loam, 3 to 8 percent slopes. This gently sloping, deep, well drained soil is on terraces. Some terraces are low, well defined stream terraces along the larger streams. Others are in high level positions as much as about 300 feet above the main streams. Slopes are typically smooth or convex with irregularities along some small drainageways. Most areas range from 3 to 10 acres.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown and brown, friable silt loam and silty clay loam about 47 inches thick. The substratum to 68 inches is yellowish brown, friable loam.

Included with this soil in mapping are small areas of somewhat poorly drained Fitchville soils, mainly in narrow bands adjacent to slope breaks to the uplands.

These soils receive runoff and seepage water from adjacent higher lying soils.

Permeability is moderate in this Elkinsville soil. The available water capacity is very high. In cultivated areas, runoff is medium. The shrink-swell potential is moderate. Potential frost action is high. Unless the soil has been limed, reaction in the subsoil is medium acid to very strongly acid.

Most areas are cropland and building sites. The potential is high for cultivated crops, small grain, hay, pasture, trees, building sites, and most sanitary facilities.

This soil is well suited to corn, small grain, grasses and legumes for hay, and many specialty crops. Deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas. The soil can be tilled early in spring. There is, however, a frost hazard because of poor air drainage. Cultivated crops can be grown year after year if the hazard of erosion is controlled. The erosion hazard is moderate if the soil is cultivated or the protective cover is removed. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, cover crops, and contour tillage reduce the erosion hazard. Most slopes are short, but the few long slopes are suited to contour stripcropping. The surface layer crusts after hard rains. Tilling within the optimum range of moisture content helps to prevent soil compaction. The soil is suited to irrigation if the hazard of erosion is controlled.

This soil is suited to pasture. If it is overgrazed or plowed to prepare seedbeds, the hazard of erosion is moderate. Reseeding with companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is well suited to trees, but only a very small acreage is used for woodland. Mechanical planting and mowing to reduce plant competition are possible.

This soil is well suited as a site for buildings, sanitary facilities, and recreation uses. The moderate shrink-swell potential can be overcome by proper design and installation. Local roads and streets can be improved by providing a suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 1o.

EIC—Elkinsville silt loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is mainly on stream terraces. Some areas are in high level coves and benches near the heads of upland drainageways. Most are dissected by one or more small drainageways. Steeper slopes are near the drainageways. Slopes are generally even to convex. Areas range from 3 to 20 acres.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown and brown, friable silt loam and silty clay loam about 47 inches thick. The substratum to about 68 inches is yellowish brown, friable loam.

About 10 percent of some areas is included spots of severely eroded Elkinsville soils that have a yellowish brown surface layer. Those severely eroded soils have poor tilth, crust and puddle easily, and are hard to protect from further erosion. Also included are small areas of moderately well drained Otwell soils, which have a very slowly permeable fragipan in the lower part of the subsoil. Otwell soils make up about 15 percent of most areas.

Permeability is moderate in this Elkinsville soil, and available water capacity is very high. In cultivated areas, runoff is rapid. The shrink-swell potential is moderate. The potential frost action is high. Unless the soil has been limed, reaction in the root zone is medium to very strongly acid.

Most areas are used for hay and pasture and to a lesser extent for cultivated crops. The potential is high for cultivated crops, hay, pasture, and trees, and medium for sanitary facilities and building site development.

This soil is well suited to corn and small grain and to grasses and legumes for hay. Stands of deep-rooted legumes are difficult to maintain. Smooth, even slopes are better suited to cultivated crops than dissected, uneven slopes. If the soil is cultivated or the protective cover is removed, the erosion hazard is severe. Controlling erosion and maintaining tilth and organic matter content are concerns of management. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, contour stripcropping, cover crops, grassed waterways, and crop residue for mulch reduce the erosion. In some areas diversions are needed. The surface layer crusts after hard rains. Tilling within the optimum range of moisture content reduces compaction.

This soil is suited to pasture. If it is overgrazed or plowed to prepare seedbeds, the hazard of erosion is severe. Reseeding with companion crops or cover crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is well suited to trees, but only a small acreage is used for woodland. Mechanical planting and mowing to reduce plant competition are possible.

This soil is suitable as a site for buildings and most sanitary facilities if good design and installation are used. Slope, high potential frost action, low strength for roads, and moderate shrink-swell potential are the main limitations. Local roads can be improved by providing a suitable base material. Leach lines in septic tank absorption fields should be constructed across the slope

to reduce seepage of the effluent to the surface. Maintaining as much cover as possible on the site during construction reduces the risk of erosion.

The capability subclass is IIIe. The woodland suitability subclass is 1o.

EID—Elkinsville silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is in narrow bands between stream terraces and flood plains. Some areas are in higher positions on benches and in coves near the heads of upland drainageways. The cove-like areas are generally dissected by drainageways. Slopes are steeper near the drainageways and not so steep on crests between drainageways. Most areas range from 5 to 25 acres.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown and brown, friable silt loam and silty clay loam about 47 inches thick. The substratum to about 68 inches is yellowish brown, friable loam.

Included with this soil in mapping are spots of Otwell soils on the less sloping parts of areas. Otwell soils have a very slowly permeable fragipan in the lower part of the subsoil. Also included are spots and narrow bands of severely eroded soils that have a yellowish brown surface layer and poor tilth. They are less productive than this Elkinsville soil. Stone fragments up to 6 inches in length are at the surface in bench and cove positions below hillsides. Included soils make up 15 to 25 percent of most areas.

Permeability is moderate in this Elkinsville soil, and available water capacity is very high. In cultivated areas, runoff is very rapid. The shrink-swell potential is moderate. Potential frost action is high. Unless the soil has been limed, reaction in the root zone is medium acid to very strongly acid.

Most areas are used for hay and pasture and to a lesser extent for cultivated crops. The potential is high for hay, pasture, trees, and woodland wildlife habitat. It is medium for cultivated crops and low for sanitary facilities and building site development.

This soil is better suited to hay, pasture, and small grain than to cultivated crops. Row crops can be grown occasionally in rotations with grasses and legumes if the hazard of erosion is controlled and good management is used. A commonly used rotation includes cultivated crops about one-fourth the time. In areas dissected by drainageways, the small irregular shaped tracts are very poorly suited to cultivated crops. If the soil is cultivated or the protective cover is removed, the erosion hazard is very severe. Controlling erosion and maintaining tilth and organic matter content are concerns of management. Contour stripcropping, conservation tillage, which leaves crop residue on the surface, diversions, and grassed waterways reduce runoff and erosion in cultivated areas. Planting winter cover crops, mulching with manure, leaving crop residue on the surface during winter, including grasses and legumes in the cropping system, and incorporating crop residue into the plow layer also reduce erosion and help to maintain tilth.

This soil is suited to pasture. Deep rooted legumes are difficult to maintain in many areas. If the soil is overgrazed or plowed to prepare seedbeds, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible. North- and east-facing slopes provide the best woodland sites. These sites have cooler temperatures and have more moisture available for growth because they have exposure to the prevailing winds and the sun.

This soil is severely limited as a site for buildings and most sanitary facilities because of the slope. Maintaining as much cover as possible on the site during construction reduces erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 1r.

FbB—Fairpoint gravelly clay loam, 0 to 8 percent slopes. This nearly level to gently sloping, deep, well drained soil is on mine spoil ridges and in concave basin-like areas between ridges in areas surface mined for coal. Ridge crests are gently rounded and have smooth slopes. On some ridges, rills and small gullies have formed near slope breaks. Some basins contain intermittent pools and do not have drainage outlets. This soil is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded siltstone, shale, sandstone, and limestone. Smaller amounts of coal and carbonaceous shale are in most areas. There are a few large stones at the surface and throughout the soil. Most areas are 5 to 20 acres.

Typically, the surface layer is light brownish gray, friable gravelly clay loam about 5 inches thick. The substratum to about 60 inches is light brownish gray, brown, and gray, firm gravelly clay loam.

About 15 percent of some areas is included areas of the more acid Bethesda soils, which commonly support only poor to fair stands of vegetation. Along some drainageways there are long narrow strips and spots of recently deposited, nongravelly sediment as much as 12 inches thick.

Permeability is moderately slow. Runoff is slow and medium. The available water capacity is low because of the high percentage of coarse fragments and the compactness of the material. The depth of the root zone

varies. Potential frost action and the shrink-swell potential are moderate. Unless the soil has been limed, the root zone is medium acid to neutral. The organic matter content is very low.

Most of the acreage is in grasses and legumes. The potential is low for crops, hay, and trees and medium for pasture. It is medium for building site development and low to medium for sanitary facilities.

This soil is generally very poorly suited to the commonly grown cultivated crops and small grain because of the variable depth of the root zone, the low available water capacity, and the very low organic matter content. The stone fragments on and in the surface layer prevent or seriously interfere with tillage.

Major problems in pasture management are the stone fragments on and in the surface layer and the low available water capacity. Maintaining a plant cover and surface mulch conserves moisture and reduces runoff and erosion. Most commonly grown forage plants are suited to this soil. Proper stocking and pasture rotation are needed to maintain an adequate stand. Limiting grazing in winter and other wet periods helps to prevent compaction. A water supply for livestock is not available in many areas, but potential reservoir sites are available.

This soil is suited to trees, but growth is generally slow because of the very low organic matter content, low available water capacity, and variable depth of the root zone. Grasses and legumes provide ground cover during the establishment of seedlings. The stones in and on the surface layer limit the use of planting and mowing equipment.

Once this soil has settled, it is moderately well suited as sites for buildings and most sanitary facilities. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff should be considered during the site investigation. The moderately slow permeability severely limits the use of this soil for septic tank absorption fields. Droughtiness is a limitation for lawns. Small stones seriously interfere with mowing and hinder excavation.

The capability subclass is VIs. No woodland suitability subclass is assigned.

FbD—Fairpoint gravelly clay loam, 8 to 25 percent slopes. This strongly sloping to moderately steep, deep, well drained soil is mainly on the sides of mine spoil ridges in areas surface mined for coal. Slopes are dominantly 8 to 18 percent and are generally smooth. Small gullies have formed in eroded areas. This soil is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded siltstone, shale, sandstone, and limestone. Smaller amounts of coal and carbonaceous (roof) shale are in most areas. There are a few stones at the surface and throughout the soil. Most areas are 10 to 50 acres.

Typically, the surface layer is light brownish gray, friable gravelly clay loam about 5 inches thick. The substratum to about 60 inches is light brownish gray, brown, and gray, firm gravelly clay loam.

Included with this soil in mapping are areas of the more acid Bethesda soils, which support poor to fair stands of vegetation. Included soils make up about 15 percent of some areas.

Permeability is moderately slow in this Fairpoint soil. The available water capacity is low because of the high content of coarse fragments and the compactness of the material. Runoff is very rapid. The depth of the root zone varies. Potential frost action and shrink-swell potential are moderate. The organic matter content is very low. Unless the soil has been limed, the root zone is medium acid to neutral.

Most of the acreage is in grasses and legumes. The potential is low for crops, hay, and trees and medium for pasture. It is medium to low for building site development and sanitary facilities.

This soil is generally very poorly suited to the commonly grown cultivated crops and small grain because of the variable depth of the root zone, the slope, the low available water capacity, and the very low organic matter content. Stone fragments on or in the surface layer prevent or seriously interfere with tillage. Erosion is a severe hazard if the soil is cultivated.

Major problems in pasture management are the stone fragments on and in the surface layer and the low available water capacity. Maintaining a plant cover and surface mulch conserves moisture and reduces runoff and erosion. Most commonly grown forage plants are suited to this soil. Pasture rotation and proper stocking are needed to maintain a good stand. Limiting grazing in winter and other wet periods helps to prevent soil compaction. Most areas provide potential reservoir sites for livestock water.

This soil is suited to trees, but growth is generally slow because of the very low organic matter content, low available water capacity, and variable depth of the root zone. Grasses and legumes provide ground cover during the establishment of seedlings. Stones in and on the surface layer limit the use of mowing equipment.

Once this soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings. Onsite investigation is needed. Thickness of the soil over bedrock and control of storm water runoff should be considered. Areas where slopes are 15 to 25 percent are severely limited as sites for buildings and sanitary facilities because of the slope and the slippage hazard. Because of the limited depth of the root zone, droughtiness is a limitation for lawns. Small stones interfere with mowing. The moderately slow permeability limits the use of this soil for septic tank absorption fields. As much cover as possible should be maintained on the site during construction.

The capability subclass is VIs. No woodland suitability subclass is assigned.

FcB—Fairpoint silty clay loam, 0 to 8 percent slopes. This deep, nearly level to gently sloping, well drained soil is on mine spoil benches and on narrow and broad mine spoil ridges in areas surface mined for coal. It has been reclaimed by grading and blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly subrounded siltstone, shale, and sandstone and some limestone, carbonaceous shale, and coal. In a few areas, shallow gullies have formed. Slopes are mostly smooth and convex. Most areas are 3 to 50 acres.

Typically, the surface layer is mixed brown and yellowish brown, firm silty clay loam about 8 inches thick. The substratum to about 60 inches is light brownish gray, brown, and gray, firm gravelly clay loam.

About 20 percent of most areas is included areas where the surface layer is channery silty clay loam. In these areas the hard, fine and medium grained sandstone fragments 3 to 6 inches long in the surface layer interfere with tillage. In some areas the surface has been covered with 18 to 30 inches of natural soil material. In these areas the soil has a higher available water capacity and is more productive than this Fairpoint soil.

Permeability is moderately slow in this Fairpoint soil, and runoff is slow and medium. The available water capacity is low because of the high content of coarse fragments and the compactness of the material in the substratum. The depth of the root zone is highly variable within short distances because of changes in the content of coarse fragments and the compactness of the substratum. Potential frost action and shrink-swell potential are moderate. Unless the soil has been limed, the root zone is medium acid to neutral.

Most of the acreage is used for hay. The potential is medium for crops, hay, pasture, and trees. It is medium to low for sanitary facilities and medium for building site development.

This soil is suited to corn, but it is better suited to small grain and hay because it is droughty. In cultivated areas, the hazard of erosion is moderate. No-till management is well suited to this soil. Included areas where the surface layer is thick can be plowed. Controlling the hazard of erosion, conserving moisture, and improving tilth and the organic matter content are management concerns. Grasses and legumes in the cropping system, contour stripcropping, cover crops, and conservation tillage, which leaves crop residue on the surface, reduce erosion, improve tilth, and increase organic matter content.

This soil is suited to pasture but is droughty during periods of low rainfall. If it is cultivated in preparing a seedbed or is overgrazed, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and frequent applications of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and wet periods helps to prevent soil compaction.

This soil is suited to trees and to openland and woodland wildlife habitat. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting and mowing to reduce plant competition are possible.

Once it has settled, this soil is moderately well suited as a site for buildings and most sanitary facilities. Onsite investigation is needed. Thickness of the soil over bedrock and control of storm water runoff should be considered during site investigation. Large stones in the soil hinder excavation. The moderately slow permeability severely limits the use of this soil for septic tank absorption fields. This soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods.

The capability subclass is IIIs. No woodland suitability subclass is assigned.

FcD—Fairpoint silty clay loam, 8 to 25 percent slopes. This strongly sloping and moderately steep, deep, well drained soil is mainly on the sides of graded mine spoil ridges in areas surface mined for coal. It has been reclaimed by grading and blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly subrounded siltstone, shale, and sandstone and some limestone, carbonaceous shale, and coal. Slopes are dominantly 8 to 18 percent. They are generally smooth and convex. Most areas range from 10 to 50 acres.

Typically, the surface layer is brown and yellowish brown, firm silty clay loam about 8 inches thick. The substratum to 60 inches is light brownish gray, brown, and gray, firm gravelly clay loam.

Included with this soil in mapping are areas of soils that have a channery silty clay loam surface layer. Also included are a few eroded areas where gullies 1 to 2 feet deep have formed. In some areas the surface has been covered with 18 to 30 inches of natural soil material. In these areas the available water capacity is higher and the soil is more productive than this Fairpoint soil. Included areas make up about 20 percent of most areas.

Permeability is moderately slow in this Fairpoint soil, and available water capacity is low. Runoff is rapid or very rapid. Potential frost action and the shrink-swell potential are moderate. The depth of the root zone varies within short distances because of changes in the content of coarse fragments and the compactness of the substratum. The root zone is medium acid to neutral unless the soil has been limed.

Most of the acreage is in grasses and legumes, but only a small percentage is grazed or harvested for hay.

The potential is medium for hay, crops, pasture, and trees. It is medium to low for building site development and sanitary facilities.

This soil is suited to small grain and hay. The cropping system can include corn if it is grown under no-till management. The hazard of erosion is severe if the soil is plowed for seedbed preparation. Including grasses and legumes in the cropping system, incorporating crop residue into the surface layer, and using contour stripcrops reduce the hazard of erosion and improve tilth and the organic matter content. Included areas that have been covered with 18 to 30 inches of soil material are well suited to crops. These areas can be used for cultivated crops about half the time if the hazard of erosion is controlled through good management.

This soil is suited to pasture but is droughty during periods of low rainfall because of the high content of rock fragments. Adequate ground cover increases the available water content by slowing runoff. All commonly grown forage plants are suited to this soil, but tall grasses and deep-rooted legumes generally produce higher yields. Reseeding with companion crops or cover crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. The soil is poorly suited to winter grazing because the silty clay loam surface layer compacts if grazed when wet.

This soil is suited to trees and woodland wildlife habitat. Trees selected for planting should tolerate the somewhat droughty conditions. Grasses and legumes provide ground cover to reduce erosion during the establishment of trees. Mechanical planting and mowing can reduce plant competition. Coves and north- and east-facing slopes are the best woodland sites. They have more moisture available for plant growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

Once the soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings. Onsite investigation is needed to determine suitability. Thickness 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 severely limited as sites for buildings and sanitary facilities because of the slope and the slippage hazard. The moderately slow permeability is also a limitation for septic tank absorption fields. Droughtiness is a limitation for lawns.

The capability subclass is IVs. No woodland suitability subclass is assigned.

FtA—Fitchville silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on smooth slopes on low stream terraces above the flood plain. Most areas are irregular in shape and range from 3 to 10 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is dark yellowish brown, mottled, firm silt loam and silty clay loam about 42 inches thick. The substratum to about 70 inches is dark yellowish brown, mottled, friable silt loam with pockets of loam and fine sandy loam.

Included with this soil in mapping are small areas of poorly drained soils in shallow depressions and along drainageways. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in this Fitchville soil. Surface runoff is slow. The available water capacity is high. The root zone is deep if the soil is adequately drained. A perched water table is at a depth of 12 to 30 inches in winter, spring, and other extended wet periods. In many places, wetness is partly caused by runoff and seepage from soils on adjacent slopes. The shrink-swell potential is moderate. Potential frost action is high. Unless the soil has been limed, reaction is medium acid to very strongly acid in the upper part of the root zone and medium acid to neutral in the lower part.

Most areas are farmed. The soil potential is high for cultivated crops, small grain, hay, pasture, and trees, and low to medium for sanitary facilities and building site development.

In drained areas this soil can be intensively cropped to corn, small grain, and hay. Yields are reduced in wet seasons. Subsurface drains are needed to lower the water table. Diversions are needed in areas where runoff from adjacent higher soils is received. Erosion is a moderate hazard on long slopes that are cultivated. Maintaining tilth and organic matter content are also concerns. Conservation tillage, which leaves crop residue on the surface, and incorporating crop residue into the plow layer reduce erosion and improve tilth. Tilling within the optimum range of moisture content reduces compaction.

In undrained areas the soil is suited to pasture but is poorly suited to grazing early in spring. It is suited to bluegrass, tall fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass. Deep-rooted legumes are difficult to maintain. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to keep the soil and pasture in good condition. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees, but only a small acreage is used for woodland. Trees selected for planting should be tolerant of wetness. Mechanical planting and mowing to reduce plant competition are possible on this soil.

Seasonal wetness and moderately slow permeability limit the use of this soil as sites for buildings and sanitary facilities. Drainage can be improved by subsurface drains and open ditches. Landscaping is needed on building sites to keep surface water away from the foundations. Local roads can be improved by providing artificial

drainage and a suitable base material. Excavation is limited during winter and spring because of wetness.

The capability subclass is IIw. The woodland suitability subclass is 2o.

He—Hartshorn silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains in narrow valleys near the headwaters of major streams. It is subject to occasional flooding. Most areas are 75 to 250 feet wide and 1/4 mile to 2 miles long. Most are 5 to 50 acres. The long narrow areas are commonly split into smaller farming tracts by meandering small streams. The slope range is 0 to 3 percent.

Typically, the surface layer is dark brown, very friable silt loam about 6 inches thick. The subsoil is brown and dark yellowish brown, friable silt loam about 18 inches thick. The substratum is dark yellowish brown, friable very gravelly sandy loam. Hard siltstone bedrock is at about 40 inches. In some areas the surface layer is gravelly loam.

Included with this soil in mapping are small areas where bedrock is at a depth of 24 to 40 inches. A few areas of somewhat poorly drained Newark Variant soils are commonly included in bands near slope breaks to uplands and in slight depressions and abandoned stream channels. Also included are a few gently sloping soils on alluvial fans on flood plains at the base of hillside drainageways. The soils on the alluvial fans are not flooded as frequently as is this Hartshorn soil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil and moderately rapid or rapid in the substratum in this Hartshorn soil. The available water capacity is low or moderate, depending on the depth to the substratum. Runoff is slow. The root zone is mainly moderately deep over sand and gravel. Potential frost action is moderate. The shrink-swell potential is low. Reaction in the root zone is medium acid to neutral.

Most areas are farmed. Corn and hay are the main crops. The potential is medium for cultivated crops, small grain, and hay. It is high for pasture and trees and low for building site development and sanitary facilities.

Larger tracts of this soil are suited to all the commonly grown crops, especially corn and midseason specialty crops. The soil can be cropped intensively under good management. The hazard of flooding and droughtiness, however, are limitations. Row crops can be planted and harvested during the nonflooding period in most years. Spring floods and frost are hazards to early season crops and specialty crops. The flood hazard and the wetness of the included Newark Variant soils delay planting in some years. Flooding and siltation significantly reduce yields of small grain and hay in some years. Maintaining tilth and organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, and tilling within the optimum range of moisture content reduce soil compaction. Some areas are narrow or are small and irregular in shape because of the meandering streams. These areas are poorly suited to row crops but are suited to pasture.

This soil is suited to grazing early in spring but is droughty in summer. It is well suited to deep-rooted grasses and legumes, but deep-rooted legumes are difficult to maintain in some areas. Scouring of the surface layer, deposition of sediment and flood debris, and crusting of the surface layer are hazards to seedings. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants.

This soil is suited to trees, but only a very small acreage is used for woodland. Seedlings grow well if competing vegetation is controlled. Planting, mowing to reduce competition, and woodland management practices are easily accomplished.

The hazards of flooding and pollution of ground water seriously limit the use of this soil as a site for buildings and sanitary facilities. The potential is good for such recreation uses as picnic areas, hiking trails, and golf fairways.

The capability subclass is IIw. The woodland suitability subclass is 1o.

LeB—Lowell silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops and on the crests of knolls on hilltops. Most areas on ridgetops are wide and have smooth, slightly rounded slopes with more nearly level areas at the center. Most areas are 3 to 20 acres.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, the middle part is strong brown, firm silty clay, and the lower part is yellowish brown, firm silty clay. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 50 inches.

Included with this soil in mapping are small areas of Westmore, Upshur, and Elba soils. Elba soils have a higher lime content and are on the crests of some ridges. Westmore soils have less clay in the upper part of the subsoil and are in saddles and near the center of wider ridgetops. The Upshur soils have a redder subsoil than this Lowell soil and are in bands around low knolls on hilltops. Included soils make up 10 to 15 percent of most areas.

Permeability is moderately slow, and runoff from cultivated areas is medium. Available water capacity is moderate. A perched seasonal water table is at a depth of 30 to 60 inches. The shrink-swell potential and potential frost action are moderate. In unlimed areas, reaction is medium acid to very strongly acid in the upper part of the root zone and strongly acid to neutral in the lower part.

Most areas are farmed. The potential is high for cultivated crops, small grain, pasture, and hay. It is

medium for trees and building site development and medium to low for most sanitary facilities.

This soil is well suited to cultivated crops and small grains and to grasses and legumes for hay. Stands of deep-rooted legumes, such as alfalfa, are difficult to maintain in some areas. Cultivated crops can be grown year after year if the hazard of erosion is controlled. The erosion hazard is moderate in cultivated areas. Controlling the hazard of erosion and maintaining tilth and the organic matter content are concerns. Conservation tillage, which leaves crop residue on the surface, incorporating crop residue into the plow layer, contour tillage, stripcropping, grassed waterways, grasses and legumes in the cropping system, and cover crops reduce erosion and improve tilth. Tilling within the proper range of moisture content reduces soil compaction.

This soil is suited to pasture. If it is overgrazed or plowed to prepare seedbeds, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, weed control, and timely application of lime and fertilizer are needed to maintain soil and pasture in good condition. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and openland and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible.

Even though the shrink-swell potential and seasonal wetness are limitations, this soil is suitable as a site for buildings, especially buildings without basements. The depth to hard bedrock hinders excavation of basements in many areas. The moderately slow permeability, seasonal wetness, and underlying bedrock are severe limitations for most sanitary facilities. Local roads can be improved by providing a suitable base material. This soil is well suited to such recreation uses as picnic areas and paths and trails.

The capability subclass is IIe. The woodland suitability subclass is 3c.

LeC—Lowell silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on side slopes and hillside benches. Some areas are on rounded ridgetops, low knolls on hilltops, and along small upland drainageways near divides. Slopes are typically smooth and are even to slightly convex. Individual areas range from 3 to 100 acres.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are yellowish brown and strong brown, firm silty clay mottled with grayish brown below 25 inches. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 50 inches.

About 10 to 30 percent of most areas is included small areas of Elba, Upshur, and Westmore soils. Elba soils have a higher lime content than does this Lowell soil and are on the crest of ridges and on slope breaks. Upshur soils have a redder subsoil than Lowell soil and are in thin bands around low knolls on hilltops. Westmore soils have less clay in the upper part of the the subsoil than Lowell soils have and are mostly in saddles and near the center of ridgetops. Also included are small areas of somewhat poorly drained soils in seep spots.

Permeability is moderately slow in this Lowell soil, and runoff from cultivated areas is rapid. A perched seasonal high water table is at a depth of 30 to 60 inches. The available water capacity is moderate. The shrink-swell potential and potential frost action are moderate. Unless the soil has been limed, reaction is medium acid to very strongly acid in the upper part of the root zone and neutral to strongly acid in the lower part.

This soil is used mainly for cultivated crops, hay, and pasture. A few small areas are wooded. The potential is high for cultivated crops, hay, pasture, and openland and woodland wildlife habitat. It is medium for trees and for building site development and low to medium for sanitary facilities.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay and pasture. Deep-rooted legumes, such as alfalfa, are difficult to maintain in some areas. If the soil is cultivated or the plant cover removed for other purposes, the erosion hazard is severe. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Seeding with a companion crop or cover crop reduces the erosion hazard. The soil is well suited to no-till management and contour stripcropping. Grassed waterways are commonly used where water concentrates in natural channels.

This soil is well suited to pasture. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces erosion. The soil compacts easily if it is grazed during wet periods.

This soil is suited to trees and openland and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible.

This soil is moderately well suited as a site for buildings without basements if special design and installation procedures are used. The slope, hard bedrock at a depth of 40 to 72 inches, seasonal wetness, moderate shrink-swell potential, and moderately slow permeability are limitations. Driveways and local roads and streets should be located across the slope to reduce erosion and the angle of incline. They can be improved by using a suitable base material. Leach lines in septic tank absorption fields should be constructed across the slope to reduce seepage of the effluent to the surface. Maintaining cover on the site as much as possible during construction reduces erosion.

The capability subclass is IIIe. The woodland suitability subclass is 3c.

LeD—Lowell silt loam, 15 to 25 percent slopes. This deep, moderately steep, moderately well drained soil is on hillsides, on knolls on ridgetops, and on bench-like bands around hillsides, bounded above and below by steeper soils. Areas on hillsides are mainly long and narrow, and those on knolls on ridgetops are rounded. Slopes are dominantly smooth. Most areas range from 10 to 100 acres.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay with mottles below about 25 inches. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 50 inches.

Included with this soil in mapping are areas of Culleoka, Upshur, and Brookside soils. The moderately deep Culleoka soils are commonly near slope breaks. The Upshur soils, which have redder subsoil than this Lowell soil, are in bands around knolls on hilltops. The deeper Brookside soils formed in colluvium in concave areas and near the lowest part of hillsides. They are subject to hillside slippage. Included soils make up 15 to 30 percent of most areas.

Permeability is moderately slow. A perched seasonal high water table is at a depth of 30 to 60 inches. Runoff from cultivated areas is very rapid. The available water capacity, shrink-swell potential, and potential frost action are moderate. In unlimed areas, reaction is medium acid to very strongly acid in the upper part of the root zone and neutral to strongly acid in the lower part.

Most areas are used for crops and pasture. Other areas are wooded. The potential is medium for cultivated crops, small grain, and trees and is high for pasture and hay. It is low for sanitary facilities and building site development.

This soil is suited to small grain and to grasses and legumes for hay. It is suited to cultivated crops in the cropping system if the hazard of erosion is controlled and careful management is used. A commonly used rotation includes cultivated crops one-fourth the time. Deep-rooted legumes are difficult to maintain in many areas. The erosion hazard is very severe in cultivated areas. Controlling erosion and maintaining tilth and organic matter content are concerns of management. No-till management, conservation tillage, which leaves crop residues on the surface, incorporating crop residue into the plow layer, contour stripcropping grasses and legumes in the cropping system, cover crops, and grassed waterways reduce the hazard of erosion and help maintain tilth and organic matter content. Tilling within the proper moisture range helps to prevent soil compaction.

This soil is suited to pasture but poorly suited to winter grazing. If the soil is overgrazed or plowed to prepare seedbeds the hazard of erosion is very severe. Reseeding by the trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing during wet periods helps to prevent soil compaction.

Even though the high clay content in the subsoil limits growth, this soil is suited to trees and woodland wildlife habitat. Locating logging roads and skid trails on the contour reduces erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun. Use of equipment is moderately limited because of the steep slopes, but mechanical planting and mowing to reduce plant competition are possible.

The moderately steep slopes, moderately slow permeability, some seasonal wetness, and bedrock at a depth of 40 to 72 inches severely limit the use of this soil as a site for buildings and sanitary facilities. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 3c.

LeE—Lowell silt loam, 25 to 40 percent slopes. This deep, well drained, steep soil is mainly on hillsides, but a few areas are on knolls on hilltops. Most areas are long and rather narrow. Slopes are mostly smooth. They tend to be slightly convex on the upper part of slopes and concave on the lower part. In a few areas, irregularities occur along drainageways. Most areas range from about 10 to 100 acres.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 46 inches.

Included with this soil in mapping are areas of somewhat poorly drained soils and Brookside soils. The somewhat poorly drained soils are around or downslope from seep spots. The deeper, moderately well drained Brookside soils, commonly in concave areas and at the base of longer slopes, are subject to hillside slippage. Included soils make up 10 to 20 percent of most areas.

Permeability is moderately slow, and runoff is very rapid. The available water capacity is moderate. The shrink-swell potential and potential frost action are moderate. Unless the soil has been limed, reaction is very strongly to medium acid in the upper part of the root zone and neutral to strongly acid in the lower part.

Most areas of this soil are in pasture and hay. Other areas are wooded. The potential is medium for hay, pasture, and trees. It is low for cultivated crops, small grain, sanitary facilities, and building site development.

This soil is suited to pasture. Smooth slopes are suited to perennial grasses and legumes for hay. The steep slopes limit the use of some kinds of farm equipment. The erosion hazard is very severe if the soil is overgrazed or plowed for seedbed preparation. Reseeding with a companion crop or the trash mulch or no-till methods reduces the erosion hazard. Stands of deep-rooted legumes, such as alfalfa, are difficult to maintain in some areas. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain the stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Locating logging roads and skid trails on the contour reduces erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have more water available for growth and cooler temperatures because they have less exposure to the drying effects of the prevailing winds and the sun. The steep slope limits the use of some mowing and planting equipment.

The steep slope severely limits the use of this soil as a site for buildings, sanitary facilities, and most recreation uses. Hillside slippage is also a hazard. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIe. The woodland suitability subclass is 3c.

LeF—Lowell silt loam, 40 to 70 percent slopes. This deep, well drained, very steep soil is commonly in long, rather narrow bands on hillsides. Most areas range from 50 to 100 acres.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 45 inches.

Included with this soil in mapping are areas of the deeper Brookside soils on concave areas at the base of long slopes. Included soils make up about 15 percent of most areas.

Permeability is moderately slow, and runoff is very rapid. The available water capacity is moderate. Shrink-swell potential and potential frost action are moderate. Unless the soil has been limed, reaction is medium acid to very strongly acid in the upper part of the root zone and strongly acid to neutral in the lower part.

Most areas are wooded. A few areas are unimproved pasture. The potential is medium for trees and low for crops, pasture, building site development, and sanitary facilities. It is high for woodland wildlife habitat.

This soil is poorly suited to pasture. Some areas previously used for pasture are reverting to brush and woodland. The slopes are too steep for commonly used mowing and fertilizing equipment.

This soil is suited to trees. Locating logging roads and skid trails on the contour reduces erosion. Logging is difficult, especially in areas where slopes are 60 to 70 percent. Plant competition can be reduced by girdling. Coves and north- and east-facing slopes are the best sites for woodland. These sites have more water available for growth and have cooler temperatures because they have less exposure to the sun and prevailing winds.

The slope and the hazard of hillside slippage severely limit the use of this soil as a site for buildings, sanitary facilities, and most recreation uses. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIIe. The woodland suitability subclass is 3c.

LoB—Lowell-Westmoreland silt loams, 3 to 8 percent slopes. This map unit consists of moderately well drained Lowell soil and well drained Westmoreland soil on wide, gently rounded ridgetops. These deep, gently sloping soils mainly have smooth and even to convex slopes. Most areas are 2 to 20 acres. Areas of this unit are about 45 percent Lowell silt loam and 35 percent Westmoreland silt loam. Areas of the two soils are so intricately mixed or are so small that mapping them separately is not practical.

Typically, the surface layer of the Lowell soil is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are yellowish brown and strong brown, firm silty clay with mottles below about 25 inches. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 50 inches.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Included with these soils in mapping are areas of Culleoka and Westmore soils. Westmore soils are near the center of ridgetops and in saddles. They are more silty in the upper part than Lowell and Westmoreland soils. The moderately deep Culleoka soils are commonly near slope breaks.

Permeability is moderately slow in the Lowell soil and moderate in the Westmoreland soil. Depth to the seasonal high water table is 30 to 60 inches in the Lowell soil and 36 to 72 inches in the Westmoreland soil. Runoff from cultivated areas is medium. The available water capacity is moderate in both soils. The

shrink-swell potential is moderate in the Lowell soil and low in the Westmoreland soil. Potential frost action is moderate in both soils. Unless the soil has been limed, reaction in the root zone of the Westmoreland soil is medium acid to very strongly acid. Reaction is medium acid to very strongly acid in the upper part of the root zone of the Lowell soil and neutral to strongly acid in the lower part.

Almost all areas are cropland. The potential is high for cultivated crops, small grain, and pasture. The potential is high for building site development in the Westmoreland soil and is medium in the Lowell soil. It is medium for sanitary facilities in the Westmoreland soil and medium to low in the Lowell soil.

These soils are suited to cultivated crops and small grain and to grasses and legumes for hay and pasture. Cultivated crops and small grain can be grown year after year if conservation practices are used. The erosion hazard is moderate in cultivated areas. Controlling erosion and maintaining tilth and organic matter are concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, grassed waterways, cover crops, and crop residue for mulch reduce erosion and help to maintain tilth and organic matter content. Tilling within the optimum moisture range reduces soil compaction.

These soils are suited to pasture. If they are overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

These soils are suited to trees and to openland and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible.

The Westmoreland soil is better suited as a site for buildings than the Lowell soil because the Lowell soil is slightly wetter, has moderately slow permeability, and has a moderate shrink-swell potential in the clayey subsoil. The depth to hard bedrock in both soils hinders excavation in many areas. Foundations in the Lowell soil should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Footing drains and exterior wall coatings are commonly used to help prevent wet basements in homes constructed on the Lowell soil. Local roads on both soils can be improved by providing a suitable base material. Both soils are well suited to such recreation uses as paths and trails and picnic areas.

The capability subclass is IIe. The woodland suitability subclass is 3c for the Lowell soil and 2o for the Westmoreland soil.

LoC—Lowell-Westmoreland silt loams, 8 to 15 percent slopes. This map unit consists of moderately well drained Lowell soil and well drained Westmoreland soil on rounded ridgetops, knolls, and to a lesser extent, on side slopes. These deep, strongly sloping soils are mainly on smooth, even or slightly convex slopes. Areas on ridgetops and side slopes are dominantly long and narrow; those on knolls are rounded. Most areas range from 5 to 100 acres.

Most areas are about 45 percent Lowell silt loam and 35 percent Westmoreland silt loam; the Westmoreland soil, however, is dominant in some areas. Areas of the two soils are so intricately mixed or are so small that mapping them separately is not practical.

Typically, the surface layer of the Lowell soil is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay with mottles below about 25 inches. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 50 inches.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Included with these soils in mapping are areas of Culleoka soils and Westmore soils. The moderately deep Culleoka soils are mainly on slope breaks and near ridge crests. Westmore soils are more silty in the upper part than Lowell and Westmoreland soils and are typically on less sloping areas near the center of ridgetops and saddles. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Lowell soil and moderate in the Westmoreland soil. Depth to the seasonal high water table is 30 to 60 inches in the Lowell soil and 36 to 72 inches in the Westmoreland soil. Runoff from cultivated areas is rapid. The available water capacity is moderate in both soils. The shrink-swell potential is moderate in the Lowell soil and low in the Westmoreland soil. Potential frost action is moderate in both soils. In unlimed areas, reaction is very strongly acid to medium acid in the root zone of the Westmoreland soil. Reaction in the Lowell soil is very strongly acid to medium acid in the upper part of the root zone and strongly acid to neutral in the lower part.

Most areas are farmed. The potential is high for cultivated crops, small grain, hay, pasture, and openland and woodland wildlife habitat. It is medium for building site development and medium to low for sanitary facilities. It is medium for trees in the Lowell soil and high in the Westmoreland soil.

These soils are suited to cultivated crops and small grain and to grasses and legumes for hay (fig.7). If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Deep-rooted legumes may be difficult to maintain. The erosion hazard is severe in cultivated areas. Controlling erosion and maintaining tilth and the organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, returning crop residue, contour stripcropping, cover crops, and grassed waterways reduce the hazard of erosion and help to maintain tilth and organic matter content. Tilling within the optimum range of moisture content helps to prevent soil compaction.

These soils are suited to pasture. If they are overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by the trash mulch or no-till methods or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

Figure 7.—Lowell-Westmoreland silt loams, 8 to 15 percent slopes, are suited to pasture, row crops, and hay.

These soils are suited to trees and woodland wildlife habitat. Locating logging roads and skid trails on the contour, if practical, reduces erosion. Mechanical planting and mowing to reduce plant competition are possible on these soils.

Even though the slope of the Westmoreland soil is a limitation, the Westmoreland soil is better suited as a site for buildings and sanitary facilities than the Lowell soil. Limitations in the Lowell soil are moderately slow permeability, slope, seasonal wetness, and the moderate shrink-swell potential of the clayey subsoil. Foundations in the Lowell soil should be designed to prevent structural damage caused by shrinking and swelling of the soil. Foundation drains and exterior wall coatings help to prevent wet basements in homes constructed on the Lowell soil. Local roads on both soils can be improved by providing a suitable base material. Both soils are suited to such recreation uses as picnic areas and paths and trails.

The capability subclass is IIIe. The woodland suitability subclass is 3c for the Lowell soil and 2o for the Westmoreland soil.

LoD—Lowell-Westmoreland silt loams, 15 to 25 percent slopes. This map unit consists of moderately well drained Lowell soil and well drained Westmoreland soil on hillsides. These deep, moderately steep soils are mainly on the upper third of hillsides. A few areas are on narrow ridgetops, knolls on rounded ridgetops, and hillside benches. Slopes are mainly even. Irregularities occur along a few small drainageways. Small sandstone fragments are at the surface of the Westmoreland soil. Most areas are 10 to 100 acres.

Most areas are about 45 percent Lowell silt loam and 35 percent Westmoreland silt loam; the Westmoreland soil, however, is dominant in some areas. The two soils are commonly in alternating strips across the hillside. Steeper areas are dominantly Westmoreland soil. The two soils are in strips so narrow or so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Lowell soil is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay with mottles below about 25 inches. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 50 inches.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Included with these soils in mapping are small areas of somewhat poorly drained soils on concave slopes and near seep spots and Westmore soils on less sloping areas and in saddles on ridgetops. Westmore soils are more silty in the upper part than Lowell and Westmoreland soils. Moderately deep Culleoka soils are included near slope breaks and on the upper part of hillsides. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Lowell soil and moderate in the Westmoreland soil. Runoff from cultivated areas is very rapid. The available water capacity is moderate in both soils. Potential frost action is moderate in both soils. The shrink-swell potential is low in the Westmoreland soil and moderate in the Lowell soil. Unless limed, the Westmoreland soil is very strongly acid to medium acid in the root zone. The Lowell soil is very strongly acid to medium acid in the upper part of the root zone and strongly acid to neutral in the lower part.

These soils are used mainly for pasture and crops. The potential is medium for cultivated crops and small grain, high for hay and pasture, and low for building site development and sanitary facilities. The potential for trees is medium in the Lowell soil and high in the Westmoreland soil.

These soils are suited to small grain, to grasses and legumes for hay, and to an occasional row crop. A commonly used rotation includes cultivated crops about one-fourth the time. Deep-rooted legumes are difficult to maintain in many areas. The hazard of erosion is very severe in cultivated areas. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, cover crops, returning crop residue, grassed waterways, contour stripcropping, and cover crops reduce the hazard of erosion. Subsurface drains are needed in included wetter soils. Tilling within the optimum range of moisture content helps to prevent soil compaction.

These soils are well suited to pasture. If they are overgrazed or plowed for seedbed preparation, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

These soils are well suited to trees. Locating logging roads and skid trails on the contour helps to control runoff and erosion. The slope somewhat limits the use of equipment; however, mechanical planting and mowing to reduce competition are possible. Coves and north- and east-facing slopes are the best sites for woodland. These sites have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

The moderately steep slope and depth to bedrock of both soils and the moderately slow permeability and

some seasonal wetness in the Lowell soil are severe limitations for buildings and sanitary facilities. Maintaining as much cover as possible on the site during construction reduces erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 3c for the Lowell soil and 2r for the Westmoreland soil.

LoE—Lowell-Westmoreland silt loams, 25 to 40 percent slopes. This map unit consists of steep, well drained, deep soils on hillsides. Slopes are generally smooth. In some areas, irregularities are along drainageways. Seep spots are common in areas of the Lowell soil. Most areas of this map unit are 10 to 50 acres.

Most areas are about 45 percent Lowell silt loam and 35 percent Westmoreland silt loam. The two soils are in alternating strips across the hillside or in areas so small that mapping them separately is not practical.

Typically, the surface layer of the Lowell soil is brown, friable silt loam about 6 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 46 inches.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 6 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 46 inches.

Included with these soils in mapping are small areas of somewhat poorly drained soils around seep spots. Also included are the deeper Brookside soils in concave areas or narrow bands on the lower part of some slopes. They are subject to hillside slippage. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Lowell soil and moderate in the Westmoreland soil. The available water capacity and potential frost action are moderate in both soils. Runoff is very rapid if the plant cover is removed. The shrink-swell potential is moderate for the Lowell soil and low for the Westmoreland soil. Unless limed, the root zone of the Lowell soil is very strongly acid to medium acid in the upper part and strongly acid to neutral in the lower part. The root zone of the Westmoreland soil is very strongly acid to medium acid.

These soils are used mainly for pasture, trees, and woodland wildlife habitat. The potential is medium for hay and pasture and low for cultivated crops, small grain, sanitary facilities, and building site development. The potential for woodland wildlife habitat is high in both soils.

Even though the steep slope limits the use of some equipment, these soils are suited to pasture. Smooth slopes are suited to hay. If the soils are overgrazed or cultivated for seedbed preparation, the hazard of erosion is very severe. Reseeding by the trash mulch or no-till methods or with a companion crop reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction. Deep-rooted legumes are difficult to maintain in many areas.

These soils are suited to trees. Locating logging roads and skid trails on the contour reduces erosion. The steep slopes limit the use of planting and mowing equipment. Coves and north- and east-facing slopes are the best woodland sites. These sites have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

The steep slope is a severe limitation for buildings, sanitary facilities, and most recreation uses. Hillside slippage is also a hazard on the Lowell soil and on the included Brookside soils. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIe. The woodland suitability subclass is 3c for the Lowell soil and 2r for the Westmoreland soil.

LoF—Lowell-Westmoreland silt loams, 40 to 70 percent slopes. This map unit consists of deep, very steep, well drained soils on hillsides and along deeply entrenched drainageways. Slopes are generally smooth. In some areas, however, slopes have benches and sharp breaks at sandstone bedrock escarpments and irregularities at hillside slips. Most areas are 50 to 200 acres.

Most areas are about 45 percent Lowell silt loam and 35 percent Westmoreland silt loam. The two soils commonly occur in such narrow bands across the hillsides or in areas that are so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Lowell soil is brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 45 inches.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 5 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 42 inches.

Included with these soils in mapping are small areas of Dekalb and Brookside soils. The moderately deep Dekalb soils are on the uppermost part of hillsides, near slope breaks, and above outcrops of sandstone bedrock. The moderately well drained Brookside soils are in coves and on lower hillside positions. They are subject to hillside slippage. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow in the Lowell soil. Runoff is very rapid. The available water capacity is moderate in both soils. The shrink-swell potential is moderate in the Lowell soil and low in the Westmoreland soil. Potential frost action is moderate in both soils. Unless it has been limed, the Westmoreland soil is medium acid to very strongly acid in the root zone and the Lowell soil is medium acid to very strongly acid in the upper part of the root zone and strongly acid to neutral in the lower part.

About two-thirds of the acreage is woodland and one-third unimproved pasture. The potential for trees is medium in the Lowell soil and high in the Westmoreland soil. In both soils the potential is low for crops, pasture, sanitary facilities, and building site development and good for woodland wildlife habitat.

These soils are poorly suited to pasture. The slopes are too steep for commonly used equipment. Some areas used for pasture are reverting to brush because they are difficult to manage.

These soils are suited to trees. On very steep slopes, however the use of logging equipment is severely limited and mechanical planting is not possible. Plant competition can be reduced by girdling. Locating skid trails and logging roads on the contour makes logging easier and reduces erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun.

The very steep slopes of both soils and the hazard of hillside slippage of the Lowell soil and the included Brookside soils severely limit the use of these soils as sites for buildings, sanitary facilities, and most recreation uses. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIIe. The woodland suitability is 3c for the Lowell soils and 2r for the Westmoreland soils.

LpF—Lowell-Westmoreland silt loams, benched, 30 to 70 percent slopes. This map unit consists of deep, well drained, very steep soils on hillsides. Slopes are uneven and have narrow benches. Sandstone bedrock escarpments and hillside slips are in a few areas. Most areas are 50 to 500 acres.

Areas of this unit are about 45 percent Lowell silt loam and 35 percent Westmoreland silt loam. The Westmoreland soil is in bands around hillsides on the steepest part of areas. The Lowell soil is commonly on moderately steep and steep, 20 to 200 foot wide benches around hillsides. Many benches are natural seepage areas. Areas of the two soils are in such narrow bands across the hillsides or are so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of Lowell soil is brown, friable silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable silty clay loam, and the middle and lower parts are strong brown and yellowish brown, firm silty clay. The substratum is light olive brown, firm gravelly silty clay loam. Hard limestone bedrock is at about 45 inches. In some areas 12 to 24 inches of stony loamy colluvial material is on the soil surface.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 5 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are brown and dark yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm very channery clay loam. Hard sandstone bedrock is at about 42 inches.

Included with these soils in mapping are small areas of Brookside, Dekalb, and Elba soils. The moderately deep Dekalb soils are near slope breaks and outcrops of massive sandstone bedrock. The moderately well drained Brookside soils are on benches and lower hillsides and in coves containing deeply dissected drainageways. They are subject to hillside slippage. Elba soils have a higher lime content and are mainly in the northeastern part of the county. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow in the Lowell soil. Runoff is very rapid. The available water capacity is moderate in both soils. The shrink-swell potential is moderate in the Lowell soil and low in the Westmoreland soil. Potential frost action is moderate in both soils. Unless it has been limed, the root zone of the Westmoreland soil is medium to very strongly acid. The Lowell soil is medium acid to very strongly acid in the upper part of the root zone and strongly acid to neutral in the lower part.

These soils are mainly used for woodland and woodland wildlife habitat. Nearly one-third the acreage was cleared and used for unimproved pasture but has reverted to woodland. The potential for trees is medium in the Lowell soil and high in the Westmoreland soil. In both soils the potential is low for crops, pasture, sanitary facilities, building site development, and most recreation uses and is high for woodland wildlife habitat.

These soils are poorly suited to pasture. The very steep, uneven slopes severely limit the use of equipment. A few of the wider benches can be used for improved pasture but are difficult to manage.

Even though the very steep slopes severely limit the use of equipment, these soils are suited to trees. Locating logging roads and skid trails on the contour

makes logging easier and reduces erosion. Bench positions can be used for logging roads and other harvesting equipment in dry periods. Coves and north- and east-facing slopes are the best woodland sites. These sites have more water available for growth and have cooler temperatures because they have less exposure to the prevailing winds and the sun. Plant competition can be reduced by such practices as girdling.

These soils are well suited to woodland wildlife habitat.

The very steep slopes of both soils and the possibility of hillside slippage in the Lowell soil and the included Brookside soils are severe limitations for buildings, sanitary facilities, and most recreation uses. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIIe. The woodland suitability subclass is 3c for the Lowell soil and 2r for the Westmoreland soil.

MnB—Morristown clay loam, 0 to 8 percent slopes. This nearly level to gently sloping, deep, well drained soil is on spoil ridges and benches in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded limestone and shale and smaller amounts of siltstone, sandstone, and coal. Most areas are long and 100 to 600 feet wide. At midsection, the wider areas are nearly level. The long narrow ridges are rounded and more sloping. Slopes are smooth. Areas range from 3 to 50 acres.

Typically, the surface layer is mixed brown and yellowish brown, firm clay loam about 8 inches thick. The substratum to about 60 inches is gray and dark gray, firm gravelly clay loam.

Included with this soil in mapping are a few areas where the surface layer is channery clay loam and eroded areas where numerous rills and small gullies have formed. The thin flat stone fragments interfere with tillage. In some areas the surface has been covered with 12 to 24 inches of natural soil material. Those areas have a higher available water capacity and are more productive than this Morristown soil. In other included areas the surface layer is friable silt loam that is easier to till. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in this Morristown soil. The available water capacity is low because the content of coarse fragments is high and the substratum is compact. Runoff is slow to medium. The potential frost action and shrink-swell potential are moderate. The substratum is mildly or moderately alkaline and calcareous.

Most of the acreage is in grasses and legumes, but only a small percentage of the acreage is grazed or harvested for hay. The potential is medium for hay, crops, pasture, and trees. It is medium for most sanitary facilities and building site development.

This soil is suited to corn grown under no-till management, but it is better suited to small grain and hay because it is droughty. In cultivated areas, the erosion hazard is moderate. No-till management is well suited to this soil. Included areas where the surface layer is thick can be plowed. Controlling the hazard of erosion, conserving moisture, improving tilth, and increasing the organic matter content are concerns of management. Grasses and legumes in the cropping system, incorporating crop residue into the surface layer, cover crops, contour tillage, stripcropping, and conservation tillage, which leaves crop residue on the surface, are effective in controlling the hazard of erosion and improving tillage.

This soil is suited to all the commonly grown tall grasses and deep-rooted legumes for pasture, but it is droughty. The erosion hazard is moderate if the soil is overgrazed or is plowed for seedbed preparation. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the erosion hazard. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction. Rills and shallow gullies limit the use of equipment in the included areas.

This soil is suited to trees that can tolerate high lime, droughty conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical planting and mowing reduce plant competition.

Once this soil has settled, it is moderately well suited as sites for buildings and most sanitary facilities. Onsite investigation is needed to determine the suitability. Thickness of the soil over bedrock and control of storm water runoff should be considered. Moderately slow permeability is a severe limitation for septic tank absorption fields. This soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods.

The capability subclass is IIIs. No woodland suitability subclass is assigned.

MnD—Morristown clay loam, 8 to 25 percent slopes. This strongly sloping and moderately steep, deep, well drained soil is mainly on the sides of mine spoil ridges and benches in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mainly subrounded limestone and shale and smaller amounts of siltstone, sandstone, and coal. Slopes are dominantly 8 to 18 percent. They are generally smooth. A few small gullies and rills have formed near slope

breaks and in convex areas. Most areas are long and 100 to 600 feet wide. Most are 10 to 50 acres.

Typically, the surface layer is brown and yellowish brown, firm clay loam about 8 inches thick. The substratum to about 60 inches is gray and dark gray, firm gravelly clay loam.

Included with this soil in mapping are areas where the surface layer is channery clay loam and eroded areas where small gullies have formed. The thin flat stone fragments interfere with tillage. Spots of the more acid Bethesda soils are also included. In some areas the surface has been covered with 12 to 24 inches of natural soil material. Those areas have a higher available water capacity and are more productive than this Morristown soil. In other included areas the surface layer is silt loam that is easier to till. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in this Morristown soil, and runoff is very rapid. The available water capacity is low because the content of coarse fragments is high and the substratum is compact. Depth of the root zone varies but is mainly moderately deep. Potential frost action and the shrink-swell potential are moderate. The substratum is mildly or moderately alkaline and calcareous.

Most of the acreage is in grasses and legumes, but only a small percentage of the acreage is grazed or harvested for hay. The potential is low for crops and medium for hay, pasture, and trees. It is medium to low for sanitary facilities and building site development.

This soil is poorly suited to cultivated crops but is suited to hay and pasture. It is suited to all the commonly grown grasses and legumes, but is most productive of tall grasses and deep-rooted legumes. The soil is droughty. The hazard of erosion is severe if it is plowed in seedbed preparation. Grasses and legumes in the cropping system, incorporating crop residue into the surface layer, minimum tillage, and contour stripcropping reduce the hazard of erosion, conserve moisture, improve tilth, and increase the organic matter content. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and to woodland wildlife habitat. Grasses and legumes provide ground cover and reduce erosion during the establishment of trees. Mechanical planting and mowing reduce plant competition. Coves and north- and east-facing slopes are the best woodland sites. These sites have more moisture available for plant growth and cooler temperatures because of less exposure to the prevailing winds and the sun.

Once this soil has settled, it is moderately well suited as sites for buildings in areas where slopes are 8 to 15 percent. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff are important considerations. Areas where slopes are 15 to 25 percent are severely limited as sites for buildings and sanitary facilities. Slippage is a hazard. Moderately slow permeability also limits the use of this soil for septic tank absorption fields. This soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods.

The capability subclass is IVs. No woodland suitability subclass is assigned.

MnE—Morristown clay loam, 25 to 40 percent slopes. This deep, well drained, steep soil is on graded mine spoil side slopes in areas surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from natural soils. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded limestone and shale and smaller amounts of siltstone, sandstone, and coal. Slopes are smooth. Most areas are long and narrow and range from 3 to 50 acres.

Typically, the surface layer is mixed brown and yellowish brown, firm clay loam about 8 inches thick. The substratum to about 60 inches is gray and dark gray, firm gravelly clay loam.

Included with this soil in mapping are small areas where the surface layer is channery clay loam and eroded areas where numerous rills and small gullies have formed. Also included are small areas of the acid Bethesda soils and areas of soils that have a friable silt loam surface layer that is easier to till. Included areas make up about 20 percent of most areas.

Permeability is moderately slow in this Morristown soil. The available water capacity is low because the content of coarse fragments is high and the substratum is compact. Runoff is very rapid. The shrink-swell potential and potential frost action are moderate. The substratum is mildly alkaline or moderately alkaline and calcareous.

Most of the acreage is in grasses and legumes, but only a small percentage is grazed. The potential is medium for pasture and trees and low for cultivated crops, small grain, and hay. It is low for sanitary facilities and building site development.

This soil is suited to pasture and limited grazing. It is suited to all the commonly grown grasses and legumes. It is poorly suited to cultivated crops, small grain, and hay because of the steep slopes, droughtiness, and very severe erosion hazard. Seeding with cover crops or by trash mulch or no-till seeding reduces the erosion hazard. Pasture rotation, mowing for weed control, and timely application of lime fertilizer are needed to maintain a good stand of key forage plants. A good ground cover increases the infiltration rate by slowing runoff.

This soil is suited to trees that can tolerate a high content of lime in the soil and droughty conditions. Grasses and legumes provide ground cover and reduce erosion during the establishment of trees. Mechanical planting and mowing for weed control are not practical

because of the steep slopes. Coves and north- and east-facing slopes are the best woodland sites. They have more moisture available for growth because they have cooler temperatures and less exposure to the prevailing winds and the sun.

This soil is very poorly suited to sanitary facilities and building site development because of steep slopes, the hazard of hillside slippage, and moderately slow permeability.

The capability subclass is VIe. No woodland suitability subclass is assigned.

MoB—Morristown stony clay loam, 0 to 8 percent slopes. This nearly level to gently sloping, deep, well drained soil is on mine spoil ridges and in basin-like areas between the ridges in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded limestone and shale and smaller amounts of siltstone, sandstone, coal, and slate. They are about 10 to 24 inches in diameter and are commonly 30 to 100 feet apart. Most areas are long and 100 to 600 feet wide. At midsection, the wider areas are nearly level. The narrow ridges are rounded and more sloping. Slopes are generally smooth. A few rills and small gullies have formed near slope breaks. Most areas are 3 to 50 acres.

Typically, the surface layer is dark gray, slightly hard stony clay loam about 5 inches thick. The substratum to about 60 inches is dark gray, light yellowish brown, and yellowish brown, slightly hard and firm gravelly clay loam and friable gravelly loam. Small areas of recently deposited sediment less than 12 inches thick are along drainageways.

Included with this soil in mapping are small areas of acid Bethesda soils and spots of the extremely acid, coarser textured Barkcamp soils. Included soils make up 5 to 10 percent of most areas.

Permeability is moderately slow in this Morristown soil. The thickness of the root zone is highly variable because the content of coarse fragments and the compactness of the soil vary. The available water capacity is mainly low. Runoff is medium on ridges and slow to ponded in basins. The shrink-swell potential and potential frost action are moderate. The organic matter content is very low. The root zone is commonly mildly or moderately alkaline and calcareous. The surface layer is slightly acid or neutral in a few areas.

Most of the acreage is in grasses and legumes, but only a small acreage is grazed or harvested for hay. The potential is low for crops and trees and medium for pasture. It is medium for sanitary facilities and building site development.

This soil is poorly suited to the commonly grown cultivated crops and small grain because of the low available water capacity, very low organic matter content, limited root zone, and surface stoniness.

Even though these properties also restrict use for pasture, the soil is suited to pasture. The stones at the surface and in the soil interfere with tillage, mowing, and harvest. The soil is generally low in nitrogen and phosphorus and medium to high in potassium. Soil tests are needed to determine specific nutrient needs. Erosion is a moderate hazard before seedings are established and in areas where the soil is overgrazed. Maintaining a plant cover and surface mulch conserves moisture and reduces runoff and erosion. Proper stocking, rotation grazing, and limited grazing in winter and other wet periods help to prevent soil compaction and help to maintain the pasture in good condition. Water for livestock is not available in many areas, but potential sites for reservoirs are available.

Trees provide protection against erosion but generally grow slowly. The rock fragments seriously interfere with mechanical planting. Grasses and legumes provide ground cover and reduce erosion during the establishment of trees.

Once this soil has settled, it is moderately well suited as a site for buildings and most sanitary facilities. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff should be considered. Some low-lying areas in basins are very poorly suited as sites for buildings because of ponding. Moderately slow permeability severely limits the use for septic tank absorption fields. The soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods. Stones seriously interfere with mowing.

The capability subclass is VIs. No woodland suitability subclass is assigned.

MoD—Morristown stony clay loam, 8 to 25 percent slopes. This strongly sloping to moderately steep, deep, well drained soil is mostly on the sides of mine spoil ridges and, to a lesser extent, on mine spoil benches and narrow ridgetops in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded limestone and shale and smaller amounts of siltstone, sandstone, coal, and slate. They are about 10 to 24 inches in diameter and are commonly 30 to 100 feet apart. Slopes are dominantly 8 to 18 percent. They are generally smooth. A few rills and small gullies have formed near slope breaks. Most areas are long and 100 to 600 feet wide. They range from 3 to 50 acres.

Typically, the surface layer is dark gray, firm stony clay loam about 5 inches thick. The substratum to about 60 inches is dark gray, light yellowish brown, and yellowish brown, firm gravelly clay loam and gravelly loam.

Included with this soil in mapping are small areas of acid Bethesda soils and spots of the coarser textured, extremely acid Barkcamp soils. In some included areas large boulders are in the substratum. Included soils make up 5 to 10 percent of most areas.

Permeability is moderately slow in this Morristown soil, and runoff is very rapid. The thickness of the root zone

is highly variable because the content of coarse fragments and the compactness of the soil vary. The available water capacity is mainly low. The organic matter content is very low. Potential frost action and shrink-swell potential are moderate. The root zone is commonly mildly or moderately alkaline and calcareous. The surface layer is slightly acid or neutral in some areas.

Most of the acreage is in grasses and legumes, but only a small acreage is grazed or harvested for hay. The potential is low for crops, hay, and trees and medium for pasture. It is low to medium for sanitary facilities and building site development.

This soil is suited to pasture but is poorly suited to cultivated crops and small grain because of the slope, low available water capacity, limited root zone, surface stoniness, and very low organic matter content. The stones at the surface and in the soil interfere with tillage, mowing, and harvest. Erosion is a severe hazard if the soil is overgrazed or seedings are established. Maintaining a plant cover and mulching conserve moisture and reduce runoff and erosion. The soil is generally low in nitrogen and phosphorus and medium to high in potassium. Soil tests are needed to determine specific nutrient needs. Except on the included areas of Bethesda and Barkcamp soils, liming is not needed. The soil is suited to all the commonly grown grasses and legumes. Proper stocking, rotation grazing, and limited grazing in winter and other wet periods are needed to maintain the soil and pasture in good condition. Overgrazed pastures recover very slowly in dry weather. Water for livestock is not available in many areas, but there are potential reservoir sites in basins between spoil ridges.

Trees provide protection against erosion, but growth is generally slow. The rock fragments seriously interfere with mechanical planting and somewhat limit the mowing needed to reduce plant competition. Grasses and legumes provide ground cover during the establishment of trees.

Once this soil has settled, it is moderately well suited as sites for buildings in areas where slopes are 8 to 15 percent. Onsite investigation is needed to determine suitability. Thickness of the soil over bedrock and control of storm water runoff are important considerations. Areas where slopes are 15 to 25 percent are severely limited as sites for buildings and sanitary facilities. Slippage is a hazard. Moderately slow permeability is also a limitation for septic tank absorption fields. The soil is sticky when wet. Droughtiness is a hazard for lawns during dry periods. Stones seriously interfere with mowing.

The capability subclass is VIs. No woodland suitability subclass is assigned.

MoE—Morristown stony clay loam, 25 to 40 percent slopes. This deep, well drained, steep soil is mainly on the sides of mine spoil ridges in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded limestone and shale and smaller amounts of siltstone, sandstone, coal, and slate. They are about 10 to 24 inches in diameter and are commonly 30 to 100 feet apart. Slopes are generally smooth. A few rills and small gullies have formed, mostly near slope breaks. Hillside slips are in some areas. Most areas are long and 100 to 800 feet wide. They range from 3 to 50 acres.

Typically, the surface layer is dark gray, firm stony clay loam about 5 inches thick. The substratum to about 60 inches is dark gray, light yellowish brown, and yellowish brown, firm gravelly clay loam and gravelly loam.

Included with this soil in mapping are small areas of acid Bethesda soils and spots of the coarser textured, extremely acid Barkcamp soils. In some included areas large boulders are in the substratum, and in others there are nearly vertical highwalls. Included soils make up 5 to 15 percent of most areas.

Permeability is moderately slow in this Morristown soil. The thickness of the root zone is highly variable because the content of coarse fragments and the compactness of the soil vary. The available water capacity is mainly low. Runoff is very rapid. The organic matter content is very low. The shrink-swell potential and potential frost action are both moderate. The root zone is commonly mildly alkaline or moderately alkaline and calcareous. The surface layer is slightly acid or neutral in a few areas.

Most of the acreage is in grasses and legumes, but only a small acreage is used for pasture. The potential is low for crops, hay, pasture, and trees. It is also low for sanitary facilities and building site development.

This soil is not suited to cultivated crops or small grain because of the steep slopes, droughtiness, limited root zone, stoniness, and very severe erosion hazard. The stones at the surface and in the soil interfere with tillage, mowing, and harvest. Erosion is a very severe hazard if the soil is overgrazed or seedings are established. Maintaining plant cover and mulching conserves moisture and reduces runoff and erosion. The soil is generally low in nitrogen and phosphorus and medium to high in potassium. Soil tests are needed to determine specific needs. Except for the included areas of Bethesda and Barkcamp soils, liming is not needed. All commonly grown grasses and legumes are suited to this soil, but tall grasses and deep-rooted legumes generally grow best. Overgrazed pastures recover very slowly in dry weather.

Trees provide protection against erosion but generally grow slowly. The rock fragments seriously interfere with mechanical planting. Grasses and legumes provide ground cover and reduce erosion during the establishment of trees.

This soil is very poorly suited to sanitary facilities and building site development because of the steep slopes, hazard of hillside slippage, and moderately slow permeability. On hillsides, areas of this soil that are underlain by natural soils are particularly susceptible to slippage.

The capability subclass is VIIe. No woodland suitability subclass is assigned.

MoF—Morristown very stony clay loam, 40 to 70 percent slopes. This very steep, deep, well drained soil is on mine spoil side slopes in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. Rock fragments are mostly subrounded limestone and shale and smaller amounts of siltstone, sandstone, coal, and slate. Flat and round stones, commonly 5 to 10 feet apart, are at the surface in most areas. Large boulders as much as 10 feet in diameter are in a few areas. Slopes are commonly uneven. There are active hillside slips in many areas. Most areas are on the outer slopes of surface-mined areas where the spoil was placed on hillsides. Other areas are narrow spoil ridges below a highwall and contain long narrow pools of water. Most areas are not graded. Most range from about 20 to 200 acres.

Typically, the surface layer is dark gray, very stony clay loam about 5 inches thick. The substratum to about 60 inches is dark gray, light yellowish brown, and yellowish brown, firm, cobbly clay loam and cobbly loam.

Included with this soil in mapping are small areas of the acid Bethesda soils and spots, generally less than 10 feet in diameter, of the extremely acid, coarser textured Barkcamp soils supporting sparse vegetation. Included soils make up 5 to 25 percent of most areas.

Permeability is moderately slow in this Morristown soil, and runoff is very rapid. The thickness of the root zone is highly variable because the content of coarse fragments and the compactness of the soil vary. The available water capacity is mainly very low. The organic matter content is very low. The shrink-swell potential and potential frost action are moderate. The root zone is generally mildly or moderately alkaline and calcareous. The surface layer is slightly acid or neutral in a few areas.

Most areas are in grasses and legumes. The potential is low for crops, hay, pasture, and trees. It is also low for sanitary facilities and building site development.

This soil is not suited to crops, hay, or improved pasture because of the very steep slopes, large stones, and severe drought hazard. It is best suited to habitat for wildlife and to trees and some recreation. Trees provide protection against erosion but generally grow slowly. Mechanical planting and mowing to reduce plant competition are not practical, and logging is difficult.

This soil is not suited to sanitary facilities and building site development because of slope, large stones, very severe hazard of hillside slippage, and moderately slow permeability. Some areas include deep, permanent pools of water.

The capability subclass is VIIs. No woodland suitability subclass is assigned.

Ne—Newark silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains and is subject to frequent flooding. It occupies the entire flood plain or is in long, narrow areas adjacent to slope breaks to the uplands or stream terraces. Abandoned stream channels and small drainage ditches are in some areas. The range is 0 to 2 percent. Most areas are 5 to 50 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is grayish brown, brown, and dark grayish brown, mottled, friable silt loam and silty clay loam about 26 inches thick. The substratum to about 60 inches is gray, grayish brown, dark yellowish brown, and yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of poorly drained soils in depressions, in abandoned stream channels, and below seep spots in adjacent soils on breaks to terraces and uplands. These soils have a gray subsoil and commonly support reeds, sedges, and swamp grasses because the water table is at or near the surface most of the year. Included soils make up less than 15 percent of most areas.

Permeability is moderate in this Newark soil. Runoff is slow, and water ponds for short periods after heavy rains or after floodwaters recede. The available water capacity is high. A high water table is at a depth of 6 to 18 inches in winter, spring, and other extended wet periods. In many places, the wetness is caused by runoff and seepage from adjacent soils on terraces and uplands. The soil layers below 3 feet are saturated for long periods. During these periods, poor subsoil aeration limits the depth of the root zone. The shrink-swell potential is low, and potential frost action is high. Reaction in the root zone is medium acid to mildly alkaline.

This soil is used mostly for pasture and hay and to a lesser extent for cultivated crops and trees. The potential is high for cultivated crops, pasture, trees, and woodland wildlife habitat, medium for small grain, hay, and wetland wildlife habitat, and low for building site development and sanitary facilites.

Drained areas are well suited to commonly grown crops but are better suited to corn and legume-grass mixtures that tolerate some wetness than to small grain and deep-rooted perennial crops. Planting is delayed in some years because of spring flooding and wetness. Logs, branches, and other debris are commonly scattered over the surface after floods. Alluvial sediment damages hay crops. Reducing wetness, maintaining tilth and the organic matter content, and controlling weeds are major concerns of management. Diversions or subsurface drains are needed to intercept water from adjacent slopes in many places. Conservation tillage, which leaves crop residue on the surface, and incorporating crop residue into the plow layer help to maintain tilth and organic matter content. Tilling within the optimum range of moisture content reduces soil compaction.

Undrained areas are better suited to pasture than to crops. Grasses and legumes, such as bluegrass, tall

fescue, ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass, are suited to this soil. Proper stocking, rotation grazing, mowing to control weeds, and restriction on grazing in winter and other wet periods are needed to keep the soil and pasture in good condition.

This soil is suited to trees, but only a small acreage is used for woodland. Wet-tolerant species should be planted. Wetness and flooding limit the use of equipment; mowing for weed control, however, is possible during the drier part of the year.

This soil is severely limited as a site for sanitary facilities and buildings because of the flood hazard and wetness. Undrained areas are fairly well suited to wetland wildlife habitat.

The capability subclass is IIw. The woodland suitability subclass is 1w.

Nm—Newark silt loam, ponded. This deep, nearly level, somewhat poorly drained soil is on flood plains. It is subject to frequent flooding for very long periods. Slopes are commonly smooth, but some areas are cut by abandoned stream meanders and small drainage ditches. The slope range is 0 to 2 percent.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is brown and dark grayish brown, mottled, friable and firm silt loam about 31 inches thick. The substratum to about 60 inches is brown, mottled, firm silt loam.

Included with this soil in mapping are narrow bands of Newark soils that are adjacent to stream channels but are not subject to ponding. Included soils make up 5 to 15 percent of most areas.

Permeability is moderate in this Newark soil. The soil is saturated or is ponded for several weeks each year. The layers below a depth of 12 inches are saturated most of the time. The high water table prevents good subsoil aeration and reduces the depth of the root zone. Shrink-swell potential is low. Potential frost action is high. Reaction in root zone is slightly acid to mildly alkaline.

Most areas support natural shrubs and trees and are wetland wildlife habitat. Areas cleared of trees are mainly in sedges, reeds, and cattails. The potential is low for cultivated crops, hay, pasture, and trees. It is high for wetland wildlife habitat. This soil is not suited to crops or pasture and is poorly suited to trees. Ponding and wetness severely limit the use of equipment and the selection of trees to plant. Draining most areas is not practical because suitable outlets are not available. Waterways have a perennial high water level. Drainageways that were deepened to improve drainage have mainly been refilled with sediment.

The soil is well suited to most wetland plants and to wetland wildlife habitat.

Wetness and flooding severely limit the use of this soil as a site for buildings and sanitary facilities.

The capability subclass is Vw. The woodland suitability subclass is 4w.

Nn—Newark Variant silt loam, frequently flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains in narrow valleys near the headwaters of major streams. It is subject to frequent flooding. Most areas are long and narrow. They range from 75 to 250 feet in width and as much as a mile in length and are 5 to 80 acres. The low-lying narrow areas are commonly split into smaller farming tracts by meandering small streams. The slope range is 0 to 2 percent.

Typically, the surface layer is dark grayish brown, very friable silt loam about 8 inches thick. The subsoil is dark grayish brown and very dark gray, mottled, friable silt loam about 18 inches thick. The substratum is about 19 inches thick. The upper part is olive brown, mottled, friable gravelly sandy loam, and the middle and lower parts are very dark gray, friable very gravelly loamy sand. Hard siltstone bedrock is at about 45 inches.

Included with this soil in mapping are small areas of poorly drained soils in depressions, in abandoned stream channels, and below seep spots in adjacent soils on breaks to terraces and uplands. These soils have a gray subsoil and commonly support reeds and sedges. Also included are a few small areas where the surface layer is gravelly silt loam and places where bedrock is at a depth of 24 to 40 inches. Included soils make up less than 20 percent of areas.

Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum of this Newark Variant soil. Runoff is slow. The available water capacity is low or moderate, depending on the depth to the substratum. The root zone is deep. A seasonal high water table is at a depth of 12 to 30 inches in winter, spring, and other extended wet periods. During these periods the water table prevents good subsoil aeration and reduces the depth of the root zone. The shrink-swell potential is low. Potential frost action is high. Reaction in the root zone is slightly acid or neutral.

Most areas are used for pasture. Some areas are used for cultivated crops and hay. In larger areas that can be drained, the potential is medium for cultivated crops, small grain, and hay and high for pasture, but in areas that are difficult to drain or are small, the potential is poor for crops and medium for pasture. The potential is high for trees and wetland wildlife for habitat, and low for sanitary facilities and building site development.

The larger areas that can be drained are suited to row crops, hay, and small grain. They are better suited to corn and legume-grass mixtures that tolerate some wetness than to small grain and deep-rooted perennial crops. Yields of hay and small grain are reduced in some years by siltation and flooding. Planting is delayed in some years by wetness and flooding late in spring. Diversions or artificial drainage are commonly needed at the base of slopes, but in some areas there are no outlets for artificial drains, especially subsurface drains, because of limited depth to bedrock. Maintaining tilth and organic matter content and controlling weeds are other concerns of management. Conservation tillage,

which leaves crop residue on the surface, and incorporating crop residue into the plow layer help to maintain tilth and increase the organic matter content. Tilling within the optimum range of moisture content reduces soil compaction.

Undrained areas are better suited to pasture than to crops but are poorly suited to grazing early in spring. Proper stocking, pasture rotation, mowing for weed control, restricted use in winter and other wet periods, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Grasses and legumes, such as bluegrass, tall fescue, reed canarygrass, ladino clover, alsike clover, and birdsfoot trefoil, are suited to this soil. Deep-rooted legumes are difficult to maintain in most areas.

This soil is suited to trees, but only a small acreage is used for woodland. Wet-tolerant trees should be planted. The hazard of flooding and wetness severely limit the use of this soil as sites for buildings and sanitary facilities. The hazard of pollution or underground water is also a limitation for sanitary facilities. Undrained areas are fairly well suited to wetland wildlife habitat.

The capability subclass is IIw. The woodland suitability subclass is 2o.

No—Nolin Variant silt loam, occasionally flooded. This nearly level, deep, well drained, mildly alkaline soil is on flood plains of the major streams and is subject to flooding. Slopes are smooth and even. The slope range is 0 to 3 percent.

Typically, the surface layer is dark brown, very friable silt loam about 10 inches thick. The subsoil is brown, friable silt loam about 31 inches thick. The substratum to about 66 inches is brown, mottled, friable silt loam. In some areas the soil is slightly acid or neutral.

Included with this soil in mapping are small areas of the somewhat poorly drained Newark soils in slight depressions, in abandoned stream channels, and in narrow bands adjacent to slope breaks to terraces and uplands. Also included on alluvial fans where very small drainageways enter wider valleys are small areas of soils that have a channery loam surface layer. The small flat stones interfere with tillage and reduce the available water capacity. Included soils make up about 20 percent of most areas.

Permeability is moderate in this Nolin Variant soil. The available water capacity is high. Runoff is slow. The shrink-swell potential is low. Potential frost action is high. Reaction in the root zone is mildly alkaline.

Most areas are cultivated. Corn and hay are the main crops. The potential is high for cultivated crops, pasture, and trees, medium for small grain and hay, and low for most building site development and sanitary facilities.

This soil is suited to continuous row cropping under good management. It is well suited to corn and mid-season specialty crops. Planting is delayed in some years because of flooding late in spring. Flooding and siltation reduce yields, especially of small grain and hay, in some areas. Water ponds on the included somewhat poorly drained Newark soils for short periods following floods and during periods of heavy rainfall. Ponding reduces yields and damages legume stands. Controlling the flood hazard, maintaining tilth and the organic matter content, and draining included wetter soils are concerns. Conservation tillage, which leaves crop residue on the surface, and incorporating crop residue into the plow layer help to maintain tilth and organic matter content. Tilling within the optimum range of moisture content reduces soil compaction and helps to maintain soil structure and improve tilth. Controlling johnsongrass and other weeds in grain fields is a problem in many areas. The soil is well suited to irrigation.

This soil is suited to pasture. Proper stocking, pasture rotation, mowing to control weeds, and timely application of fertilizer help to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is well suited to trees, but only a very small acreage is used for woodland. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or discing.

This soil is severely limited as a site for sanitary facilities and buildings by the flood hazard. It is suited to such recreation uses as picnic areas, golf fairways, and hiking trails.

The capability subclass is IIw. The woodland suitability subclass is 1o.

Nu—Nolin Variant-Urban land complex. This map unit consists of deep, nearly level, well drained, mildly alkaline Nolin Variant soil and areas of Urban land on flood plains. The unit is subject to occasional flooding. The slope range is 0 to 3 percent. Most areas range from 5 to 50 acres.

Areas of this unit are about 40 percent Nolin Variant silt loam and 40 percent Urban land. Areas of the Nolin Variant soil and Urban land are so intricately mixed or are so small that mapping them separately is not practical.

Typically, the surface layer of the Nolin Variant soil is dark brown, very friable silt loam about 10 inches thick. The subsoil is brown, friable silt loam about 31 inches thick. The substratum to about 66 inches is brown, friable silt loam. In some areas the soil is slightly acid or neutral. In some places the soil has been radically altered; areas have been cut, built up, or smoothed.

Urban land consists of streets, parking lots, buildings, and other structures that so obscure or alter the soil that identification is not feasible.

Included in mapping are areas of soils that have a channery loam surface layer on alluvial fans. Also included are a few spots of somewhat poorly drained Newark soils in depressions. Included soils make up about 20 percent of most areas.

Permeability in the Nolin Variant soil is moderate. Runoff is slow. The available water capacity is high.

Potential frost action is high. The shrink-swell potential is low. Reaction in the root zone is mildly alkaline.

The Nolin Variant soil, the open part of the map unit, is used mainly for lawns and gardens. The potential is medium for lawns and vegetable and flower gardens and high for shrubs and trees. It is low for sanitary facilities and building site development and medium to high for recreation.

The hazard of flooding is a limitation for lawns and vegetable and flower gardens. The soil is well suited to trees and shrubs. Incorporating vegetable crop residue and leaf litter into the surface layer and using cover crops help to maintain the organic matter content and tilth. Tilling within the optimum range of moisture content reduces soil compaction and surface crusting after intense rains. Species selected for planting should tolerate standing water for brief periods. Subsurface drains are needed in the included Newark soils.

The hazard of flooding severely limits the use of the Nolin Variant soils as sites for building and sanitary facilities. Diking to control flooding is difficult. Filling elevates roads above normal flood levels. Local roads and streets can also be improved by using a suitable base material. The soil is suited to such recreation uses as picnic areas, hiking trails, and golf fairways.

The capability subclass for Nolin Variant soil is IIw. No woodland suitability subclass is assigned. No capability subclass or woodland suitability subclass is assigned for Urban land.

OtB—Otwell silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on terraces at elevations that range from about 20 to more than 300 feet above present streams. Most of these terraces are well defined, bench-like areas in the larger valleys. Some at higher elevations are not so long or wide and are less distinct. Slopes are typically smooth or slightly convex. Most areas range from 3 to 25 acres.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish brown, friable and firm silt loam with mottles below about 22 inches, and the lower part is a yellowish brown, very firm and brittle silty clay loam fragipan. The substratum to about 81 inches is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are spots of the somewhat poorly drained Fitchville soils, commonly in narrow bands adjacent to slope breaks to the uplands. They receive runoff and seepage water from adjacent higher lying soils. They make up about 10 percent of some areas.

Permeability is very slow in the fragipan of this Otwell soil. In cultivated areas, runoff is medium. The available water capacity is moderate. A perched seasonal high water table is at a depth of 42 to 72 inches. Roots are restricted mainly to the moderately deep zone above the fragipan. The shrink-swell potential is moderate. Potential frost action is high. In unlimed areas, reaction in the root zone is medium acid to very strongly acid.

Most areas are farmed. A few are used as building sites. Only a small acreage is wooded. The potential is high for crops, hay, and pasture. It is medium for trees, most sanitary facilities, and building site development.

This soil is well suited to corn and small grain and to grasses and legumes for hay. Deep-rooted legumes, such as alfalfa, however, are difficult to maintain in many areas. A perched water table is above the fragipan during wet periods. The soil dries slowly in spring. Wetness delays planting in most years. Diversions or subsurface drains at the base of slope breaks to the uplands reduce wetness in some areas. A complete subsurface drainage system is needed only in areas used for high value crops. The erosion hazard is moderate in cultivated areas, but cultivated crops can be grown year after year if the hazard of erosion is controlled. The surface layer crusts after hard rains. Conservation tillage, which leaves crop residue on the surface, incorporating crop residue into the plow layer, grasses and legumes in the cropping system, grassed waterways, cover crops, and contour tillage or stripcropping reduce the hazard of erosion and improve tilth. Tilling within the optimum range of moisture content helps to prevent soil compaction. This soil is suited to irrigation if the hazard of erosion is controlled.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by no-till or trash mulch seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer help to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Mechanical planting and mowing to reduce plant competition are possible.

Even though some seasonal wetness and the moderate shrink-swell potential are limitations, this soil is suitable as a site for buildings and some sanitary facilities. Footing drains and exterior wall coatings help to keep basements dry. The very slowly permeable fragipan and wetness are limitations for septic tank absorption fields. Local roads and streets can be improved by providing artificial drainage and a suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 3d.

OtC—Otwell silt loam, 8 to 15 percent slopes. This strongly sloping, deep, moderately well drained soil is on terraces at elevations that range from about 20 to more than 300 feet above present streams. Most of these terraces are well defined bench-like areas in the larger valleys. Some at higher elevations are not so easily recognized. Most slopes are smooth and convex. Irregularities are along a few small drainageways. Areas range from 3 to 30 acres.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 47 inches

thick. The upper part is yellowish brown, friable silt loam that is mottled below about 24 inches, and the lower part is a yellowish brown, very firm and brittle silty clay loam fragipan. The substratum to about 81 inches is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are spots of severely eroded Otwell soils near slope breaks and along drainageways. In these eroded spots the yellowish brown surface layer has poor tilth and crusts and puddles easily after intense rains.

Permeability is very slow in the fragipan in this Otwell soil. In cultivated areas, runoff is rapid. The available water capacity is moderate. The shrink-swell potential is moderate. Potential frost action is high. A perched seasonal high water table is at a depth of 42 to 72 inches. The root zone is mainly moderately deep to the fragipan. A few roots are along vertical structure breaks in the pan. Unless the soil has been limed, the root zone is medium acid to very strongly acid.

This soil is used for cultivated crops, hay, and pasture. The potential is high for these uses. It is medium for trees and for building site development and low to medium for sanitary facilities.

This soil is well suited to cultivated crops and small grains and to grasses and legumes for hay. A perched seasonal high water table is above the fragipan during wet periods. The soil dries slowly in spring. Wetness delays planting in most years. Diversions or subsurface drains at the base of slope breaks to the uplands are needed to reduce wetness in some areas. A complete subsurface drainage system is needed only in areas used for high value crops. The erosion hazard is severe in cultivated areas. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, contour stripcropping, grassed waterways, cover crops, and crop residue for mulch reduce the hazard of erosion. Tilling within the optimum range of moisture content helps to prevent soil compaction. The roots of alfalfa are limited by the fragipan, and stands in most areas are severely reduced by frost.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain a good stand of key forage species. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees, but only a very small acreage is used for woodland. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible.

This soil can be used as a site for buildings, especially those without basements, if good design and installation procedures are used. The slope, some seasonal wetness, and the moderate shrink-swell potential are limitations. Footing drains and exterior basement wall coatings help to keep basements dry. The very slowly permeable fragipan and wetness are limitations for septic tank absorption fields. Local roads and streets can be improved by providing artificial drainage and a suitable base material. Maintaining as much cover on the site as possible during construction reduces the risk of erosion.

The capability subclass is IIIe. The woodland suitability subclass is 3d.

RcC—Richland loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on foot slopes at the base of very steep hillsides. Some of the smaller areas are in coves near the head of drainageways below steep hillsides. Slopes are generally smooth, but in a few areas irregularities are along shallow drainageways. Most areas range from 5 to 10 acres.

Typically, the surface layer is dark brown, friable loam about 5 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable loam and channery loam, and the lower part is yellowish brown and strong brown, mottled, firm channery clay loam. The substratum to about 80 inches is strong brown and dark yellowish brown, mottled, firm channery clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils that commonly have a darker surface layer. Also included are small areas of soils that have slowly permeable clayey textures in the lower part of the subsoil and soils that have a stony surface layer. Areas of soils with clayey textures in the lower part of the subsoil commonly have uneven slopes. Included soils make up about 15 percent of most areas.

Permeability and available water capacity are moderate in this Richland soil. A seasonal high water table is at a depth of 36 to 72 inches. Runoff is rapid from cultivated areas. The shrink-swell potential and potential frost action are moderate. Unless the soil has been limed, reaction in the root zone is strongly acid to neutral.

Most areas are used for hay, pasture, and some cultivated crops. The potential is high for cultivated crops, hay, pasture, and trees, and for openland and woodland wildlife habitat. It is medium for sanitary facilities and building site development.

Most areas are suited to corn and small grain and to grasses and legumes for hay. If the soil is cultivated or the plant cover is removed for other purposes, the hazard of erosion is severe. Controlling erosion and draining included wetter soils are concerns of management. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, cover crops, crop residue for mulch, grassed waterways, and grasses and legumes in the cropping system reduce the hazard of erosion. Diversions are needed in some areas.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer help to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Seedlings grow well if competing vegetation is controlled. Locating skid trails and logging roads on the contour reduces erosion.

This soil is suited as sites for buildings if good design and installation procedures are used to overcome the limitations imposed by the slope and the moderate shrink-swell potential. Local roads and streets can be improved by providing a suitable base material. Driveways should be located across the slope to reduce erosion and the angle of incline. Maintaining as much cover as possible on the site during construction reduces erosion. Seasonal wetness is a limitation for sanitary facilities. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IIIe. The woodland suitability subclass is 2o.

RcD—Richland loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is mainly on foot slopes at the base of very steep hillsides. Some of the smaller areas are in coves near the heads of drainageways below steeper hillsides. In most areas slopes are slightly uneven, and there are small drainageways. Hillside slips and seep spots are in a few places. Most areas range from 5 to 80 acres.

Typically, the surface layer is dark brown, friable loam about 5 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown and brown, friable loam and channery loam, and the lower part is yellowish brown and strong brown, mottled, firm channery clay loam. The substratum to about 80 inches is strong brown and dark yellowish brown, mottled, firm channery clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils that commonly have a darker surface layer. Also included are small areas of soils that have slowly permeable clayey texture in the lower part of the subsoil and soils that have a very stony surface layer. Areas of soils with clayey texture in the lower part of the subsoil commonly have uneven slopes. Included soils make up about 15 percent of most areas.

Permeability and available water capacity are moderate in this Richland loam. A seasonal high water table is at a depth of 36 to 72 inches. Runoff is very rapid from cultivated areas. Shrink-swell potential and potential frost action are both moderate. Unless the soil has been limed, the root zone is strongly acid to neutral.

Most areas are used for hay, pasture, and trees. The potential is high for hay, pasture, and trees. It is low for sanitary facilities and building site development and medium for crops.

Some areas of this soil are suited to cultivated crops, small grain, and hay if conservation measures are used. The included very stony areas and areas where slopes are rough and uneven and drainageways are deep are better suited to permanent pasture and woodland. Controlling erosion and draining included wetter soils are concerns of management. Conservation tillage, which leaves crop residue on the surface, contour stripcropping, cover crops, crop residue for mulch, grassed waterways, and grasses and legumes in the cropping system reduce the erosion hazard. Diversions are needed in some areas to intercept runoff from adjacent slopes.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with companion crops or cover crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible in most areas, but equipment use is limited on included areas where the surface layer is very stony and on areas where slopes are uneven. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and more water available for growth because they have less exposure to the prevailing winds and the sun.

The moderately steep slope and some seasonal wetness severely limit the use of this soil as a site for buildings and sanitary facilities. As much cover as possible should be maintained on the site during construction to reduce erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 2r.

RcE—Richland moderately stony loam, 25 to 40 percent slopes. This deep, well drained, steep soil is mainly on foot slopes at the base of very steep hillsides. A few small areas are in coves near the heads of drainageways below steeper hillsides. Slopes are generally uneven with irregularities along a few drainageways. The stones on the surface and in the surface layer are 10 to 24 inches in diameter and about 10 to 30 feet apart. In some areas a few boulders are on the surface. Active hillside slips and small seep spots are in a few areas. Most areas range from 5 to 100 acres.

Typically, the surface layer is dark brown, friable moderately stony loam about 5 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable channery loam, and the lower part is yellowish brown and strong brown, mottled, firm channery clay loam. The substratum to about 80 inches is strong brown and dark yellowish brown, mottled, firm channery clay loam.

Included with this soil in mapping are small areas of soils that have slowly permeable clayey textures in the lower part of the subsoil. These areas are very unstable. Active hillside slips are common. Also included are areas of somewhat poorly drained soils that commonly have a dark surface layer. Included soils make up about 20 percent of most areas.

Permeability is moderate, and runoff is very rapid in this Richland soil. A seasonal high water table is at a depth of 36 to 72 inches. The available water capacity, shrink-swell potential, and potential frost action are all moderate. Unless the soil has been limed, the root zone is strongly acid to neutral.

Nearly half the acreage is cleared and used for pasture. The rest is mostly wooded. The potential is high for trees and woodland wildlife habitat and low for crops, hay, pasture, sanitary facilities, and building site development.

This soil is poorly suited to cultivated crops, small grain, hay, and pasture because of the steep slopes and the stones in the surface layer and on the surface. Some areas on smooth slopes could be used for permanent pasture if the larger stones were removed and the included wet spots drained. Deep-rooted legumes are difficult to maintain in many areas. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. The surface stones and uneven slopes limit the use of planting and mowing equipment. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and more water available for growth because they have less exposure to prevailing winds and the sun.

The steep slopes, some seasonal wetness, and surface stones are severe limitations for sanitary facilities and building site development. Some of the included areas where more clay is in the lower part of the subsoil are subject to hillside slippage.

The capability subclass is VIIs. The woodland suitability subclass is 2r.

RhB—Richland silt loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on alluvial fans at the base of hillsides. Most areas are near the edge of flood plains or on low stream terraces. Areas are typically 2 to 5 acres and have smooth, convex slopes.

Typically, the surface layer is dark yellowish brown, friable silt loam about 5 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is brown, mottled, firm clay loam. The substratum to about 80 inches is brown, mottled, firm channery clay loam.

Included with this soil in mapping are small areas of Hartshorn soils, which are subject to flooding, on flood plains. They make up about 15 percent of most areas.

Permeability and the available water capacity are moderate in this Richland soil. Runoff is medium in cultivated areas. Potential frost action and the shrink-swell potential are moderate. In unlimed areas, the upper and middle parts of the root zone are neutral to strongly acid and the lower part is neutral to medium acid.

About 75 percent of the acreage is farmed. The rest is used mainly for building sites. The potential is high for crops, hay, pasture, and trees, and medium for most sanitary facilities and building site development.

This soil is suited to corn and small grain and to grasses and legumes for hay. Cultivated crops can be grown year after year if the hazard of erosion is controlled. The hazard of erosion is moderate in cultivated areas. Controlling erosion and maintaining tilth and organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, contour tillage, grasses and legumes in the cropping system, cover crops, and incorporating crop residue into the plow layer reduce the hazard of erosion and help to maintain tilth and the organic matter content. Tilling within the optimum range of moisture content reduces soil compaction.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and to woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible.

This soil is suitable for building sites if good design and installation procedures are used to overcome the seasonal wetness and moderate shrink-swell potential. Footing drains and exterior wall coatings help to prevent wet basements. Seasonal wetness is a severe limitation for sanitary facilities. Local roads and streets can be improved by providing a suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 2o.

Uc—Udorthents-Pits complex. This map unit is mostly areas that have been surface mined for coal, limestone, and sandstone. These areas are about 70 percent Udorthents and about 20 percent pits. Udorthents are gently sloping to steep soils around pits or near the edges of the unit.

Typically, Udorthents are a mixture of rock fragments and partly weathered fines in cone-shaped piles 10 to 70 feet high.

Pits are the nearly level areas between vertical highwalls or between vertical highwalls and Udorthents.

Included in mapping are moderately deep and deep soils around the edges of pits or in small scattered areas within pits. Included soils make up about 10 percent of most areas.

In areas of Udorthents where the surface is bare, the erosion hazard is severe. Suitable plant cover is needed to control erosion. A number of abandoned limestone and sandstone quarries support brush and trees. These areas provide habitat for wildlife. Grasses and trees planted in reclaimed areas where sandstone was quarried should tolerate a very low available water capacity and extremely acid reaction; those planted where limestone was quarried should tolerate high lime conditions. The available water capacity of Udorthents is variable but is dominantly low or very low in the root zone.

The suitability of areas as sites for buildings and sanitary facilities is highly variable. Onsite investigation is needed to determine the potential and limitation for any proposed use.

No capability subclass or woodland suitability subclass is assigned.

Ud—Udorthents-Urban land complex. This map unit consists mostly of areas that have been cut and filled during the construction of highways. These areas are about 60 percent Udorthents and about 35 percent Urban land. The areas of Udorthents and Urban land are so small or so long and narrow that mapping them separately is not practical. Urban land is the paved part of areas. Udorthents are mainly in the cut and fill part of areas.

Typically, the upper 60 inches of Udorthents is a mixture of rock fragments and silty clay loam, silt loam, loam, channery loam, and shaly silty clay loam from natural soils.

Typically, Urban land consists of concrete or asphalt over subgrade material.

Included in mapping are bedrock escarpments along highways and a few borrow pits where the soils were removed to reclaim surface-mined land.

Permeability in the Udorthents is highly variable, ranging from very slow to rapid. The available water capacity is low or very low. The organic matter content is very low.

The surface of Udorthents seals after hard rains and cracks during drying because of shrinkage. On some nearly level areas, uneven settling has occurred. Steep and very steep areas are subject to hillside slippage. Plant cover should be maintained to reduce runoff and erosion. Most areas support grasses and shrubs.

No capability subclass or woodland suitability subclass is assigned.

WhB—Wellston silt loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on broad ridgetops and benches. Slopes are dominantly smooth and even to convex. Areas are 3 to 50 acres.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and brown, friable silt loam and silty clay loam, and the lower part is olive brown, friable gravelly silt loam. The substratum is light olive brown, friable very gravelly silt loam. Partly weathered siltstone bedrock is at about 59 inches.

Included with this soil in mapping are small areas of the more loamy Westmoreland soils and the moderately deep Dekalb soils near slope breaks. The moderately well drained Zanesville soils are at the center of the broader ridgetops. Included soils make up about 15 percent of most areas.

Permeability is moderate in this Wellston soil, and the available water capacity is high. Runoff is medium from cultivated areas. The shrink-swell potential is low. Potential frost action is high. In unlimed areas, the upper part of the root zone is medium acid to extremely acid and the lower part is medium acid to very strongly acid.

Most of the acreage is in crops and pasture. A small acreage is wooded. The potential is high for cultivated crops, hay, pasture, and trees, high or medium for most sanitary facilities, and high for building site development.

This soil is suited to corn and small grain and to grasses and legumes for hay. Cultivated crops can be grown year after year if the hazard of erosion is controlled. Deep-rooted legumes are difficult to maintain in many areas. The hazard of erosion is moderate in cultivated areas. Controlling erosion and maintaining tilth and organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, incorporating crop residue into the plow layer, grasses and legumes in the cropping system, contour tillage, stripcropping, and cover crops help to control the erosion hazard and maintain tilth and organic matter content. Tilling within the optimum range of moisture content helps to prevent soil compaction.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Mechanical planting and mowing to reduce plant competition are possible.

This soil provides some of the best sites in the uplands for buildings. It is also suited to sanitary facilities, such as septic tank absorption fields, if good design and installation procedures are used. Local roads can be improved by providing a suitable base material to reduce damage from frost action.

The capability subclass is IIe. The woodland suitability subclass is 2o.

WhC—Wellston silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is mainly on rounded ridgetops and in saddles between knolls. A few areas are on benches. Slopes are generally smooth, but irregularities are along a few shallow drainageways. Most areas are 4 to 20 acres.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and brown, friable silt loam and silty clay loam, and the lower part is olive brown, friable gravelly silt loam. The substratum is light olive brown, friable very gravelly silt loam. Partly weathered soft siltstone is at about 59 inches.

Included with this soil in mapping are small areas of the more loamy Westmoreland soil and small areas of the moderately deep Culleoka soils near slope breaks. The moderately well drained, slowly or moderately slowly permeable Zanesville soils are included near the center of wider ridgetops. Included soils make up about 25 percent of most areas.

Permeability is moderate in this Wellston soil, and the available water capacity is high. Runoff is medium from cultivated areas. The shrink-swell potential is low. Potential frost action is high. Unless the soil has been limed, reaction in the root zone is medium acid to extremely acid.

Most areas are used for cultivated crops, hay, and pasture. The potential is high for these uses and for trees and woodland and openland wildlife habitat. It is medium for sanitary facilities and building site development.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay. If it is cultivated or the plant cover is removed for other purposes, the erosion hazard is severe. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, cover crops, crop residue for mulch, contour stripcropping, diversions, and grassed waterways reduce the hazard of erosion (fig. 8). Tilling within the optimum range of moisture content helps to prevent soil compaction.

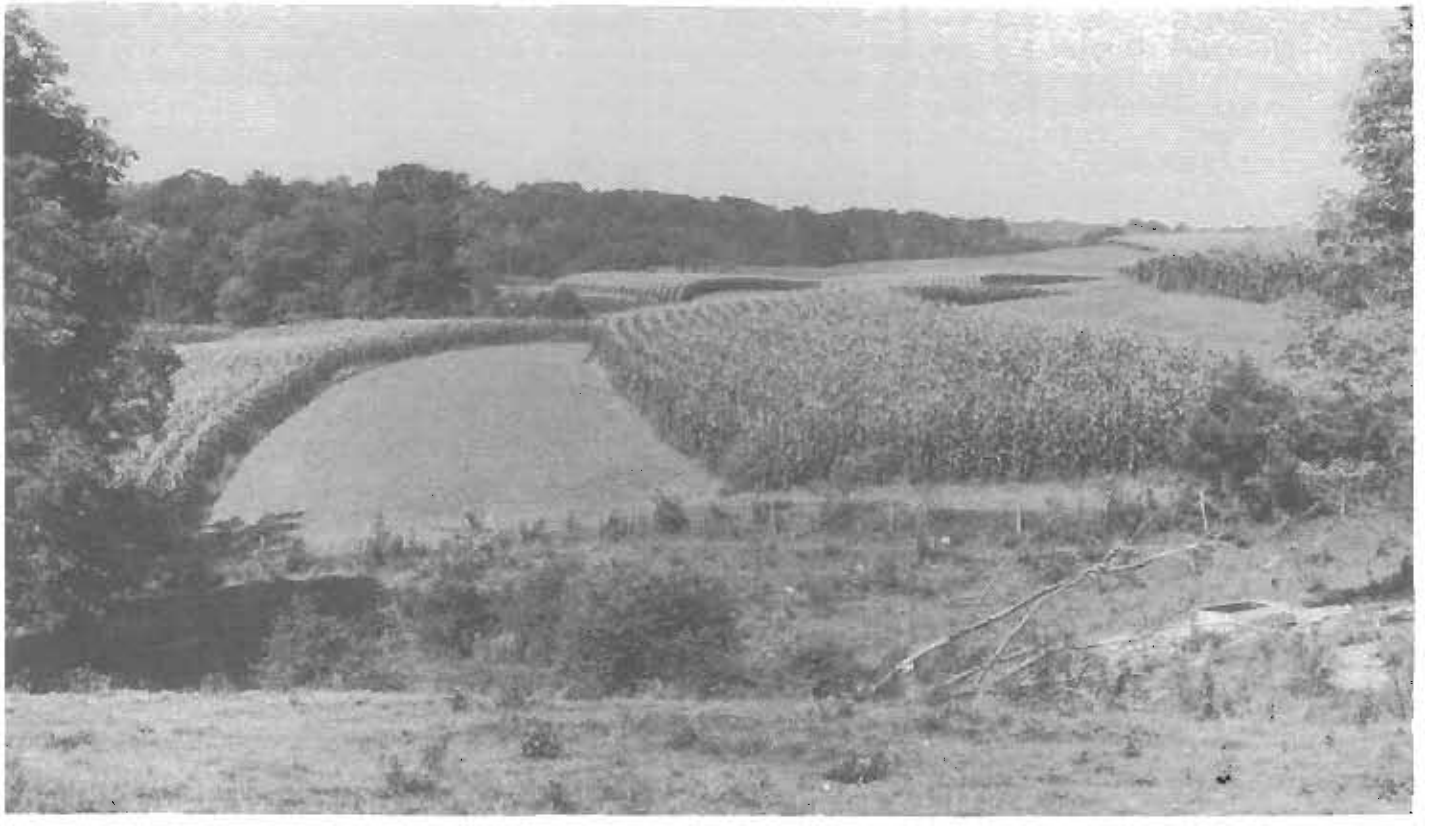

Figure 8.—Wellston silt loam, 8 to 15 percent slopes, is well suited to contour stripcropping.

This soil is suited to pasture. If it is overgrazed or plowed for sedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Mechanical planting and mowing to reduce plant competition are possible. Locating skid trails and logging roads on the contour reduces erosion.

This soil is suitable as a site for buildings and some sanitary facilities if good design and installation are used. The slope and depth to bedrock are the major limitations. As much cover as possible should be maintained on the site during construction to reduce erosion. Locating driveways across the slope reduces erosion and the angle of incline. Leach lines in septic tank absorption fields should be constructed across the slope to reduce seepage to the surface. Local roads can be improved by using a suitable base material to reduce the damage from frost action. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IIIe. The woodland suitability subclass is 2o.

WkB—Westmore silt loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is mainly on ridgetops and to a lesser extent on bench-like areas. Slopes are typically smooth and uniform. Most areas range from 5 to 20 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is olive brown, firm clay with mottles below about 32 inches. The substratum is yellowish brown, firm shaly silty clay loam. Weathered shale bedrock is at about 50 inches.

Included with this soil in mapping are small areas of Lowell and Wellston soils. Wellston soils are moderately permeable and have a lower content of clay in the lower part of the subsoil than this Westmore soil. Lowell soils have more clay in the upper part of the subsoil and are mainly near slope breaks and on slight rises. Included soils make up about 20 percent of most areas.

Permeability is moderately slow or slow in this Westmore soil. Runoff from cultivated areas is medium. The available water capacity is moderate. The shrink-swell potential in the lower part of the subsoil is high. Potential frost action is high. In unlimed areas, reaction is strongly acid or medium acid in the upper part of the root zone and is medium acid to mildly alkaline in the lower part.

Most areas are used for cropland and pasture. The potential is high for cultivated crops, small grain, hay, pasture, trees, and openland and woodland wildlife habitat. It is medium for most building site development and sanitary facilities.

This soil is well suited to cultivated crops and small grain and to grasses and legumes for hay. If it is cultivated, the erosion hazard is moderate. Cultivated crops can be grown year after year if the hazard of erosion is controlled and good management is used. Maintaining tilth and organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, incorporating crop residue into the plow layer, contour tillage or stripcropping, and grassed waterways reduce the hazard of erosion and help to maintain tilth and organic matter content. Tilling within the optimum moisture range helps to prevent soil compaction.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees. Mechanical planting and mowing to reduce plant competition are possible.

This soil is suitable as a site for buildings if special foundations are used to withstand the shrinking and swelling in the lower part of the subsoil. The slow or moderately slow permeability and depth to bedrock are limitations for sanitary facilities. Local roads can be improved by providing a suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 2o.

WkC—Westmore silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on benches on hillsides, on the upper part of slopes below ridgetops, and along small drainageways near upland divides. Most areas are long and rather narrow. Slopes are mainly smooth, but in a few areas irregularities occur along small drainageways. Areas are dominantly 5 to 30 acres.

Typically the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is olive brown, firm clay. The substratum is yellowish brown, firm shaly silty clay loam. Dark gray partly weathered shale bedrock is at about 50 inches.

Included with this soil in mapping are small areas of Lowell and Wellston soils. Lowell soils have more clay in the upper part of the subsoil than does this Westmore soil and are mainly near slope breaks. Wellston soils are moderately permeable and have a lower clay content in the lower part of the subsoil. They are in narrow bands

on hillside benches. Included soils make up about 20 percent of most areas.

Permeability is moderately slow or slow, and runoff from cultivated areas is rapid. The available water capacity is moderate. The shrink-swell potential in the lower part of the subsoil is high. Potential frost action is high. Unless the soil has been limed, the root zone is strongly acid or medium acid in the upper part and medium acid to mildly alkaline in the lower part.

This soil is used for cultivated crops, hay, and pasture. The potential is high for cultivated crops, small grain, hay, pasture, trees, and openland and woodland wildlife habitat. It is medium or low for sanitary facilities and building site development.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay and pasture. In cultivated areas the erosion hazard is severe. If conservation measures are used, a common rotation includes a cultivated crop or small grain for about half the time of the rotation. Maintaining tilth and organic matter are concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, contour stripcropping, grassed waterways, cover crops, and crop residue reduce erosion and reduce crusting after intense rains. Tilling within the optimum moisture range helps to prevent soil compaction.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by the trash mulch or no-till methods or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible. Locating logging roads and skid trails on the contour reduces erosion.

The slow or moderately slow permeability, depth to bedrock, slope, and high shrink-swell potential in the lower part of the subsoil are limitations for buildings and sanitary facilities. Specially designed foundations and footings are needed to withstand the shrinking and swelling of the soil. Local roads can be improved by using a suitable base material. Locating driveways across the slope reduces erosion and the angle of incline. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IIIe. The woodland suitability subclass is 2o.

WkD—Westmore silt loam, 15 to 25 percent slopes. This deep, well drained, moderately steep soil is on hillsides. It is mostly in bench-like areas and coves with steeper soils above and below. Most slopes are even to slightly concave and are dissected along drainageways. Areas commonly range from 5 to 40 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is olive brown, firm clay. The substratum is yellowish brown, firm shaly silty clay loam. Dark gray partly weathered shale bedrock is at about 50 inches.

Included with this soil in mapping are small areas of Lowell soils that have more clay in the upper part of the subsoil than does this Westmore soil. Those areas are on convex slopes and near slope breaks. Also included are small areas of somewhat poorly drained soils near seep spots. Included soils make up about 15 percent of most areas.

Permeability is moderately slow or slow in this Westmore soil, and runoff from cultivated areas is very rapid. The available water capacity is moderate. The shrink-swell potential in the lower part of the subsoil is high. Potential frost action is high. In unlimed areas, the root zone is strongly acid or medium acid in the upper part of the subsoil and medium acid to mildly alkaline in the lower part.

Most areas are used for crops and pasture. The potential is medium for cultivated crops and small grain and high for pasture, hay, and trees and woodland wildlife habitat. It is low for sanitary facilities and building site development.

This soil is suited to small grain, grasses and legumes for hay, and an occasional cultivated crop. A commonly used rotation includes a cultivated crop about once every four years. Deep-rooted legumes are difficult to maintain in some areas. In cultivated areas, the erosion hazard is very severe. Controlling erosion and maintaining tilth and organic matter content are concerns of management. No-till or conservation tillage, which leaves crop residue on the surface, and legumes in the cropping system, incorporating crop residue into the plow layer, grassed waterways, and cover crops reduce erosion and help to maintain tilth and organic matter content. Tilling within the optimum moisture range helps to prevent soil compaction. Diversions and subsurface drains are needed in some included wetter soils on hillside benches. Areas containing drainageways are generally better suited to pasture or trees.

This soil is suited to pasture. If it is plowed for seedbed preparation or is overgrazed, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with companion crops or cover crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour if practical reduces erosion. The slope

somewhat limits the use of equipment, but mechanical planting and mowing to reduce competition are possible. Coves and north- and east-facing slopes are the best sites for woodland. These sites have cooler temperatures and more water available for growth because they have less exposure to the prevailing winds and the sun.

The slope, slow or moderately slow permeability, depth to bedrock, and high shrink-swell potential in the lower part of the subsoil severely limit the use of this soil as a site for buildings and sanitary facilites. Specially designed foundations and footings are needed to withstand the shrinking and swelling of the soil. As much cover as possible should be maintained on the site during construction to reduce erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 2r.

WmB—Westmoreland silt loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is mainly on broad ridgetops. Slopes are dominantly uniform to convex. Areas are 2 to 20 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper and middle parts are brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Included with this soil in mapping are small areas of the moderately deep Culleoka and Dekalb soils near slope breaks. Both are more droughty than this Westmoreland soil. Included soils make up 10 to 20 percent of most areas.

Permeability and available water capacity are moderate in this Westmoreland soil. The root zone is deep. Runoff from cultivated areas is medium. Potential frost action is moderate. The shrink-swell potential is low. In unlimed areas, reaction in the root zone is medium acid to very strongly acid.

Most of the acreage is farmed. The soil potential is high for cultivated crops, small grain, hay, pasture, and trees, medium for sanitary facilities, and high for building site development.

This soil is suited to corn and small grain and to grasses and legumes for hay. Deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas. The hazard of erosion is moderate in cultivated areas. Cultivated crops can be grown year after year if the hazard of erosion is controlled. Controlling erosion and maintaining tilth and organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, contour farming or stripcropping, incorporating crop residue into the plow layer, cover crops, and grasses and legumes in the cropping system reduce the hazard of erosion and help to maintain tilth and organic matter content. Tilling within the optimum range of moisture content helps to prevent soil compaction.

This soil is suited to pasture. If it is overgrazed or is plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, weed control, and timely application of lime and fertilizer are needed to maintain pasture and soil in good condition. Controlled grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and openland and woodland wildlife habitat. Mechanical planting and mowing for weed control are possible.

This soil provides some of the best sites in the uplands for buildings. The depth to hard bedrock, however, hinders excavation in many areas. Depth to bedrock is also a limitation for such sanitary facilities as septic tank absorption fields and trench type sanitary landfills. Local roads can be improved by providing a suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 2o.

WmC—Westmoreland silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is near slope breaks to steeper soils on broad ridgetops, on rounded knolls and ridgetops, and in bands around hillsides. Slopes are generally smooth. Irregularities occur around shallow drainageways in some areas. Most areas are 3 to 20 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper and middle parts are brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Included with this soil in mapping are small areas of the moderately deep Culleoka and Dekalb soils, commonly on narrow ridge crests or near slope breaks. Both soils are more droughty than this Westmoreland soil. Included soils make up about 10 to 20 percent of most areas.

Permeability and available water capacity are moderate in this Westmoreland soil. The root zone is deep. Runoff from cultivated areas is rapid. The potential frost action is moderate. The shrink-swell potential is low. Reaction in the root zone is medium acid to very strongly acid unless the soil has been limed.

This soil is used mostly for cultivated crops, hay and pasture. The potential is high for these uses and for trees and is medium for sanitary facilities and building site development.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay (fig. 9). If it is

cultivated or the plant cover is removed for other purposes, the hazard of erosion is severe. No-till or conservation tillage, which leaves crop residue on the surface, contour stripcropping, grasses and legumes in the cropping system, cover crops, crop residue, diversions, and grassed waterways reduce the hazard of erosion. Tilling within the optimum range of moisture content helps to prevent soil compaction. Deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain soil and pasture in good condition. Controlling grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible.

This soil is suitable as a site for buildings and some sanitary facilities if good design and installation procedures are used. The slope and depth to hard bedrock are the major limitations. Driveways should be located across the slope to reduce erosion and the incline angle. Leach lines in septic tank absorption fields should be constructed across the slope to reduce seepage to the surface. Local roads can be improved by using a suitable base material. As much cover as possible should be maintained on the site during construction to reduce erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IIIe. The woodland suitability subclass is 2o.

Figure 9.—Westmoreland silt loam, 8 to 15 percent slopes, is suited to hay. Dekalb soils are on the knoll in the background

WmD—Westmoreland silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is mainly in bands around hillsides. A few small areas are on ridgetops and on knolls on ridgetops. Slopes are mainly smooth. Most areas range from about 10 to 40 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper and middle parts are brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Included with this soil in mapping are small areas of moderately deep Dekalb soils on the crests of ridges and knolls or near slope breaks. The deeper Richland soils are included in coves or on the lower part of hillsides. Included soils make up 10 to 20 percent of most areas.

Permeability and available water capacity are moderate in this Westmoreland soil. The root zone is deep. Runoff is very rapid in cultivated areas. The potential frost action is moderate. The shrink-swell potential is low. In unlimed areas, reaction in the root zone is medium acid to very strongly acid.

This soil is used mostly for crops and pasture. The potential is medium for cultivated crops and small grain, high for hay, pasture, and trees, and low for building site development and sanitary facilities.

This soil is suited to small grain, grasses and legumes for hay, and to an occasional cultivated crop. A commonly used rotation includes a cultivated crop about 1 in every 4 years. In cultivated areas, the hazard of erosion is very severe. Controlling erosion and maintaining organic matter content are concerns of management. No till or conservation tillage, which leaves crop residue on the surface, incorporating crop residue into the plow layer, grasses and legumes in the cropping system, contour stripcropping, cover crops, diversions, and grassed waterways reduce the hazard of erosion. Deep-rooted legumes are difficult to maintain in many areas.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing to control weeds, and timely application of lime and fertilizer are needed to maintain pasture and soil in good condition. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. The slope somewhat limits the use of equipment, but mechanical planting and mowing to reduce plant competition are possible. Coves and north- and east-facing slopes are the best sites for woodland. These sites have cooler temperatures and have more water available because they have less exposure to the prevailing winds and the sun.

The moderately steep slope and depth to bedrock severely limit the use of this soil as a site for buildings and sanitary facilities. As much cover as possible should be maintained on the site during construction to reduce erosion. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is IVe. The woodland suitability subclass is 2r.

WmE—Westmoreland silt loam, 25 to 40 percent slopes. This deep, well drained, steep soil is on hillsides. Slopes are generally smooth. Irregularities occur along a few drainageways. Most areas range from 10 to 50 acres.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at a depth of about 46 inches.

Included with this soil in mapping are small areas of the coarser textured, moderately deep Dekalb soils near slope breaks and the deeper Richland soils on concave slopes and the lower part of hillsides. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil, and runoff is very rapid. The root zone is deep. The available water capacity is moderate. Potential frost action is moderate. The shrink-swell potential is low. In unlimed areas, reaction in the root zone is very strongly acid to medium acid.

This soil is used mostly for pasture and woodland. The potential is high for trees and woodland wildlife habitat and is medium for hay and pasture. It is low for cultivated crops, small grain, sanitary facilities, and building site development.

Even though the steep slope limits the use of some equipment, this soil is suited to pasture. Smooth slopes are suited to hay. If the soil is overgrazed or plowed for seedbed preparation, erosion is a very severe hazard. Reseeding with a companion crop or using the trash mulch or no-till seeding reduces erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction. Deep-rooted legumes are difficult to maintain in many areas.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. The slope limits the use of planting and mowing equipment. Coves and north- and

east-facing slopes are the best sites for woodland. These sites have cooler temperatures and more water available for growth because they have less exposure to the prevailing winds and the sun.

The slope severely limits the use of this soil as a site for buildings, sanitary facilities, and most recreation uses. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIe. The woodland suitability subclass is 2r.

WmF—Westmoreland silt loam, 40 to 70 percent slopes. This very steep, well drained soil is in bands around hillsides and on hillsides along deeply dissected drainageways. Slopes are generally smooth. In a few areas slopes are broken by a few outcrops of sandstone bedrock and by drainageways. Most areas range from 40 to 100 acres.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 24 inches thick. The upper and middle parts are brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 42 inches.

Included with this soil in mapping are small areas of the moderately deep, more sandy Dekalb soils near slope breaks, a few rock outcrops, and stony areas. The deeper Richland soils are included in concave areas and on the lower part of hillsides. Included areas make up 15 to 20 percent of most map areas.

Permeability and available water capacity are moderate in this Westmoreland soil. The root zone is deep. Runoff is very rapid. Potential frost action is moderate. The shrink-swell potential is low. Reaction in the root zone is medium acid to very strongly acid in unlimed areas.

Most areas of this soil are wooded. A few areas are unimproved pasture. The potential is low for crops, pasture, building site development, and sanitary facilities and high for trees and woodland wildlife habitat.

In some cleared areas this soil is used for pasture, but it is poorly suited to this use. Most of the pasture is reverting to brush. The soil is too steep for commonly used mowing and fertilizing equipment.

This soil is suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Coves and north- and east-facing slopes are best suited for woodland. These sites have more water available for growth and cooler temperatures because they have less exposure to the prevailing winds and the sun. Mechanical planting and mowing to reduce plant competition are not possible because of the very steep slopes. Logging is difficult, especially in areas where slopes are 60 to 70 percent.

The slope severely limits the use of this soil as a site for buildings, sanitary facilities, and most recreation uses. Trails in recreation areas should be protected against erosion and should be laid out on the contour if possible.

The capability subclass is VIIe. The woodland suitability subclass is 2r.

WoC—Westmoreland-Upshur complex, 8 to 15 percent slopes. This map unit consists of deep, strongly sloping, well drained soils on rounded knolls and narrow ridgetops. These soils are also near the edges of broad ridgetops and in bands around hillsides. Slopes are generally smooth, but along a few shallow drainageways they are irregular. Most areas are 2 to 20 acres.

This unit is about 45 percent Westmoreland silt loam and 35 percent Upshur silty clay loam. Both soils are in alternate bands of varying width on hillsides. The Westmoreland soil is generally on the steeper parts of areas and on slope breaks. The Upshur soil is in the less sloping areas and on knolls. Areas of the two soils are so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part is brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Typically, the surface layer of the Upshur soil is reddish brown, friable silty clay loam about 6 inches thick. The subsoil is reddish brown and weak red, firm silty clay and clay about 22 inches thick. The substratum to a depth of about 60 inches is dusky red, very firm clay.

Included with these soils in mapping are small areas of moderately deep Culleoka soils on slope breaks, crests of knolls, and narrow ridgetops. Also included are severely eroded spots of soils that have a yellowish brown channery silt loam and reddish brown clay surface layer. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and slow in the Upshur soil. Available water capacity is moderate in both soils. Runoff is rapid from cultivated areas. Tilth is good in the Westmoreland soil and fair in the Upshur soil. The Westmoreland soil dries faster than the Upshur soil. Cracks occur in the surface of the Upshur soil during drying. The Upshur soil is sticky when wet and puddles and clods easily. The shrink-swell potential is low in the Westmoreland soil. It is high in the subsoil of the Upshur soil and moderate in the substratum. Potential frost action is moderate in both soils. In unlimed areas, the root zone of the Westmoreland soil is medium acid to very strongly acid. The root zone of the Upshur soil is very strongly acid to mildly alkaline.

These soils are mainly cropland and pasture. A small acreage is woodland. The potential is high for hay and

pasture and for cultivated crops under a conservation farming program. The potential is high for trees in the Westmoreland soil and medium in the Upshur soil. The potential is medium for building site development and sanitary facilities in the Westmoreland soil and low in the Upshur soil.

These soils are suited to cultivated crops, small grain, and hay. The hazard of erosion is severe in cultivated areas. Controlling erosion, improving tilth, and increasing the organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, incorporating crop residue into the plow layer, contour stripcropping, and the use of diversions, grassed waterways, and cover crops reduce erosion and improve tilth. These practices are especially useful on the Upshur soil. The Upshur soil should be tilled within a limited range of moisture content because it becomes compacted and cloddy if worked when wet and sticky.

These soils are suited to pasture. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by trash mulch or no-till seeding or with cover crops or companion crops reduces erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain the pasture in good condition. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

These soils are suited to trees. Locating skid trails and logging roads on the contour reduces erosion. Mechanical tree planting and mowing to reduce plant competition are possible on these soils. Use of equipment is somewhat difficult on the Upshur soil when the silty clay loam surface layer is soft and slippery.

The Westmoreland soil is better suited as a site for buildings and sanitary facilities than the Upshur soil because it has better internal drainage and a lower content of clay. Slow permeability and high shrink-swell potential of the clayey subsoil of the Upshur soil are severe limitations for building sites and sanitary facilities. Specially designed footings and foundations are needed. Leach lines in septic tank absorption fields should be constructed across the slope to reduce seepage to the surface. Maintaining as much cover as possible on the site during construction reduces the erosion hazard. Local roads can be improved by providing a suitable base material.

The capability subclass is IIIe. The woodland suitability subclass is 2o for the Westmoreland soil and 3c for the Upshur soil.

WoD—Westmoreland-Upshur complex, 15 to 25 percent slopes. This map unit consists of deep, moderately steep, well drained soils in bands around hillsides. A few areas are on knolls on hilltops. Slopes are mostly smooth and convex. Some irregularities are along shallow drainageways and at narrow benches, low escarpments, and a few hillside slips. Most areas are 10 to 40 acres.

This unit is about 50 percent Westmoreland silt loam and 30 percent Upshur silty clay loam. The Westmoreland soil is on the steepest part of areas. The Upshur soil is in the less sloping areas and on benches. Areas of the two soils are so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Westmoreland soil is brown, friable silt loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part is brown and yellowish brown, friable silt loam and firm clay loam, and the lower part is yellowish brown, firm channery clay loam. The substratum is yellowish brown, firm channery clay loam. Hard sandstone bedrock is at about 50 inches.

Typically, the surface layer of the Upshur soil is reddish brown, friable silty clay loam about 6 inches thick. The subsoil is reddish brown and weak red, firm silty clay and very firm clay about 22 inches thick. The substratum to about 60 inches is dusky red, firm and very firm clay.

Included with these soils in mapping are small areas of the moderately deep Culleoka soils on the tops of knolls and near and above slope breaks. Severely eroded spots of soil with a yellowish brown channery silt loam and reddish brown clayey surface layer are also included. Also included are narrow strips where slopes are 25 to 40 percent. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and slow in the Upshur soil. The available water capacity is moderate in both soils. Runoff is very rapid from cultivated areas. The Westmoreland soil has good tilth and dries faster than the Upshur soil, which has fair tilth. The Upshur soil is sticky when wet and puddles and clods easily. The soil surface cracks during drying. The shrink-swell potential is low in the Westmoreland soil. It is high in the subsoil of the Upshur soil and moderate in the substratum. Potential frost action is moderate in both soils. In unlimed areas, the root zone of the Westmoreland soil is medium acid to very strongly acid. The root zone of the Upshur soil is very strongly acid to mildly alkaline.

These soils are used mainly for pasture and cropland. A small acreage is wooded. The potential is medium for crops and high for hay, pasture, and woodland wildlife habitat. The potential for trees is high in the Westmoreland soil and medium in the Upshur soil. It is low in both soils for building site development and sanitary facilities.

These soils are suited to a cropping system that includes small grain and an occasional cultivated crop if erosion is controlled and good management is used. A commonly used rotation includes sod crops about three-fourths of the time. The hazard of erosion is very severe in cultivated areas. Tillage is more difficult in the included severely eroded areas of Upshur soils because of the high clay content in the surface layer. Controlling erosion, maintaining tilth, and increasing the organic

matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, incorporating crop residue into the plow layer, contour stripcropping, and the use of diversions, grassed waterways, and cover crops reduce erosion, improve tilth, and increase organic matter content. These practices are especially useful on the Upshur soil. The Upshur soil should be tilled within a limited range in moisture content because it becomes compacted and cloddy when wet. Tillage is more difficult in the included severely eroded areas of Upshur soils because of the high clay content in the surface layer.

These soils are suited to pasture. If they are overgrazed or plowed for seedbed preparation, the hazard of erosion is very severe. Reseeding by trash mulch or no-till seeding or with companion crops or cover crops reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain pasture and soil in good condition. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

These soils are suited to trees and woodland wildlife habitat. Locating skid trails and logging roads on the contour reduces erosion. Mechanical planting and mowing to reduce plant competition are possible; care, however, must be taken in the operation of equipment. The Upshur soil is soft and slippery when wet. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and more water available for growth because they have less exposure to the prevailing winds and the sun.

The slope of both soils and the slow permeability and high shrink-swell potential in the subsoil of the Upshur soil are severe limitations for buildings and sanitary facilities. The Westmoreland soil is better suited to these uses than the Upshur soil. Specially designed footings and foundations are needed on the Upshur soil. Excavations around foundations should be backfilled with material that contains considerably less clay than does the Upshur soil. The silty clay loam surface layer of the Upshur soil is sticky when wet. Local roads can be improved by providing a suitable base material. As much cover as possible should be maintained on the site during construction to reduce the erosion hazard.

The capability subclass is IVe. The woodland suitability subclass is 2r for the Westmoreland soil and 3c for the Upshur soil.

ZnB—Zanesville silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on benches and broad ridgetops. Slopes are generally smooth and are even to slightly convex. Most areas range from 5 to 40 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam with mottles in the lower 2 inches, and the lower part is a strong brown, mottled, very firm and brittle, compact silty clay loam fragipan. The substratum is yellowish brown, mottled, firm gravelly silty clay loam and channery clay loam. Hard siltstone bedrock is at about 59 inches.

Included with this soil in mapping are small areas of the well drained Wellston soils. Narrow bands of the moderately deep, well drained Culleoka soils are included near slope breaks. Included soils make up about 20 percent of most areas.

Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Depth to the seasonal high water table is 24 to 36 inches. Roots are restricted to the moderately deep zone above the pan. The available water capacity is moderate. Runoff is medium in cultivated areas. Potential frost action is high. The shrink-swell potential is low. Unless the soil has been limed, reaction in the root zone is medium acid to very strongly acid.

This soil is used for cultivated crops, hay, pasture, and trees. The potential is high for row crops, hay, and pasture and medium for trees, sanitary facilities, and building site development.

This soil is suited to cultivated crops and small grain and to grasses and legumes for hay. Cultivated crops can be grown year after year if the hazard of erosion is controlled. In cultivated areas the hazard of erosion is moderate. Controlling erosion and maintaining tilth and organic matter content are concerns of management. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, incorporating crop residue into the plow layer, cover crops, contour tillage, and stripcropping reduce the hazard of erosion and help to maintain tilth and organic matter content. Tilling within the optimum range of moisture content helps to prevent soil compaction. Subsurface drainage is generally not needed except for intensive uses, such as special crops. Stands of deep-rooted legumes, such as alfalfa, are difficult to maintain in many areas because of the acid subsoil, seasonal wetness, and high potential frost action.

This soil is suited to pasture. If it is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a maximum stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and openland and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible.

Even though seasonal wetness and depth to bedrock are limitations, this soil is suitable as a site for buildings. It is better suited to houses without basements than to houses with basements. Footing drains and exterior wall coatings are commonly used to help prevent wet

basements. The slow or moderately slow permeability and wetness severely limit use for septic tank absorption fields. Local roads and streets can be improved by providing artificial drainage and suitable base material.

The capability subclass is IIe. The woodland suitability subclass is 3o.

ZnC—Zanesville silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on rounded ridgetops and, to a lesser extent, on benches and the upper part of hillsides. Slopes are typically smooth and convex. Most areas are 3 to 60 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam with mottles in the lower 2 inches, and the lower part is a strong brown, mottled, compact, very firm silty clay loam fragipan. The substratum is yellowish brown, mottled, firm gravelly silty clay loam and channery clay loam. Hard siltstone bedrock is at about 59 inches.

Included with this soil in mapping are small areas of well drained Wellston soils. Narrow bands of the moderately deep, well drained Culleoka soils and the more loamy, well drained Westmoreland soils are included near slope breaks. Included soils make up about 20 percent of most areas.

Permeability is moderate above the fragipan and moderately slow or slow in the pan. Depth to the seasonal high water table is 24 to 36 inches. Runoff is rapid from cultivated areas. Roots are restricted to the moderately deep zone above the pan. The available water capacity is moderate. Potential frost action is high. The shrink-swell potential is low. Unless the soil has been limed, the reaction in the root zone is medium acid to very strongly acid.

Most areas are used for cultivated crops, hay, and pasture. The potential is high for these uses. It is medium for trees and low or medium for sanitary facilities and building site development.

This soil is suited to cultivated crops, small grain, and grasses and legumes for hay. If it is cultivated or the protective cover is removed, the hazard of erosion is severe. If conservation measures are used, a common rotation includes a cultivated crop or small grain about half the time of the rotation. Conservation tillage, which leaves crop residue on the surface, grasses and legumes in the cropping system, incorporating crop residue into the plow layer, contour stripcropping, and cover crops reduce the hazard of erosion. Tilling within the optimum range of moisture content helps to prevent soil compaction. Stands of alfalfa are difficult to maintain because of the limited root zone, high potential frost action, acid subsoil, and some seasonal wetness.

This soil is suited to pasture. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding reduces the hazard of erosion. Proper stocking, pasture rotation, mowing for weed control, and timely application of lime and fertilizer are needed to maintain a good stand of key forage plants. Limiting grazing in winter and other wet periods helps to prevent soil compaction.

This soil is suited to trees and to openland and woodland wildlife habitat. Mechanical planting and mowing to reduce plant competition are possible. Locating skid trails and logging roads on the contour reduces erosion.

This soil is moderately well suited as a site for buildings without basements if special design and installation procedures are used. The slope, depth to hard bedrock, seasonal wetness, high potential frost action, and slow or moderately slow permeability are limitations. Footing drains and exterior basement wall coatings are commonly used to help prevent wet basements. Leach lines in septic tank absorption fields should be constructed across the slope to reduce seepage of the effluent to the soil surface. Cover should be maintained on the site as much as possible during construction to reduce erosion. Local roads can be improved by providing artificial drainage and a suitable base material.

The capability subclass is IIIe. The woodland suitability subclass is 3o.

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

David A. Coulter, 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 and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967, more than 170,000 acres in the survey area was used for crops and pasture according to the Conservation Needs Inventory (*7*). Of this total about 9,000 acres was used for row crops, mainly corn; 7,700 acres was used for close-growing crops, mainly wheat and oats; 34,600 acres was used for rotation hay and pasture; and 90,500 acres was used for permanent pasture. The other 28,200 acres was idle cropland or was in crops such as fruits and vegetables.

The potential for increased production of food is good. About 28,500 acres of potential cropland is currently used as woodland and about 14,000 acres as pasture. In addition to the reserved productive capacity represented by this land, food, production could be increased considerably by using the most recent crop production technology on all cropland and pasture in the county. This survey can help in applying technology.

Acreage in crops and pasture has gradually been decreasing as more land is used for woodland, urban development, and strip mining. In 1967, there was 24,127 acres of Urban and built-up land in the county (*7*); this figure has been increasing at the rate of 100 to 150 acres per year. The acreage in crops and pasture decreased each year for a number of years prior to 1972, mainly because of off-farm income opportunities. In addition, land was purchased or leased by coal companies for surface mining (strip mining); after it was mined this land was not adequately reclaimed. Since 1972 the income potential for cropland has increased. Mining activities have resulted in more jobs, and more income has been invested in rehabilitating formerly idle cropland. At the same time the State of Ohio enacted a new strip mine reclamation law requiring that spoil be graded to the original contour and 8 inches of soil material be placed over the spoil. Reclaimed land is mainly used for hay crops and pasture. In a few instances land owners have required coal companies to replace up to 30 inches of soil material, bringing the production potential of the land to nearly the former level. The use of this soil survey to help make land use

decisions that will influence the future role of farming in the county is discussed in the section "General soil map units."

Erosion is the major soil problem on most of the cropland and on some of the pasture in Belmont County. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced if the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a clayey subsoil, such as Brookside, Elba, Lowell and Upshur soils, and on soils with a layer in or below the subsoil that limits roots. Such layers include fragipans in Otwell and Zanesville soils and bedrock in Culleoka and Dekalb soils. Second, soil erosion results in the sedimentation of streams. Controlling erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many fields, preparing a good seedbed and tilling are difficult on included eroded spots because much of the original friable surface layer has eroded away. Such spots are common in areas of Elba, Lowell, Otwell, and Upshur soils.

Erosion control measures provide protective surface cover, reduce runoff, and increase the rate of water intake. A cropping system that keeps plant cover on the soil for extended periods can hold soil losses to amounts that do not reduce the productive capacity of the soils. Conservation tillage, which leaves crop residue on the surface, increases infiltration and reduces the hazards of runoff and erosion. These measures can be adapted to most soils in the survey area but are more difficult to use successfully on eroded soils and on soils that have a silty clay loam surface layer, such as Brookside, Elba, and Upshur soils. No-till for corn, which is used on an increasing acreage, is very effective in reducing erosion and can be adapted to most soils in the survey area. It is more difficult to practice successfully, however, on soils with a silty clay loam surface layer.

Terraces and diversions reduce the length of slopes and reduce runoff and erosion. Most of the nearly level to strongly sloping soils in the survey area are suited to terraces and diversions. Some soils are not very well suited to terraces and diversions because of clayey textures in the subsoil, which would be exposed in terrace channels, irregular slopes, slopes of more than 15 percent, or bedrock at a depth of 20 to 40 inches. Diversions have been successfully used on slopes of up to 30 percent to help control erosion and to establish plant cover on Bethesda, Fairpoint, and Morristown soils, which formed in rock fragments and partly weathered fines mixed by surface mining for coal.

Contouring and contour stripcropping are erosion control practices commonly used in the survey area. They are suited to most of the gently sloping to moderately steep soils.

Drainage is needed on soils on flood plains, such as Newark silt loam, frequently flooded. It is also needed in wet spots of well drained and moderately well drained soils, such as Brookside and Westmore soils, on hillsides. In areas of the Newark silt loam, ponded, suitable outlets, are seldom available, and the soil is ponded most of the year. Adequate outlets are seldom available on Newark Variant soils, and the areas are commonly too small to economically manage for crop production.

Fertility is naturally low in soils on uplands and terraces. All the soils on uplands, except Fairpoint, Morristown, and, in places Richland and Upshur soils, are naturally acid. Ashton soils on low stream terraces and alluvial fans are medium in natural fertility and are medium acid to neutral. The soils and flood plains, such as Chagrin and Newark soils, are medium to high in natural fertility and typically medium acid to mildly alkaline. Nolin Variant soils are mildly alkaline throughout.

Upland soils that are naturally acid require applications of lime to raise the pH level sufficiently for good growth of crops such as alfalfa. Available phosphorus and potash levels are naturally low in most of the soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amount of fertilizer and the amount of lime to apply.

Tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a silt loam surface layer that is light in color and moderately low or moderate in organic matter content. Generally, the structure of such soils is weak. Intense rainfall causes a crust to form on the surface. Because the crust is hard when it is dry and is nearly impervious to water, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material help to improve soil structure and reduce crusting.

Fall plowing is not a good practice on light colored soils that have a silt loam surface layer because of crusting during winter and spring. If plowed in fall, many of the soils are nearly as dense and hard at planting time as they were before they were plowed. Erosion damage is even more serious on slopes of more than 8 percent.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Corn and, to a very minor extent, soybeans are the row crops commonly grown. Grain sorghum, sunflowers, potatoes, and similar crops can be grown if economic conditions are favorable. Wheat and oats are the common close-growing crops. Rye, barley, buckwheat, and flax could be grown.

Special crops grown commercially in the survey area are vegetables, small fruits, tree fruits, and nursery plants. A small acreage is used for melons, strawberries,

raspberries, sweet corn, tomatoes, peppers, pumpkins, and other vegetables and small fruits. In addition, other special crops such as blueberries and grapes could be grown. Apples and peaches are the most important tree fruits grown in the county.

Deep soils that have good natural drainage and that warm early in spring are especially well suited to many vegetables and small fruits. Ashton, Chili, Elkinsville, Wellston, and Westmoreland soils on slopes of less than 8 percent are examples. Areas of these soils not in complex with Urban land or other soils total more than 11,000 acres. Also, about 4,300 acres of gently sloping Culleoka and Dekalb soils that have slopes of 3 to 8 percent are very well suited to vegetables and small fruits if irrigated. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area.

Most of the nearly level to moderately steep, well drained soils on terraces and uplands are suitable for orchards. Soils on low positions, where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

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

The 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 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

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 slight 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, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Approximately 36 percent of Belmont County is wooded. The woodland is mostly privately-owned stands and farm woodlots. The most extensive wooded areas are in the Lowell-Westmoreland association, in the eastern part of the county.

The woodland is largely mixed hardwoods, dominantly cherry and maple. Most of the wooded acreage is on steep and very steep soils that formed in material weathered from the underlying limestone, siltstone, shale, and sandstone bedrock. Woodland is not a dominant land use on colluvial foot slopes and is only a minor land use on ridgetops and high terraces that are suited to farming. The wooded acreage has increased in recent years, particularly in areas where the topography is steep and the soils formed in residuum of the underlying bedrock. These areas are not well suited to crops or hay, and some large tracts that were cropped are reverting to woodland.

In places, the woodland shows the result of abuse and neglect. Heavy cutting without planning for future timber production has resulted in understocked stands of trees near maturity. High grading has continually removed the best trees and left diseased or damaged trees to occupy valuable growing space on excellent woodland soils. Low-value white elm and hollow beech and poorly formed black cherry and maple now occupy thousands of acres where yellow-poplar, oak, black walnut, and sugar maple were once prevalent. Grazing has damaged or destroyed leaf litter and desirable seedlings, has damaged roots, and has packed the soil. Good management can, in time, restore this woodland to a higher level of production.

Soils differ greatly in productivity for woodland. The factors that influence tree growth are almost the same as those that influence production of annual crops and pasture. The major difference is that tree roots extend deeper into the soil, especially around rock fragments in the lower part of the soil. The direction of exposure, or aspect, and the position of the soil on the landscape are important in evaluating a soil for woodland. Other properties to be considered are the percentage of slope, the degree of past erosion, the acidity, and the fertility.

Aspect is the compass direction toward which the slope faces. Trees grow better on north and east aspects because exposure to the prevailing winds and the sun is less and the soil moisture is more abundant. Some of the factors that make south and west aspects less suitable are higher soil temperature as a result of more direct sunrays, high evaporation by prevailing winds, earlier melting of snow, and a greater degree of freezing and thawing.

The position of the soil on the landscape is important in determining moisture supply for tree growth. Soil moisture increases as elevation decreases, partly because of seepage downslope. Also, on the lower part of slopes the soils are generally deeper than on the upper part, the loss of soil moisture by evaporation is less, and the soil temperature is somewhat lower.

Steepness of slope is an important factor in woodland management. Steep and very steep slopes seriously limit equipment use. On steeper slopes, the rate of water infiltration is less and the rate of runoff and the hazard of erosion are greater.

Erosion reduces the volume of soil available to store water. Severe erosion removes the protective surface layer and exposes the subsoil, which is commonly less porous, increasing runoff, and lowering the water-intake rate. Both growth and natural reseeding are adversely affected.

Soil reaction and fertility influence the growth of trees. For example, black walnut trees grow better on such soils as Brookside, Chagrin, Hartshorn, and Nolin Variant soils, in which the natural content of lime in the subsoil is favorable for growth. Growth is slower on soils with low fertility.

Table 7 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 7, *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 a 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. 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.

recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as flooding, 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 8, 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 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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

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

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

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

The potential of the soil is rated good, fair, poor, or very poor (*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 panicum.

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

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, 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 11 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 11 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 effectively filter the effluent. 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 11 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 11 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 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, sand, gravel, and topsoil. 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 properties and classifications 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 used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

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 13 gives information on the soil properties and site features that affect water management. The kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds.

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 testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

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 properties and classifications

Table 14 gives estimates of engineering properties and classifications 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 a soil contains particles coarser than sand, 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. The AASHTO classification for soils tested is given in table 17.

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 oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, 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.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on 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 15, the estimated content of organic matter of the plow layer 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 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are 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 and water in swamps and marshes are not considered flooding.

Table 16 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 an average of once or less in 2 years; and *frequent* that it occurs on an average of 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 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, 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 16.

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 shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

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

Many of the soils in Belmont County were sampled and laboratory data determined by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained on most samples include particle size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in classifying and correlating the soils and in evaluating their behavior under various land uses. Eight of the profiles were selected as representative for the respective series and are described in this survey. These series and their laboratory identification number are: Barkcamp (Bt-I2), Bethesda (Bt-I4), Fairpoint (Bt-I8), Lowell (Bt-5), Morristown (Bt-21), Nolin Variant (Bt-7), Otwell (Bt-8), and Wellston (Bt-6).

Laboratory data are also available from nearby counties that have many of the same soils. These data and the Belmont County data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

engineering test data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Ohio Department of Highways Testing Laboratory.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-66T); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); moisture-density, method A (T99-57).

The coarse fragments in the samples were crushed prior to sieving; therefore, a higher percentage passed the sieves than is typical for the soils.

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. In table 18, the soils of the survey area are classified according to the system. 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 an 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-loamy, 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."

Allegheny Variant

The Allegheny Variant consists of deep, moderately well drained, moderately permeable soils. These soils formed in alluvium on high terraces. The slope range is 8 to 15 percent.

Allegheny Variant soils are similar to Elkinsville soils and are commonly adjacent to Dekalb and Richland soils. Elkinsville soils contain more silt and less sand in the upper part of the subsoil than do Allegheny Variant soils. Dekalb soils are 20 to 40 inches deep over bedrock, contain more than 35 percent coarse fragments in the solum, and do not have an argillic horizon.

Richland soils formed in colluvium, contain more coarse fragments throughout than do Allegheny Variant soils, and have a higher base status.

Typical pedon of Allegheny Variant loam, 8 to 15 percent slopes, in Somerset Township, T. 7 N., R. 6 W., 1,660 feet west and 580 feet south of the northeast corner sec. 23:

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) loam; strong fine granular structure; very friable; many fine roots; extremely acid; abrupt smooth boundary.

A12—4 to 9 inches; brown (10YR 4/3) loam; moderate medium granular structure; very friable; common fine roots; extremely acid; clear smooth boundary.

B1—9 to 14 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; few fine roots; extremely acid; clear smooth boundary.

B21t—14 to 26 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; few fine roots; medium patchy brown (7.5YR 5/4) clay films on faces of peds; extremely acid; clear smooth boundary.

B22t—26 to 40 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 5/l) and few fine distinct yellowish red (5YR 5/8) mottles; moderate coarse prismatic structure parting to strong medium subangular blocky; firm; thin patchy light gray (10YR 7/2) clean silt and sand grains; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; clear smooth boundary.

B3—40 to 58 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak coarse angular blocky; firm; thick continuous gray (10YR 5/1) and brown (10YR 5/3) clean silt and sand grains; dark yellowish brown (10YR 4/4) clay bridging sand grains in peds; extremely acid; clear smooth boundary.

C—58 to 70 inches; strong brown (7.5YR 5/6) loam with a few thin strata of clay loam and sandy loam; massive; friable; thick continuous brown (10YR 5/3) silt coatings on sand grains; very strongly acid.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock ranges from 5 to 10 feet or more. Content of pebbles ranges from 0 to 10 percent by volume in the A and B2t horizons and from 0 to 15 percent in the B3 and C horizons. Reaction is strongly acid to extremely acid, unless the soil has been limed.

The A1 horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 to 4. It is dominantly loam but ranges to silt loam.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is dominantly loam or silt loam but ranges to sandy loam, fine sandy loam, or clay loam in some pedons.

The C horizon is similar to the B horizon in hue, value, and chroma. It is sandy loam, loam, or clay loam.

Ashton series

The Ashton series consists of deep, well drained, moderately permeable soils formed in alluvium on low stream terraces and on alluvial fans. The slope range is 0 to 3 percent.

Ashton soils are similar to Duncannon and Elkinsville soils and are commonly adjacent to Chili, Duncannon, Elkinsville, and Otwell soils. All of those soils are on higher level stream terraces, have a lighter colored A horizon than Ashton soils, and are not subject to flooding. In addition, Duncannon soils have less clay in the upper 20 inches of the argillic horizon, Otwell soils have a fragipan, and Chili soils have sand and gravel in the C horizon.

Typical pedon of Ashton silt loam, occasionally flooded, in York Township, T. 4 N., R. 3 W., 2,000 feet west and 2,700 feet south of the northeast corner sec. 27:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many fine roots; many fine dark concretions (Fe and Mn oxides); neutral; abrupt smooth boundary.

B1—9 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common fine roots; thick continuous very dark grayish brown (10YR 3/2) organic coatings on faces of peds and in root and worm channels; many fine dark concretions (Fe and Mn oxides); slightly acid; clear smooth boundary.

B2t—13 to 29 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; medium patchy very dark grayish brown (10YR 3/2) organic coatings on faces of peds and in root and worm channels; common fine dark concretions (Fe and Mn oxides); medium acid; clear smooth boundary.

B3t—29 to 43 inches; brown (7.5YR 5/4) silt loam; weak coarse subangular blocky structure; friable; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

C—43 to 89 inches; yellowish brown (10YR 5/4) heavy loam; massive; friable; medium acid.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock ranges from 5 to 10 feet or more. Content of pebbles ranges from 0 to 3 percent by volume in the solum and from 0 to 10 percent in the C horizon. Reaction ranges from neutral to medium acid throughout the soil.

The Ap or A1 horizon has hue of 10YR, value of 3 moist and less than 6 dry, and chroma of 2 or 3. It is dominantly silt loam but ranges to loam in some pedons.

The B2t horizon has hue of 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is silt loam or light silty clay loam. Some pedons have subhorizons of loam in the lower part.

The C horizon is similar to the B horizon in hue, value, and chroma except that hue of 10YR is included. It is silt loam, silty clay loam, loam, or fine sandy loam with thin strata of sandy loam in some pedons. In some pedons few or common mottles in shades of brown or gray are below 36 inches.

Barkcamp series

The Barkcamp series consists of deep, well drained soils formed in a mixture of extremely acid, partly weathered fine earth and fragments of medium and coarse grained sandstone and lesser amounts of fine grained sandstone, siltstone, shale, and coal from surface mining. Permeability is moderately rapid or rapid. The slope range is 0 to 70 percent.

Barkcamp soils are commonly adjacent to Bethesda, Fairpoint, and Morristown soils. All those soils are less acid, have mixed mineralogy, and have a higher clay content in the C horizon.

Typical pedon of Barkcamp gravelly sandy loam, 8 to 40 percent slopes, in Kirkwood Township, T. 3 N., R. 6 W., 2,600 feet north and 100 feet east of the southwest corner sec. 34:

A1—0 to 5 inches; pale brown (10YR 6/3) gravelly sandy loam; weak medium granular structure; friable; 15 percent fragments of gray (10YR 5/1) and yellowish brown (10YR 5/6) coarse grained sandstone and 5 percent fragments of dark gray (10YR 4/1) shale; extremely acid; abrupt smooth boundary.

C1—5 to 12 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam with few small masses of very gravelly sandy clay loam; massive; friable; 55 percent fragments of gray (10YR 5/1) and yellowish brown (10YR 5/6) coarse grained sandstone and 5 percent fragments of dark gray (10YR 4/1) shale; extremely acid; gradual smooth boundary.

C2—12 to 60 inches; variegated light brownish gray (10YR 6/2), pale brown (10YR 6/3), and red (2.5YR 5/6) very gravelly sandy loam; massive; very friable; 55 percent fragments of gray (10YR 5/1) and yellowish brown (10YR 5/6) coarse grained sandstone and 5 percent fragments of dark gray (10YR 4/1, N 4/0) shale; extremely acid.

Depth to bedrock is more than 5 feet. Reaction is extremely acid (pH 1.5 to 3.5) except where the surface layer has been limed or where the surface has been covered with less acid natural soil material. Content of coarse fragments consisting of gravel, cobbles, and stones, ranges from 15 to 50 percent by volume in the A horizon and from 35 to 75 percent in the C horizon.

The A1 or Ap horizon has hue of 10YR to 5Y, value of 4 to 6, and choma of 0 to 8. The fine earth part is dominantly sandy loam but includes loam or loamy sand. Reclaimed areas have an A horizon of natural soil material, 4 to 12 inches thick. This horizon is dominantly clay loam, but includes loam or silty clay loam.

The C horizon has hue of 2.5YR to 2.5Y, value of 4 to 6, and chroma of 0 to 8. Texture of the fine earth part is loam, sandy loam, and loamy sand.

Bethesda series

The Bethesda series consists of deep, well drained, moderately slowly permeable soils. They formed in a mixture of partly weathered fine earth and fragments of shale, sandstone, and siltstone from surface mining. The slope range is 0 to 70 percent.

Bethesda soils are commonly adjacent to Barkcamp, Fairpoint, and Morristown soils. Barkcamp soils are more acid, are coarser textured in the C horizon, and have siliceous mineralogy. Fairpoint soils are less acid than this Bethesda soil. Morristown soils are calcareous.

Typical pedon of Bethesda shaly silty clay loam, 0 to 8 percent slopes, in Kirkwood Township, T. 9 N., R. 6. W., 2,250 feet west and 100 feet south of the northeast corner sec. 27:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) shaly silty clay loam; weak coarse granular structure; friable; few roots; 15 percent shale fragments and 10 percent sandstone fragments; extremely acid; abrupt smooth boundary.

C1—5 to 20 inches; 80 percent variegated yellowish brown (10YR 5/4) and 20 percent brown (10YR 4/3), shaly clay loam; massive; firm; few roots; 25 percent shale fragments and 15 percent sandstone fragments; extremely acid; clear smooth boundary.

C2—20 to 60 inches; 70 percent variegated brown (10YR 4/3) and 30 percent yellowish brown (10YR 5/4) shaly clay loam; massive; very firm; 30 percent shale fragments and 15 percent sandstone fragments; extremely acid.

Depth to bedrock is greater than 5 feet. Reaction ranges from strongly acid to extremely acid except where the surface layer has been limed or where the surface has been covered with less acid natural soil material. Coarse fragments include shale, sandstone, and coal. They are mostly less than 10 inches in size but include stones and boulders. Content of coarse fragments in the C horizon ranges from 35 to 80 percent by volume and averages about 45 percent.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 0 to 8. It is dominantly shaly silty clay loam, very cobbly silty clay loam, or silt loam. Reclaimed

areas have a 4- to 12-inch A horizon from natural soil material.

The C horizon has hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 0 to 8. Texture of the fine earth part is silty clay loam, clay loam, silt loam, or loam.

Brookside series

The Brookside series consists of deep, moderately well drained, moderately slowly permeable soils. These soils formed in colluvium weathered from limestone, shale, siltstone, and thin layers of sandstone on foot slopes and alluvial fans. The slope range is 3 to 40 percent.

Brookside soils are commonly adjacent to Elba and Lowell soils and are similar to Elba, Lowell, and Richland soils. Elba and Lowell soils are in higher positions in the uplands and dominantly have a thinner solum than Brookside soils. Richland soils have less clay throughout.

Typical pedon of Brookside silty clay loam, 15 to 25 percent slopes, in Washington Township, T. 5 N., R. 4 W., 1,900 feet west and 2,550 feet north of the southeast corner sec. 28:

Ap—0 to 7 inches; dark brown (10YR 3/3) light silty clay loam, brown (10YR 4/3) rubbed, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to weak fine and medium granular; friable; many roots; 5 percent sandstone, siltstone, and shale fragments; medium acid; abrupt wavy boundary.

A&B—7 to 10 inches; 60 percent brown (10YR 4/3) silty clay loam (A2); weak medium subangular blocky structure; 40 percent dark yellowish brown (10YR 4/4) silty clay loam (B2t); moderate medium subangular blocky structure; friable; common roots; 5 percent randomly oriented sandstone, siltstone, and shale fragments; medium acid; clear wavy boundary.

B21t—10 to 18 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin continuous brown (7.5YR 4/4) clay films on faces of peds; 5 percent randomly oriented sandstone, siltstone, and shale fragments; medium acid; clear smooth boundary.

B22t—18 to 26 inches; yellowish brown (10YR 5/4) clay; moderate medium angular blocky structure; firm; few roots; thin continuous dark yellowish brown (10YR 4/4) clay films; 5 percent randomly oriented sandstone, siltstone, and shale fragments; medium acid; clear smooth boundary.

B23t—26 to 40 inches; yellowish brown (10YR 5/4) clay; few medium faint strong brown (7.5YR 5/6) and few medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few roots; thin continuous light olive brown (2.5Y 5/4) and olive brown (2.5Y 4/4) clay films on faces of peds; 5 percent randomly oriented sandstone, siltstone, and shale fragments; few concretions (iron and manganese oxides); slightly acid; gradual wavy boundary.

B3t—40 to 55 inches; yellowish brown (10YR 5/4) clay; common fine distinct light olive brown (2.5Y 5/6) and grayish brown (10YR 5/2) mottles; weak medium and coarse subangular blocky structure; firm; thin patchy grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) clay films on faces of peds; 10 percent randomly oriented sandstone, siltstone, and shale fragments; few concretions (iron and maganese oxides); slightly acid; gradual wavy boundary.

C1—55 to 70 inches; yellowish brown (10YR 5/4) silty clay; many medium faint light olive brown (2.5Y 5/6) and few fine distinct light brownish gray (2.5Y 6/2) mottles; massive; firm; 3 percent small red shale fragments and 5 percent randomly oriented siltstone fragments; few concretions (iron and manganese oxides); slightly acid; gradual wavy boundary.

C2—70 to 80 inches; yellowish brown (10YR 5/6) channery clay loam; many medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; 20 percent randomly oriented sandstone, siltstone, and shale fragments; neutral.

Solum thickness ranges from 40 to 70 inches. Depth to bedrock ranges from 5 to more than 10 feet. Content of coarse fragments, mostly sandstone, siltstone, shale, and limestone, is commonly 5 to 20 percent by volume in the solum but ranges to 35 percent in the C horizon. Reaction ranges from medium acid to neutral in the upper part of the solum and from medium acid to mildly alkaline in the lower part of the solum and in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly silty clay loam but ranges to silt 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 dominantly silty clay and clay but ranges to heavy silty clay loam or heavy clay loam.

The C horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 6. Texture of the fine earth part is dominantly silty clay or clay but ranges to silty clay loam or clay loam.

Chagrin series

The Chagrin series consists of deep, well drained, moderately permeable soils formed in alluvium on flood plains. The slope range is 0 to 3 percent.

Chagrin soils are commonly adjacent to Nolin Variant soils, which have more silt and less sand in the B horizon and are calcareous throughout.

Typical pedon of Chagrin silt loam, occasionally flooded, in York Township, T. 4 N., R. 3 W., 210 feet

north and 1,600 feet east of the southwest corner sec. 21:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable; many roots; neutral; abrupt smooth boundary.
B21—9 to 15 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; many roots; dark grayish brown (10YR 4/2) organic stains on faces of peds; neutral; clear smooth boundary.
B22—15 to 35 inches; brown (10YR 4/3) silt loam; weak coarse subangular blocky structure; friable; common roots; neutral; clear wavy boundary.
B3—35 to 43 inches; brown (10YR 4/3) loam; weak coarse subangular blocky structure; friable; few roots; neutral; clear wavy boundary.
C1—43 to 57 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; few roots; neutral; clear smooth boundary.
C2—57 to 62 inches; brown (10YR 4/3) sandy loam; massive; friable; neutral; clear smooth boundary.

Solum thickness ranges from 30 to 48 inches. Depth to bedrock ranges from 5 feet along some of the smaller streams to 10 feet or more along the larger streams. Content of coarse fragments ranges from zero to 10 percent by volume in the B and C horizons. Reaction is medium acid to neutral throughout the soil.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly silt loam but ranges to loam in some pedons.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam or loam but includes thin layers of sandy loam, fine sandy loam, clay loam, or silty clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly loam but includes stratified layers of silt loam and sandy loam.

Chili series

The Chili series consists of deep, well drained soils formed in outwash deposits on stream terraces. Permeability is moderately rapid in the B horizon and rapid in the C horizon. The slope range is 0 to 8 percent.

Chili soils are commonly adjacent to Ashton and Duncannon soils. Ashton soils have a darker colored A horizon and more silt and less sand in the B horizon than do Chili soils. Duncannon soils have more silt and less clay in the B horizon and a lower base status than Chili soils.

Typical pedon of Chili gravelly loam, 3 to 8 percent slopes, in Mead Township, T. 1 N., R. 2 W., 3,800 feet south and 860 feet west of the northeast corner sec. 35:

O1—2 inches to 0; leaf litter.
Ap—0 to 9 inches; brown (10YR 4/3) gravelly loam; moderate fine granular structure; very friable; many roots; 20 percent gravel; strongly acid; abrupt wavy boundary.
B21t—9 to 21 inches; brown (7.5YR 4/4) gravelly loam; weak medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; brown (7.5YR 4/4) clay films bridging sand grains; 30 percent gravel; strongly acid; clear wavy boundary.
B22t—21 to 29 inches; dark yellowish brown (10YR 4/4) gravelly loam; weak fine subangular blocky structure; friable; common roots; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 30 percent gravel; medium acid; clear wavy boundary.
B23t—29 to 44 inches; dark yellowish brown (10YR 4/4) gravelly loam; weak fine subangular blocky structure; friable; common roots; brown (7.5YR 4/4) clay films bridging sand grains; 40 percent gravel; medium acid; gradual smooth boundary.
B3—44 to 54 inches; brown (10YR 4/3) very gravelly sandy loam; massive; very friable; few roots; brown (7.5YR 4/4) clay films bridging pebbles and sand grains; 60 percent gravel; medium acid; gradual smooth boundary.
C—54 to 60 inches; brown (10YR 5/3) very gravelly sand; single grained; loose; 60 percent gravel; medium acid.

Solum thickness ranges from 40 to 60 inches. Reaction ranges from very strongly acid to medium acid in the solum and from strongly acid to neutral in the C horizon. Gravel content ranges from 0 to 30 percent by volume above 20 inches, from 15 to 50 percent from 20 to 40 inches, and from 25 to 60 percent below 40 inches with an average of less than 35 percent in the control section.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture of the fine earth part is loam or sandy loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is stratified sand and gravel.

Culleoka series

The Culleoka series consists of moderately deep, well drained soils formed in residuum of fine grained sandstone, siltstone, and thin layered shale on uplands. Permeability is moderate or moderately rapid. The slope range is 3 to 15 percent.

Culleoka soils are commonly adjacent to Dekalb, Wellston, Westmoreland, and Zanesville soils and are similar to Dekalb soils. Dekalb soils contain more sand and coarse fragments and less clay in the solum than do Culleoka soils. Wellston, Westmoreland, and Zanesville soils are deep to bedrock. Wellston soils contain more silt and less sand in the upper part of the soil. Zanesville soils are wetter and have a fragipan.

Typical pedon of Culleoka silt loam, 8 to 15 percent slopes, in Goshen Township, T. 7 N., R. 5 W., 1,920 feet south and 520 feet east of the northwest corner sec. 3:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; 5 percent sandstone fragments; slightly acid; abrupt wavy boundary.
B1—8 to 11 inches; brown (7.5YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; 10 percent sandstone fragments; medium acid; clear smooth boundary.
B21t—11 to 18 inches; brown (7.5YR 5/4) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; 10 percent sandstone fragments; strongly acid; clear smooth boundary.
B22t—18 to 25 inches; brown (7.5YR 5/4) channery heavy loam; weak medium subangular blocky structure; friable; few roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; 25 percent sandstone fragments; strongly acid; clear smooth boundary.
C—25 to 33 inches; yellowish brown (10YR 5/4) very channery loam; massive; friable; thin very patchy yellowish brown (10YR 5/4) clay films on faces of peds; 60 percent sandstone fragments; medium acid; gradual smooth boundary.
R—33 to 35 inches; olive brown (2.5Y 4/4) fine grained sandstone; massive.

Solum thickness ranges from 20 to 37 inches. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments, mostly sandstone and siltstone, ranges from 0 to 35 percent by volume in the A horizon, from 10 to 35 percent in the B horizon, and from 25 to 80 percent in the C horizon. Unless the soil has been limed, reaction is strongly acid or medium acid in the solum and strongly acid to slightly acid in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Texture of the fine earth part is silt loam, loam, or silty clay loam.

The C horizon has hue of 7.5YR to 2.5Y and value and chroma of 4 to 6. Texture of the fine earth is silt loam, loam, or silty clay loam.

Dekalb series

The Dekalb series consists of moderately deep, well drained soils formed in residuum of gray and brown acid sandstone bedrock on ridgetops and hillsides. Permeability is moderately rapid or rapid. The slope range is 3 to 70 percent.

Dekalb soils are commonly adjacent to Allegheny Variant, Culleoka, Richland, Wellston, and Westmoreland soils and are similar to Culleoka soils. All of these soils have a small content of coarse fragments in the solum than do Dekalb soils. Allegheny Variant, Richland, Wellston, and Westmoreland soils are deeper to bedrock.

Typical pedon of Dekalb loam, 25 to 40 percent slopes, in Wayne Township, T. 6 N., R. 5 W., 3,100 feet west and 1,200 feet north of the southeast corner sec. 20:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam; moderate fine granular structure; very friable; common roots; 10 percent sandstone fragments; very strongly acid; abrupt smooth boundary.
A2—2 to 6 inches; brown (10YR 5/3) loam; weak fine and medium subangular blocky structure parting to moderate fine granular; friable; few roots; 10 percent sandstone fragments; very strongly acid; abrupt smooth boundary.
B21—6 to 13 inches; yellowish brown (10YR 5/6) channery loam; weak medium subangular blocky structure; friable; few roots; thin very patchy brown (7.5YR 5/4) silt coatings on coarse fragments; 40 percent sandstone fragments; strongly acid; clear smooth boundary.
B22—13 to 23 inches; yellowish brown (10YR 5/6) very channery loam; weak medium subangular blocky structure; friable; few roots; thin very patchy brown (7.5YR 5/4) silt coatings on coarse fragments; 55 percent sandstone fragments, most are greater than 3 inches in length; strongly acid; clear smooth boundary.
C—23 to 28 inches; yellowish brown (10YR 5/4) very channery sandy loam; massive; very friable; few roots; 80 percent sandstone fragments, most are greater than 3 inches in length; strongly acid; abrupt smooth boundary.
R—28 to 30 inches; brown (10YR 5/3) and olive brown (2.5Y 4/4) fine and medium grained sandstone; massive; hard.

Solum thickness ranges from 20 to 36 inches. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments of sandstone increases with increasing depth and ranges from 10 to 50 percent by volume in the A horizon, from 10 to 60 percent in the B horizon, and from 50 to 90 percent in the C horizon. Unless the soil has been limed, reaction throughout is very strongly acid or strongly acid.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam or moderately channery loam. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. It is dominantly loam but ranges to sandy loam in some pedons.

The B horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. Texture of the fine earth part is loam or sandy loam.

The C horizon has colors like those in the B horizon. Texture of the fine earth part is sandy loam or loamy sand.

Duncannon series

The Duncannon series consists of deep, well drained, moderately permeable soils formed in loess on terraces and uplands. The slope range is 0 to 15 percent.

Duncannon soils are commonly adjacent to Ashton and Chili soils and are similar to Elkinsville soils. Ashton soils have a darker colored A horizon than Duncannon soils. Elkinsville soils have more clay in the upper 20 inches of the argillic horizon. Chili soils have more clay, sand, and coarse fragments in the solum.

Typical pedon of Duncannon silt loam in an area of Duncannon-Urban land complex, 0 to 15 percent slopes, in Mead Township T. 1 N., R. 2 W., 1,780 feet south and 600 feet east of the northwest corner sec. 35:

O1—1 1/2 inches to 0; leaf litter.
Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak coarse granular structure; friable; many roots; strongly acid; abrupt smooth boundary.
B1—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common roots; strongly acid; clear smooth boundary.
B21t—13 to 24 inches; yellowish brown (10YR 5/4) silt loam; weak medium angular blocky structure; friable; common roots; thin very patchy brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.
B22t—24 to 31 inches; yellowish brown (10YR 5/4) silt loam; weak medium angular blocky structure; friable; few roots; thin very patchy brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.
B23t—31 to 39 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; few roots; thin very patchy brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.
B3—39 to 47 inches; brown (7.5YR 4/4) silt loam; weak coarse subangular blocky structure; friable; medium acid; abrupt smooth boundary.
C—47 to 95 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; medium acid.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock ranges from 5 to 10 feet or more. Unless the soil has been limed, reaction is strongly acid or medium acid in the solum and ranges from slightly acid to strongly acid in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is dominantly silt loam, but ranges to very 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 silt loam or very fine sandy loam. Clay content of individual subhorizons of the Bt horizon ranges from 10 to 24 percent; the weighted average clay content is less than 18 percent.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or very fine sandy loam.

Elba series

The Elba series consists of deep, well drained, slowly permeable soils formed in residuum of limestone, calcareous shale, and siltstone on uplands. The slope range is 3 to 40 percent.

Elba soils are similar to Lowell and Upshur soils. They are commonly adjacent to Lowell and Westmore soils on ridgetops and hillsides and to Brookside soils on foot slopes. Lowell, Upshur, and Westmore soils are more acid in the upper part of the soil than are Elba soils. Upshur soils have redder hues. Brookside soils are deeper to bedrock. Westmore soils formed in loess and residuum and have less clay in the upper part than do Elba soils.

Typical pedon of Elba silty clay loam, 8 to 15 percent slopes, Kirkwood Township, T. 9 N., R. 6 W., 1,240 feet east and 3,000 feet north of the southwest corner sec. 8:

Ap—0 to 6 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure parting to weak medium granular; friable; many roots; slightly acid; abrupt wavy boundary.
B21t—6 to 9 inches; yellowish brown (10YR 5/4) heavy silty clay loam; strong fine angular blocky structure; friable; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear smooth boundary.
B22t—9 to 14 inches; yellowish brown (10YR 5/4) silty clay; strong fine and medium angular blocky structure; firm; common roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; neutral; clear smooth boundary.
B23t—14 to 22 inches; brown (7.5YR 5/4) clay; moderate fine angular blocky structure; firm; few roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent brownish yellow (10YR 6/6) weathered limestone fragments; slight effervescence; mildly alkaline; clear wavy boundary.
B24t—22 to 30 inches; brown (7.5YR 5/4) channery silty clay; moderate fine and medium subangular blocky structure; friable; few roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; about 20 percent weathered limestone fragments; many medium and coarse brownish yellow (10YR 6/6) zones of calcareous light silty clay loam; slight effervescence; moderately alkaline; clear smooth boundary.
B3t—30 to 42 inches; light yellowish brown (2.5Y 6/4) heavy silty clay loam; moderate fine and medium

subangular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent soft calcareous shale fragments; slight effervescence; moderately alkaline; abrupt wavy boundary.

C1—42 to 48 inches; dark gray (10YR 4/1) channery heavy silty clay loam; weak very fine subangular blocky structure; firm; dark yellowish brown (10YR 4/4) zones make up about 5 percent by volume; 30 percent light gray (10YR 7/2) soft calcareous siltstone and limestone fragments and 10 percent brownish yellow (10YR 6/6) soft limestone fragments; strong effervescence; moderately alkaline; clear wavy boundary

C2—48 to 54 inches; dark gray (5Y 4/1) very channery silty clay loam, light olive gray (5Y 6/2) crushed; few fine distinct brownish yellow (10YR 6/6) mottles; massive; firm; thin very patchy yellowish brown (10YR 5/4) coatings on fragments; about 50 percent light gray (5Y 6/1) limestone fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

R—54 to 56 inches; hard gray limestone.

Solum thickness ranges from 24 to 48 inches. Depth to bedrock ranges from 40 to 80 inches. Depth to carbonates range from 10 to 30 inches. Content of limestone, siltstone, and shale coarse fragments ranges from 0 to 15 percent by volume in the A horizon, 0 to 35 percent in the B2 horizon, and 5 to 60 percent in the B3 and C horizons.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly silty clay loam but ranges to silt loam and silty clay. Reaction is medium acid to neutral.

The B2t horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. Texture of the fine earth part is dominantly silty clay or clay, but subhorizons range to silty clay loam. Reaction is medium acid to mildly alkaline in the upper part and neutral to moderately alkaline in the lower part.

The C horizon has hue of 7.5YR or 5Y, value of 4 to 6, and chroma of 0 to 6. Texture of the fine earth part is silty clay loam, silty clay, or clay. Reaction is mildly alkaline or moderately alkaline.

Elkinsville series

The Elkinsville series consists of deep, well drained, moderately permeable soils formed in alluvium on terraces. The slope range is 3 to 25 percent.

Elkinsville soils are similar to Allegheny Variant, Ashton, and Duncannon soils and are commonly adjacent to Ashton and Otwell soils. Allegheny Variant soils have a lower base status and more sand and less silt in the upper 20 inches of the argillic horizon than do Elkinsville soils. Ashton soils have a darker colored A horizon. Duncannon soils formed in loess and have less clay in the upper 20 inches of the argillic horizon. Otwell soils have a fragipan and are moderately well drained.

Typical pedon of Elkinsville silt loam, 3 to 8 percent slopes in York Township, T. 4 N., R. 3 W., 2,600 feet west and 800 feet south of the northeast corner of sec. 20:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

B21t—9 to 20 inches; yellowish brown (10YR 5/4) heavy silt loam; weak medium and coarse subangular blocky structure; friable; common roots; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin patchy pale brown (10YR 6/3) clean silt and sand grains; strongly acid; gradual smooth boundary.

B22t—20 to 29 inches; brown (7.5YR 5/4) light silty clay loam; moderate medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; thin patchy pale brown (10YR 6/3) clean silt and sand grains; strongly acid; gradual smooth boundary.

B23t—29 to 56 inches; brown (7.5YR 5/4) silt loam; weak coarse subangular blocky structure; friable; few roots; thin very patchy brown (7.5YR 4/4) clay films on faces of peds; thin very patchy pale brown (10YR 6/3) clean silt and sand grains; few fine dark concretions (iron and manganese oxides); strongly acid; gradual wavy boundary.

C—56 to 68 inches; yellowish brown (10YR 5/4) heavy loam; massive; friable; thin patchy pale brown (10YR 6/3) clean silt and sand grains; few fine dark concretions (iron and manganese oxides); 2 percent coarse fragments; strongly acid.

Solum thickness is typically 45 to 60 inches and ranges from 40 to 72 inches. Depth to bedrock ranges from 5 to 10 feet or more. Unless the soil has been limed, reaction is strongly acid or very strongly acid in the B horizon and is medium acid or strongly acid in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam and light silty clay loam in the upper part and silty clay loam, silt loam, loam, or clay loam in the lower part.

The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4. It is silty clay loam, silt loam, or sandy loam.

Fairpoint series

The Fairpoint series consists of deep, well drained, moderately slowly permeable soils. These soils formed in a mixture of partly weathered fine earth and fragments of medium and fine grained sandstone, siltstone, neutral or

calcareous shale, and coal from surface mining. The slope range is 0 to 25 percent.

Fairpoint soils are commonly adjacent to Barkcamp, Bethesda, and Morristown soils and are similar to Morristown soils. Barkcamp and Bethesda soils are more acid in the C horizon than Fairpoint soils. Barkcamp soils are coarser textured in the C horizon and have a siliceous mineralogy. Morristown soils are calcareous in the C horizon.

Typical pedon of Fairpoint gravelly clay loam, 8 to 25 percent slopes, in Kirkwood Township, T. 9 N., R. 6 W., 2,100 feet north and 850 feet east of the southwest corner sec. 27:

Ap—0 to 5 inches; light brownish gray (2.5Y 6/2) gravelly clay loam; moderate medium and coarse granular structure; friable; many roots; 15 percent sandstone fragments, 5 percent siltstone fragments, and few fragments of coal; neutral; abrupt smooth boundary.

C1—5 to 17 inches; 70 percent variegated light brownish gray (2.5Y 6/2), 20 percent brown (10YR 4/3), and 10 percent gray (10YR 5/1), gravelly clay loam; massive; firm; few roots in vertical cracks; 30 percent sandstone fragments, 5 percent siltstone fragments, and few fragments of coal; slightly acid; clear smooth boundary.

C2—17 to 60 inches; 70 percent variegated light brownish gray (2.5Y 6/2), 20 percent brown (10YR 4/3), and 10 percent gray (10YR 5/1), gravelly clay loam; massive; firm; 35 percent sandstone fragments, 10 percent siltstone fragments, and few fragments of coal; slightly acid.

Depth to bedrock is more than 5 feet. Reaction ranges from medium acid to neutral except in surface layers that have been limed. Reclaimed areas where the surface has been covered with natural soil material are strongly acid to neutral. The content of rock fragments in the C horizon ranges from 20 to 80 percent by volume and averages about 45 percent. Coarse fragments are commonly less than 10 inches in diameter, but some are stones and boulders.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 1 to 6. It is dominantly gravelly clay loam or silty clay loam. Reclaimed areas have an A horizon of natural soil material 4 to 12 inches thick.

The C horizon has hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 0 to 8. Texture of the fine earth part is clay loam, silty clay loam, silt loam, or loam.

Fitchville series

The Fitchville series consists of deep, somewhat poorly drained soils that have moderately slow permeability. These soils formed in alluvium on stream terraces. The slope range is 0 to 3 percent.

The Fitchville soils in Belmont County have a slightly higher reaction in the B23t horizon than is characteristic of the Fitchville series and do not have the stratification in the solum defined for the series. These differences, however, do not alter the use and behavior of the soils.

Fitchville soils are similar to Newark and Newark Variant soils and are commonly adjacent to Otwell soils. Newark and Newark Variant soils are on flood plains and are subject to flooding. Newark soils are commonly less acid in the upper part of the B horizon than Fitchville soils. Newark Variant soils have more sand and less silt in the B horizon and have coarse textured material in the C horizon. Otwell soils are moderately well drained and have a fragipan.

Typical pedon of Fitchville silt loam, 0 to 3 percent slopes, in Washington Township, T. 5 N., R. 4 W., 1,390 feet west and 600 feet south of the northeast corner sec. 4:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable; many roots; 1 percent small pebbles; slightly acid; abrupt smooth boundary.

B21t—10 to 14 inches; dark yellowish brown (10YR 4/4) heavy silt loam; common medium distinct strong brown (7.5YR 5/6) and few fine distinct dark gray (10YR 4/1) mottles; weak medium subangular blocky structure; firm; common roots; thin patchy dark grayish brown (10YR 4/2) clay films on faces of peds; 1 percent small pebbles; strongly acid; clear smooth boundary.

B22t—14 to 32 inches; yellowish brown (10YR 5/4) light silty clay loam; many medium distinct gray (10YR 5/1) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; thin continuous dark gray (10YR 4/1) and thin very patchy brown (7.5YR 4/4) clay films on faces of peds; 1 percent small pebbles; medium acid; gradual smooth boundary.

B23t—32 to 45 inches; dark yellowish brown (10YR 4/4) light silty clay loam; common medium distinct strong brown (7.5YR 5/6) and many medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; few roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; 1 percent small pebbles; neutral; gradual smooth boundary.

B3—45 to 52 inches; yellowish brown (10YR 5/4) heavy silt loam; many medium distinct strong brown (7.5YR 5/6) and gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; 1 percent small pebbles; neutral; gradual smooth boundary.

C—52 to 70 inches; dark yellowish brown (10YR 4/4) silt loam with pockets of loam and fine sandy loam; many medium distinct strong brown (7.5YR 5/8) and dark gray (10YR 4/1) mottles; massive; friable; 1 percent small pebbles; neutral.

Solum thickness ranges from 40 to 70 inches. Depth to bedrock is more than 5 feet. Unless the soil has been

limed, reaction ranges from very strongly acid to medium acid in the upper part of the solum and from medium acid to neutral in the lower part of the solum and in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6. It is silt loam or silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is generally silt loam or silty clay loam but includes thin strata of loam and fine sandy loam.

Hartshorn series

The Hartshorn series consists of deep, well drained soils formed in alluvium on narrow flood plains. Permeability is moderate in the solum and moderately rapid or rapid in the C horizon. The slope range is 0 to 3 percent.

Hartshorn soils in Belmont County have more silt and clay in the C horizon than is defined in the range for the Hartshorn series. This difference, however, does not alter the use or behavior of the soils.

Hartshorn soils are commonly adjacent to Newark Variant soils. Newark Variant soils are somewhat poorly drained and have gray colors in the upper part of the B horizon.

Typical pedon of Hartshorn silt loam, occasionally flooded, in Goshen Township, T. 7 N., R. 5 W., 300 feet west and 800 feet north of the southeast corner sec. 2:

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam; moderate very fine granular structure; very friable; many roots; 2 percent pebbles; neutral; abrupt smooth boundary.

B21—6 to 19 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common roots; 5 percent pebbles; neutral; clear smooth boundary.

B22—19 to 24 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint brown (10YR 5/3) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; 5 percent fragments of fine gravel and coal; neutral; abrupt wavy boundary.

IIC—24 to 40 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam; massive; friable; 50 percent coarse fragments; neutral; abrupt smooth boundary.

IIIR—40 to 42 inches; hard olive brown (2.5Y 4/4) siltstone.

Solum thickness ranges from 18 to 30 inches. Depth to bedrock ranges from 40 to 72 inches. The content of coarse fragments in the solum averages about 10 percent by volume, but in individual layers in the B horizon it ranges from 5 to 40 percent. Reaction ranges from medium acid to neutral throughout the soil.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly silt loam but is loam in some pedons.

The B horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is dominantly silt loam or gravelly silt loam but includes loam and gravelly loam.

The C horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is very gravelly loamy sand, very gravelly sandy loam, or very gravelly sand.

Lowell series

The Lowell series consists of deep, moderately well drained and well drained, moderately slowly permeable soils on uplands. These soils formed in residuum of limestone, siltstone, and shale with thin layers of sandstone. The slope range is 3 to 70 percent.

Lowell soils are similar to Elba, Upshur, and Westmore soils and are commonly adjacent to Brookside, Elba, Westmore, and Westmoreland soils. Brookside soils are deeper to bedrock than Lowell soils. Elba soils have carbonates at a depth of 10 to 30 inches. Upshur soils have redder hues than Lowell soils. Westmore soils have more silt and less clay in the upper part of the solum. Westmoreland soils have a lower base status and have a lower clay content in the B horizon.

Typical pedon of Lowell silt loam, 3 to 8 percent slopes, Washington Township, T. 5 N., R. 4 W., 2,560 feet east and 1,800 feet north of the southwest corner sec. 12:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to weak fine granular; friable; many roots; 1 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B21t—7 to 13 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common roots; common fine pores; thin patchy yellowish brown (10YR 5/4) silt films on faces of peds; thin very patchy brown (7.5YR 5/4) clay films on faces of peds; 2 percent soft siltstone fragments; very strongly acid; clear smooth boundary.

B22t—13 to 18 inches; yellowish brown (10YR 5/6) heavy silty clay loam; moderate medium angular blocky structure; friable; common roots; few fine pores; thin continuous yellowish brown (10YR 5/4) silt films on faces of peds; thin patchy brown (7.5YR 5/4) clay films on faces of peds; few fine black concretions (iron and manganese oxides); 1 percent soft siltstone fragments; very strongly acid; clear smooth boundary.

B23t—18 to 25 inches; strong brown (7.5YR 5/6) silty clay; weak coarse subangular blocky structure; firm; few roots; few fine pores; thin patchy yellowish brown (10YR 5/4) silt films on faces of peds; thin patchy grayish brown (10YR 5/2) and brown (7.5YR

5/4) clay films on faces of peds; common fine and medium black concretions (iron and manganese oxides); 1 percent soft siltstone fragments; very strongly acid; clear wavy boundary.

B24t—25 to 31 inches; yellowish brown (10YR 5/6) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few roots; thin patchy gray (10YR 5/1) and thin very patchy reddish brown (5YR 4/4) clay films on faces of peds; many coarse concretions (iron and manganese oxides); 1 percent soft shale fragments; very strongly acid; clear wavy boundary.

B3t—31 to 42 inches; yellowish brown (10YR 5/6) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; thin patchy reddish brown (5YR 4/4) and gray (10YR 5/1) clay films on faces of peds; common fine concretions (iron and manganese oxides); 10 percent soft shale fragments; neutral; gradual wavy boundary.

C2—42 to 50 inches; light olive brown (2.5Y 5/4) gravelly silty clay loam; massive; firm; few fine black concretions (iron and manganese oxides); 45 percent soft limestone fragments; mildly alkaline.

R—50 to 52 inches; hard limestone bedrock.

Thickness of the solum ranges from 36 to 54 inches. Depth to bedrock ranges from 40 to 72 inches. Depth to fine textured material ranges from 9 to 20 inches. Depth to mottles with chroma of 2 or less ranges from 24 to 40 inches. Unless the soil has been limed, reaction is medium acid to very strongly acid in the upper part of the solum and strongly acid to neutral in the lower part. Reaction in the C horizon is medium acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is dominantly silt loam but is light silty clay loam in some pedons.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The B2t horizon is silty clay loam, silty clay, or clay in the upper 10 inches and clay or silty clay in the lower part.

The C horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 3 to 6. It is silty clay loam, silty clay, or clay and the gravelly or shaly analogues.

Morristown series

The Morristown series consists of deep, well drained, moderately slowly permeable soils. These soils formed in a mixture of calcareous, partly weathered fine earth and fragments of limestone, shale, and lesser amounts of medium grained sandstone and siltstone from surface mining operations. The slope range is 0 to 70 percent.

Morristown soils are adjacent to the Barkcamp, Bethesda, and Fairpoint soils, which do not have free carbonates throughout the soil. Barkcamp soils are coarser textured and have siliceous mineralogy.

Typical pedon of Morristown stony clay loam, 0 to 8 percent slopes, in Kirkwood Township, T. 9 N., R. 6 W., 3,800 feet south and 1,600 feet east of the northwest corner sec. 22:

Ap—0 to 5 inches; dark gray (10YR 4/1) stony clay loam; moderate medium granular structure; slightly hard; common roots; common pores; 20 percent gravel; strong effervescence; moderately alkaline; abrupt wavy boundary.

C1—5 to 18 inches; variegated dark gray (5Y 4/1) and yellowish brown (10YR 5/4-5/6) gravelly clay loam; massive; slightly hard; common roots; 40 percent pebbles and cobblestones; strong effervescence; mildly alkaline; clear wavy boundary.

C2—18 to 37 inches; variegated dark gray (5Y 4/1), light yellowish brown (10YR 6/4), and black (N 2/0) gravelly clay loam; massive; firm; 40 percent pebbles and cobblestones; strong effervescence; mildly alkaline; clear wavy boundary.

C3—37 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; 40 percent pebbles and cobblestones; slight effervescence; mildly alkaline.

Depth to bedrock is more than 5 feet. Content of coarse fragments in the control section ranges from 35 to 70 percent by volume and averages about 40 percent. Coarse fragments are dominantly less than 10 inches in size, but some are stones or boulders.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 8. The fine earth part is dominantly clay loam but includes silty clay loam, silt loam, or loam. Reclaimed areas have an A horizon from natural soil material 6 to 12 inches thick. This horizon is dominantly clay loam but includes silty clay loam, silt loam, or loam. Reaction is moderately alkaline to slightly acid, but in reclaimed areas ranges to strongly acid.

The C horizon has hue of 5YR to 5Y, value of 2 to 6, and chroma of 0 to 8. Texture of the fine earth part is loam, sandy clay loam, clay loam, or silty clay loam. Reaction is mildly alkaline or moderately alkaline.

Newark series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils formed in recent alluvium on flood plains. The slope range is 0 to 2 percent.

Newark soils are similar to Fitchville and Newark Variant soils and are commonly adjacent to Nolin Variant soils. Fitchville soils formed in stream terrace deposits on low terraces above the flood plains. Newark Variant soils have more sand and less silt in the solum than Newark soils and have a coarse textured C horizon. They are well drained and do not have gray colors within 36 inches of the surface.

Typical pedon of Newark silt loam, frequently flooded, in Kirkwood Township, T. 9 N., R. 6 W., 1,040 feet east and 980 feet north of the southwest corner sec. 5:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium subangular blocky structure; friable; common roots; neutral; abrupt smooth boundary.

B21g—8 to 15 inches; grayish brown (10YR 5/2) heavy silt loam; common medium faint dark grayish brown (10YR 4/2) and few fine distinct yellowish brown (10YR 5/8) mottles; moderate fine and medium subangular blocky structure; friable; common roots; dark brown (10YR 3/3) organic stains; neutral; clear smooth boundary.

B22—15 to 25 inches; brown (10YR 4/3) silty clay loam; few fine distinct yellowish brown (10YR 5/6) and common medium distinct gray (10YR 5/1) and grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; friable; few roots; neutral clear smooth boundary.

B23g—25 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam; many coarse distinct gray (N 6/0) and dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; friable; neutral; clear smooth boundary.

Clg—34 to 39 inches; gray (N 6/0) silty clay loam; many coarse distinct grayish brown (2.5Y 5/2) and common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; neutral; clear smooth boundary.

C2g—39 to 60 inches; variegated gray (2.5Y 5/1), grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), and dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; neutral.

Solum thickness ranges from 24 to 40 inches. Gravel content in the solum ranges from 0 to 5 percent by volume but is commonly less than 2 percent. Reaction in the solum ranges from medium acid to mildly alkaline.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 2 or 3. It is dominantly silt loam but is light silty clay loam in some pedons.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The C horizon has hue of 10YR, 2.5Y, or neutral, value of 4 to 6, and chroma of 0 to 6. It is dominantly silt loam or silty clay loam with thin strata of loam, fine sandy loam, or silty clay in some pedons.

Newark Variant

The Newark Variant consists of deep, somewhat poorly drained soils formed in recent alluvium on narrow flood plains. Permeability is moderate or moderately rapid in the B horizon and rapid in the C horizon. The slope range is 0 to 2 percent.

Newark Variant soils are commonly adjacent to Hartshorn soils and are similar to Fitchville and Newark soils. Hartshorn soils are well drained and do not have mottles in the upper part of the B horizon. Fitchville and Newark soils have finer textured material in the C horizon than do Newark Variant soils. Fitchville soils are on low terraces above the flood plain.

Typical pedon of Newark Variant silt loam, frequently flooded, in Somerset Township, T. 7 N., R. 6 W., 1,900 feet east and 280 feet north of the southwest corner sec. 26:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; many roots; 3 percent small pebbles; neutral; abrupt smooth boundary.

B21—8 to 18 inches; dark grayish brown (2.5Y 4/2) silt loam; many medium faint dark gray (10YR 4/1), many fine distinct strong brown (7.5YR 5/6), and few fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; common roots; 1 percent small pebbles; neutral; gradual smooth boundary.

B22g—18 to 26 inches; very dark gray (10YR 3/1) silt loam borderline to loam; common fine prominent strong brown (7.5YR 5/6) and common medium faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; few roots; 3 percent small pebbles; neutral; clear smooth boundary.

IIC1—26 to 30 inches; olive brown (2.5Y 4/4) gravelly sandy loam; many medium distinct dark grayish brown (2.5Y 4/2) and common medium distinct olive gray (5Y 4/2) mottles; massive; friable; 25 percent angular and rounded pebbles; neutral; gradual smooth boundary.

IIC2g—30 to 45 inches; very dark gray (5Y 3/1) very gravelly loamy sand; massive; friable; 55 percent angular and rounded pebbles; neutral; abrupt smooth boundary.

IIIR—45 to 46 inches; olive brown (2.5Y 4/4) hard siltstone.

Solum thickness ranges from 18 to 30 inches. Depth to bedrock ranges from 40 to 72 inches. Depth to gravelly or very gravelly horizon ranges from 16 to 30 inches. Reaction is slightly acid or neutral throughout.

The B horizon is neutral or has hue of 10YR to 5Y, value of 3 to 6, and chroma of 0 to 4. It is dominantly silt loam, loam, silty clay loam, or clay loam and ranges to sandy loam, gravelly sandy loam, or gravelly loam in the lower part of many pedons.

The C horizon is neutral or has hue of 10YR to 5Y, value of 3 to 6, and chroma of 0 to 4. It is dominantly very gravelly loamy sand or very gravelly sand, but ranges to very gravelly sandy loam, very gravelly loam, and gravelly sandy loam.

Nolin Variant

The Nolin Variant consists of deep, well drained, moderately permeable soils formed in alluvium on flood plains. The slope range is 0 to 3 percent.

Nolin Variant soils are commonly adjacent to Chagrin and Newark soils on flood plains. Chagrin soils do not have carbonates and have more sand and less silt in the B horizon than do Nolin Variant soils. Newark soils are somewhat poorly drained and have gray colors in the upper part of the B horizon.

Typical pedon of Nolin Variant silt loam, occasionally flooded, in York Township, T. 4 N., R. 3 W., 3,600 feet east and 1,000 feet north of the southwest corner sec. 8:

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam; light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; many roots; slight effervescence; mildly alkaline; clear smooth boundary.

B21—10 to 22 inches; brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common roots; slight effervescence; mildly alkaline; gradual smooth boundary.

B22—22 to 41 inches; brown (10YR 4/3) silt loam; weak coarse subangular blocky structure; friable; common roots; slight effervescence; mildly alkaline; clear smooth boundary.

C—41 to 66 inches; brown (10YR 4/3) silt loam; few fine distinct yellowish red (5YR 4/6) mottles; massive; friable; few roots; slight effervescence; mildly alkaline.

Solum thickness ranges from 40 to 54 inches. Depth to bedrock ranges from 5 to more than 10 feet.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is dominantly silt loam but is loam or light 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 or 4. It is silt loam or light silty clay loam.

The C horizon has hue of 10YR or 2.5YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or fine sandy loam or stratified layers of these textures or the gravelly analogues.

Otwell series

The Otwell series consists of deep, moderately well drained, very slowly permeable soils formed in old alluvium on terraces. These soils have a fragipan. The slope range is 3 to 15 percent.

Otwell soils are commonly adjacent to Ashton, Elkinsville, and Fitchville soils and are similar to Zanesville soils. Ashton, Elkinsville, and Fitchville soils do not have a fragipan. Ashton soils have a darker colored A horizon than do Otwell soils. Fitchville soils are somewhat poorly drained. Zanesville soils formed in loess and residuum of sandstone and siltstone bedrock in uplands.

Typical pedon of Otwell silt loam, 3 to 8 percent slopes, in York Township, R. 4 N., R. 3 W., 1,900 feet south and 1,300 feet west of the northeast corner sec. 33:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; moderate medium and coarse granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

B&A—9 to 14 inches; yellowish brown (10YR 5/4) silt loam (B2t); weak medium subangular blocky structure; dark grayish brown (10YR 4/2) silt loam (Ap); weak fine and medium granular structure; friable; common roots; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of B2t peds; medium acid; abrupt wavy boundary.

B21t—14 to 22 inches; yellowish brown (10YR 5/6) silt loam; moderate medium angular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin continuous yellowish brown (10YR 5/4) silt films on faces of peds; medium acid; clear wavy boundary.

B22t—22 to 26 inches; yellowish brown (10YR 5/6) silt loam; few fine faint strong brown (7.5YR 5/8) mottles; moderate fine angular blocky structure; friable; few roots; few concretions (iron and manganese oxides); thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; thin patchy brown (10YR 5/3) silt films on faces of peds; strongly acid; abrupt wavy boundary.

B23t—26 to 30 inches; yellowish brown (10YR 5/4) heavy silt loam; common medium distinct strong brown (7.5YR 5/8) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; few roots; common concretions (iron and manganese oxides); medium patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin patchy brown (10YR 5/3) silt films on vertical faces of peds; strongly acid; abrupt wavy boundary.

Bx—30 to 56 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate very coarse prismatic structure parting to weak coarse angular blocky; very firm, brittle; thick continuous grayish brown (10YR 5/2) and medium very patchy brown (7.5YR 5/4) clay films on faces of peds; medium patchy light grayish brown (10YR 6/2) silt films on faces of peds; common concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

C—56 to 81 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak medium platy structure; firm; medium patchy grayish brown (10YR 5/2) and thin patchy brown (7.5YR 4/4) clay films on faces of peds; thick patchy pale brown (10YR 6/3) silt films on vertical faces of peds; medium acid.

Thickness of the solum ranges from 40 to 60 inches. Depth to bedrock ranges from 5 feet to more than 10 feet.

Depth to the fragipan ranges from 26 to 36 inches. Gravel content ranges from 0 to 5 percent by volume in the solum and 0 to 35 percent in the C horizon. Unless the soil has been limed, reaction is medium acid to very strongly acid in the solum and strongly acid to neutral in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4.

The B2 horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 3 to 6. It is silt loam or light silty clay loam. The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is heavy silt loam, heavy loam, light silty clay loam, or light clay loam.

The C horizon is stratified and has colors and textures like those of the B horizon except that some pedons have gravelly analogues of those textures.

Richland series

The Richland series consists of deep, well drained, moderately permeable soils formed in colluvium weathered from sandstone, siltstone, and shale on foot slopes. The slope range is 3 to 40 percent.

Richland soils are commonly adjacent to Allegheny Variant, Dekalb, and Westmoreland soils and are similar to Allegheny Variant, Brookside, and Westmoreland soils. Allegheny Variant soils have a lower base status and have less coarse fragments throughout than Richland soils. Brookside soils have more clay in the solum. Dekalb soils have bedrock at a depth of 20 to 40 inches and have more coarse fragments in the solum. Westmoreland soils have a thinner solum and a lower base status.

Typical pedon of Richland loam, 15 to 25 percent slopes, in Richland Township, T. 7 N., R. 4 W., 2,600 feet east and 700 feet south of the northwest corner sec. 1:

Ap—0 to 5 inches; dark brown (10YR 3/3) loam; brown (10YR 5/3) dry; moderate fine granular structure; friable; many roots; 10 percent flat and rounded fine grained sandstone fragments; slightly acid; abrupt smooth boundary.

B1—5 to 8 inches; 60 percent yellowish brown (10YR 5/6) and 40 percent brown (10YR 4/3) loam; weak fine subangular blocky structure parting to moderate fine granular; friable; many roots; 10 percent flat and rounded fine grained sandstone fragments; slightly acid; clear smooth boundary.

B21t—8 to 20 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; friable; common roots; 10 percent flat and rounded fine grained sandstone fragments; thin very patchy dark yellowish brown (10YR 4/4) clay films and brown (10YR 5/3) silt coatings on faces of peds; medium acid; clear smooth boundary.

B22t—20 to 36 inches; yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable; few roots; 15 percent flat fine and coarse grained sandstone fragments; thin patchy brown (7.5YR 4/4) clay films and brown (10YR 5/3) silt coatings on faces of peds; few concretions and stains (iron and manganese oxides); medium acid; gradual wavy boundary.

B23t—36 to 44 inches; yellowish brown (10YR 5/6) channery light clay loam; few fine faint yellowish brown (10YR 5/8) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few roots; 20 percent flat fine and coarse grained sandstone fragments; thin very patchy brown (7.5YR 4/4) clay films on faces of peds and on coarse fragments; thin very patchy brown (10YR 5/3) and pale brown (10YR 6/3) silt coatings on faces of peds; few concretions and stains (iron and manganese oxides); medium acid; gradual wavy boundary.

B3t—44 to 55 inches; strong brown (7.5YR 5/6) channery light clay loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few roots; 30 percent flat and rounded coarse grained sandstone fragments; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds and on coarse fragments; thin very patchy pale brown (10YR 6/3) and brown (10YR 5/3) silt coatings on faces of peds; medium acid; clear smooth boundary.

C—55 to 80 inches variegated strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4) channery light clay loam; common medium distinct grayish brown (10YR 5/2) and common medium faint yellowish brown (10YR 5/8) mottles; massive; firm; 45 percent flat and rounded coarse grained sandstone fragments; slightly acid.

Solum thickness ranges from 44 to 60 inches. Depth to bedrock ranges from 5 to 10 feet. Content of coarse fragment of sandstone, siltstone, and shale range from 5 to 20 percent by volume in the A horizon and upper part of the B horizon, from 20 to 35 percent in the lower part of the B horizon, and from 20 to 55 percent in the C horizon. Reaction ranges from neutral to strongly acid in the A and B2 horizons and from neutral to medium acid in the B3 and C horizons.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. Where value is 3 and chroma is 2 or 3, the horizon is less than 7 inches thick. It is loam, silt loam, or moderately stony loam.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, silty clay loam, or sandy clay loam and their channery analogues.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture of the fine earth part is loam, clay loam, or silty clay loam.

Upshur series

The Upshur series consists of deep, well drained, slowly permeable soils formed in residuum of red clay shale on uplands. The slope range is 8 to 25 percent.

Upshur soils are commonly adjacent to Westmoreland soils and are similar to Brookside, Elba, and Lowell soils. Brookside, Elba, Lowell, and Westmoreland soils have yellower hues than Upshur soils. Brookside soils formed in colluvium. Brookside and Elba soils are less acid in the solum than Upshur soils. Westmoreland soils contain less clay and have a lower base saturation.

Typical pedon of Upshur silty clay loam in an area of Westmoreland-Upshur complex, 15 to 25 percent slopes, in Wayne Township, T. 6 N., R. 5 W., 1,300 feet west and 1,400 feet north of the southeast corner sec. 15:

Ap—0 to 6 inches; reddish brown (5YR 4/3) silty clay loam; moderate medium platy structure parting to weak fine and very fine subangular blocky; friable; many roots; very strongly acid; abrupt smooth boundary.

B21t—6 to 10 inches; reddish brown (2.5YR 4/4) silty clay; moderate fine and medium subangular blocky structure; firm; common roots; thick continuous dark reddish brown (2.5YR 3/4) clay films on faces of peds; thin patchy reddish brown (5YR 4/3) silt coatings on faces of peds; 1 percent soft shale fragments; very strongly acid; clear smooth boundary.

B22t—10 to 28 inches; weak red (10R 4/4) clay; strong medium and coarse angular blocky structure; very firm; common roots; thin continuous dusky red (10R 3/3) clay films on faces of peds; 1 percent soft shale fragments; medium acid; clear smooth boundary.

C1—28 to 45 inches; dusky red (10R 3/4) clay; massive; very firm; few roots; thin continuous dark reddish gray (10R 4/1) clay films in cracks and voids; very pale brown (10YR 7/3) calcareous silt coatings in cracks and voids; 3 percent soft shale fragments; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—45 to 60 inches; dusky red (10R 3/4) clay; massive; firm; very pale brown (10YR 7/3) calcareous silt coatings in cracks and voids; 5 percent soft shale fragments; strong effervescence; moderately alkaline.

Solum thickness ranges from 26 to 50 inches. Depth to rippable red clay shale bedrock ranges from 40 to 72 inches. Content of coarse fragments ranges from 0 to 25 percent by volume in the solum.

The Ap horizon has hue of 10YR to 5YR, value of 4, and chroma of 2 to 4. It is dominantly silty clay loam but ranges to silt loam, silty clay, and clay. Reaction is medium acid to very strongly acid unless the soil has been limed.

The Bt horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. It is silty clay or clay. Reaction is medium acid to very strongly acid. A B3t horizon occurs in some pedons. It is strongly acid to mildly alkaline.

The C horizon commonly has colors like those in the B horizon, but in some pedons it has variegated colors. It is dominately silty clay loam, silty clay, or clay but ranges to clay loam in some pedons. Reaction is strongly acid to moderately alkaline.

Wellston series

The Wellston series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and residuum or entirely in residuum of siltstone or fine grained sandstone bedrock. The slope range is 3 to 15 percent.

Wellston soils are commonly adjacent to Culleoka, Westmoreland, and Zanesville soils and are similar to Westmore soils. Culleoka soils are 20 and 40 inches deep over bedrock. Westmore soils have more clay in the lower part of the solum and a higher base status than do Wellston soils. Westmoreland soils contain more sand and coarse fragments and less silt in the upper part of the solum. Zanesville soils are wetter and have a fragipan.

Typical pedon of Wellston silt loam, 3 to 8 percent slopes, in Goshen Township, T. 7 N., R. 5 W., 1,600 feet east and 250 feet south of the northwest corner sec. 19:

Ap—0 to 8 inches; yellowish brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; neutral; abrupt smooth boundary.

B21t—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; thin very patchy yellowish brown (10YR 5/4) clay films on faces of peds; medium acid; clear smooth boundary.

B22t—12 to 23 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate fine angular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

IIB23t—23 to 29 inches; brown (7.5YR 4/4) silty clay loam; moderate fine angular blocky structure; friable; few roots; thin very patchy brown (7.5YR 4/4) clay films on faces of peds; common concretions (iron and manganese oxides); 2 percent soft, light olive brown and dark brown siltstone fragments; very strongly acid; clear wavy boundary.

IIB3t—29 to 46 inches; olive brown (2.5Y 4/4) gravelly silt loam; weak coarse subangular blocky structure; friable; thin patchy brown (7.5YR 4/4) clay films on faces of peds; many concretions (iron and manganese oxides); 20 percent soft, light olive brown siltstone fragments; very strongly acid; clear wavy boundary.

IIC—46 to 59 inches; light olive brown (2.5Y 5/4) very gravelly silt loam; massive; friable; thin patchy brown (7.5YR 4/4) clay films on siltstone fragments; 70 percent soft, light olive brown siltstone fragments; common concretions (iron and manganese oxides) medium acid; clear wavy boundary.
IICr—59 to 67 inches; light olive brown (2.5Y 5/4) partly weathered siltstone; medium acid.
IIIR—67 to 69 inches; fine grained sandstone.

Solum thickness ranges from 32 to 48 inches and depth to bedrock from 40 to 72 inches. Content of coarse fragments ranges from 0 to 20 percent by volume in the upper part of the solum, from 20 to 60 percent in the lower part, and from 20 to 90 percent in the C horizon. Unless limed, reaction is medium acid to extremely acid to a depth of about 25 inches and medium acid to very strongly acid in the lower part of the solum and in the C horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. Some pedons have IIB2t and IIB3t horizons. The IIB3t horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is dominantly silt loam or silty clay loam but ranges to loam or clay loam and the gravelly analogues.

The C horizon has the same color and texture as the IIB3t horizon but is gravelly or very gravelly.

Westmore series

The Westmore series consists of deep, well drained, slowly permeable or moderately slowly permeable soils formed in loess and residuum of limestone, siltstone, and limy shale bedrock on uplands. The slope range is 3 to 25 percent.

Westmore soils are commonly adjacent to Elba and Lowell soils and are similar to Wellston soils. Elba and Lowell soils have more clay and less silt in the upper part of the solum than do Westmore soils. Wellston soils have less clay in the lower part of the solum and a lower base status.

Typical pedon of Westmore silt loam, 3 to 8 percent slopes, Washington Township, T. 5 N., R. 4 W., 310 feet north and 2,080 feet west of the southeast corner sec. 12:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; common roots; strongly acid; abrupt smooth boundary.
B1—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; few roots; strongly acid; clear smooth boundary.
B21t—12 to 20 inches; yellowish brown (10YR 5/4) heavy silt loam; moderate fine subangular blocky structure; friable; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin patchy brown (10YR 5/3) silt films on faces of peds; strongly acid; clear wavy boundary.
B22t—20 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine angular blocky structure; friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin patchy brown (10YR 5/3) silt films on faces of peds; strongly acid; clear wavy boundary.
IIB23t—25 to 32 inches; olive brown (2.5Y 4/4) clay; weak medium subangular blocky structure; firm; thin patchy brown (7.5YR 4/4) clay films on faces of peds; thin patchy grayish brown (10YR 5/2) silt films on faces of peds; common concretions and stains (iron and manganese oxides); medium acid; clear wavy boundary.
IIB24t—32 to 41 inches; olive brown (2.5Y 4/4) clay; common coarse distinct yellowish brown (10YR 5/8) and few medium distinct grayish brown (10YR 5/2) mottles in the lower part; weak coarse subangular blocky structure; firm; thin patchy brown (7.5YR 4/4) clay films on faces of peds; 7 percent coarse fragments; slightly acid; clear wavy boundary.
IIC—41 to 50 inches; yellowish brown (10YR 5/6) shaly silty clay loam; massive; firm; many coarse distinct light gray (10YR 6/1) and dark gray (10YR 4/1) streaks; 25 percent soft shale fragments; slightly acid; clear smooth boundary.
IICr—50 to 61 inches; dark gray (10YR 4/1) soft partly weathered shale bedrock; many brown (7.5YR 4/4) and yellow (2.5Y 7/6) coatings on horizontal partings; neutral.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock ranges from 48 to 72 inches. Depth to the IIB2t horizon ranges from 20 to 36 inches. The percentage of coarse fragments is less than 5 percent by volume in the upper part of the solum and ranges from 5 to 25 percent in the lower part of the solum and in the C horizon. Unless limed, the upper part of the solum is strongly acid or medium acid and the lower part of the solum and the C horizon are medium acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. Pedons in undisturbed areas have A1 horizons as much as 5 inches thick with value and chroma of 2 or 3.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is heavy silt loam or light silty clay loam in the upper part and heavy silty clay loam, silty clay, or clay in the lower part.

The C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 0 to 6. Texture of the fine earth part is clay, silty clay, or silty clay loam.

Westmoreland series

The Westmoreland series consists of deep, well drained, moderately permeable soils on uplands. These

soils formed in residuum of siltstone, fine and medium grained sandstone, and thin-bedded, non-acid shale. The slope range is 3 to 70 percent.

Westmoreland soils are similar to Culleoka, Dekalb, Richland, and Wellston soils and are commonly adjacent to Culleoka, Dekalb, Lowell, Richland, Upshur, and Wellston soils. Culleoka and Dekalb soils are 20 to 40 inches deep over bedrock. Dekalb soils contain more coarse fragments in the solum than do Westmoreland soils. Lowell, Upshur, and Richland soils have a higher base status than Westmoreland soils. Lowell and Upshur soils have a higher content of clay in the argillic horizon. Upshur soils are redder in color. Richland soils formed in colluvium and are deeper over bedrock. Wellston soils contain more silt and less sand and coarse fragments in the upper part of the solum.

Typical pedon of Westmoreland silt loam, 3 to 8 percent slopes, in Richland Township, T. 7 N., R. 4 W., 1,250 feet west and 340 feet north of the southeast corner sec. 6.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; 2 percent coarse fragments; neutral; abrupt smooth boundary.

B1—8 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; many roots; thin patchy brown (10YR 4/3) organic coatings; 2 percent coarse fragments; medium acid; clear smooth boundary.

B21t—11 to 16 inches; brown (7.5YR 4/4) heavy silt loam; moderate fine and medium subangular blocky structure; friable; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 5 percent coarse fragments; strongly acid; gradual smooth boundary.

B22t—16 to 28 inches; brown (7.5YR 4/4) light clay loam; moderate fine angular blocky structure; firm; few roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; common concretions (iron and manganese oxides); 5 percent coarse fragments; strongly acid; clear smooth boundary.

B3—28 to 35 inches; yellowish brown (10YR 5/6) channery clay loam; weak coarse subangular blocky structure; firm; few roots; thin very patchy yellowish brown (10YR 5/4) clay films and thin patchy pale brown (10YR 6/3) silt films on faces of peds; common concretions (iron and manganese oxides); 25 percent coarse fragments; medium acid; clear smooth boundary.

C—35 to 50 inches; yellowish brown (10YR 5/6) channery light clay loam; massive; firm; common concretions (iron and manganese oxides); 45 percent coarse fragments; medium acid.

R—50 to 52 inches; brown (10YR 5/3) hard fine grained sandstone; massive.

Solum thickness ranges from 20 to 40 inches. Depth to bedrock ranges from 40 to 72 inches. Content of coarse fragments, mostly sandstone and siltstone, ranges from 2 to 30 percent in the solum and from 45 to 80 percent in the C horizon. Unless the soil has been limed reaction ranges from medium acid to very strongly acid in the solum and is medium acid or strongly acid in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly silt loam but ranges to light silty clay loam in some pedons.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Texture of the fine earth part is silt loam, silty clay loam, loam, or clay loam.

The C horizon has color and texture like those in the B horizon.

Zanesville series

The Zanesville series consists of deep, moderately well drained soils formed in loess and residuum of sandstone and siltstone bedrock on uplands. These soils have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. The slope range is 3 to 15 percent.

Zanesville soils are commonly adjacent to Culleoka and Wellston soils and are similar to Otwell soils. Culleoka soils are 20 to 40 inches deep over bedrock. Culleoka and Wellston soils are better drained than Zanesville soils and do not have a fragipan. Otwell soils formed in old alluvium on terraces and are deeper over bedrock than Zanesville soils.

Typical pedon of Zanesville silt loam, 3 to 8 percent slopes, in Somerset Township, T. 7 N., R. 6 W., 500 feet west and 1,100 feet south of the northeast corner sec. 3:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak medium platy structure parting to weak medium granular; friable; many roots; few concretions (iron and manganese oxides); neutral; abrupt wavy boundary.

B21t—8 to 17 inches; yellowish brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; few concretions (iron and manganese oxides); medium acid; clear smooth boundary.

B22t—17 to 25 inches; yellowish brown (10YR 5/6) light silty clay loam; few fine distinct gray (10YR 6/1) mottles in lower 2 inches; moderate fine and medium angular blocky structure; friable; few roots; medium patchy brown (7.5YR 4/4) clay films on faces of peds; common concretions (iron and manganese oxides); 2 percent siltstone pebbles; very strongly acid; clear smooth boundary.

Bx—25 to 46 inches; strong brown (7.5YR 5/6) light silty clay loam; few medium distinct gray (10YR 6/1) and

yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to weak coarse subangular blocky; very firm; brittle; few roots; thick continuous grayish brown (10YR 5/2) clay films on faces of prisms and thick patchy dark yellowish brown (10YR 4/4) clay films in prism interiors; few concretions (iron and manganese oxides); 3 percent soft siltstone pebbles; very strongly acid; granular smooth boundary.

IIC1—46 to 53 inches; yellowish brown (10YR 5/4) gravelly light silty clay loam; few medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/8) mottles; massive; firm; 20 percent siltstone pebbles; medium acid; gradual smooth boundary.

IIC2—53 to 59 inches; yellowish brown (10YR 5/4) channery light clay loam; few medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; massive; firm; 45 percent siltstone pebbles; medium acid; abrupt smooth boundary.

IIR—59 to 61 inches; light olive brown (2.5Y 5/4) siltstone; massive; hard.

Solum thickness ranges from 40 to 60 inches. Depth to the top of the fragipan ranges from 23 to 32 inches. Depth to bedrock is 40 to 80 inches. Content of coarse fragments ranges from 0 to 10 percent by volume in the solum and from 5 to 50 percent in the C horizon. Unless the soil has been limed, reaction is medium acid to very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2 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. The Bx horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or light silty clay loam.

The C horizon has hue, value, and chroma like those in the Bx horizon. Texture of the fine earth part is silty clay loam or clay loam but includes silt loam and loam.

formation of the soils

This section describes the major factors of soil formation, tells how these factors have affected the soils in Belmont County, and explains some of the processes of soil formation.

factors of soil formation

Soils are the product of soil-forming processes acting on material deposited or accumulated by geologic forces. The major factors in the 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 the parent material is modified by relief and by the length of time the parent material has been acted upon. The relative importance of each factor differs from place to place. In some places, one factor dominates and determines most of the soil properties, but normally the interaction of all five factors determines the kind of soil that forms in any given place.

parent material

The soils in Belmont County formed in several kinds of parent material: residuum, colluvium, glacial outwash, and loess or combinations of these materials and old alluvium and recent alluvium.

Residuum of bedrock is the most extensive parent material in the county. The upland soils formed in residuum. As much as 46 inches of loess, however, overlies the residuum in some areas. In these areas the upper part of the soil formed in the loess. Wellston, Westmore, and Zanesville are the principal soils that formed partly in loess. Residuum of limestone and shale is moderately fine textured or fine textured. Soils formed in it, such as Elba and Lowell soils, have a moderately fine textured or fine textured subsoil. Residuum of siltstone is medium textured. Soils formed in it, such as, Culleoka and Westmoreland soils, have a medium textured or moderately fine textured subsoil. Residuum of fine and coarse grained sandstone is medium textured or moderately coarse textured. Soils formed in it, such as Westmoreland and Dekalb soils, have a medium textured or moderately coarse textured subsoil.

Colluvium is weathered bedrock and soil material that accumulated below steep hillsides. Colluvium weathered from limestone, shale, siltstone, and small amounts of sandstone and moderately fine textured or fine textured soil material is moderately fine textured or fine textured. Soils formed in it, such as Brookside soils, have a moderately fine textured or fine textured subsoil. Colluvium weathered from siltstone and sandstone bedrock and medium textured or moderately coarse textured soil material is medium textured or moderately coarse textured. Soils formed in it, such as Richland soils, dominantly have a medium textured or moderately coarse textured subsoil.

Glacial outwash, which consists of sand and gravel, was deposited along the Ohio River, forming terraces at Yorkville, Martins Ferry, Bridgeport, Bellaire, Shadyside, Dilles Bottom, and Powhatan Point. Much of this fairly well sorted coarse textured outwash was covered by finer textured silty or loamy outwash. Duncannon and Chili soils formed in this material.

Old alluvium, or old floodwater deposits, is on low and high terraces along major streams in the county. High terraces are mainly extensively dissected and are too small to recognize in some areas. The sediment is from the surface layer of the higher lying soils in the county and from exposed bedrock. Allegheny Variant, Elkinsville, Otwell, and Ashton soils formed in this material.

Recent alluvium, or recent floodwater deposits, is the youngest parent material in the county. These materials are still accumulating as fresh sediment is added by the overflow of streams. The sediment is from the surface layer of the higher lying soils in the county. Chagrin, Hartshorn, Newark, Newark Variant, and Nolin Variant soils formed in this parent material.

climate

The climate in Belmont County is uniform enough that it has not greatly contributed to differences among the soils. It has been favorable for physical change and chemical weathering of parent material and for the activity of living organisms.

Rainfall has been adequate to leach from the subsoil any carbonates that may have been in the parent material of many upland and terrace soils. The Dekalb, Allegheny Variant, and Elkinsville soils have a strongly acid, very strongly acid, or extremely acid subsoil and less than 60 percent base saturation. Frequency of rainfall caused wetting and drying cycles conducive to the translocation of clay minerals and to the formation of the soil structure common in most of the soils in Belmont County.

The range of temperature has favored both physical change and chemical weathering of parent material. Freezing and thawing aided the formation of soil structure. Warm temperatures in summer favored chemical reactions in the weathering of primary minerals. Rainfall and temperature have been conducive to plant growth and the accumulation of organic matter in all soils.

relief

Relief can account for formation of different soils from the same kind of parent material. For example, Nolin Variant and Newark soils both formed in recent silty alluvium. The well drained Nolin Variant soils are on the higher parts of the flood plain, and the somewhat poorly drained Newark soils are in depressions or low areas.

living organisms

All living organisms—vegetation, animals, bacteria, and fungi—play a role in soil formation. When Belmont 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, earth worms, and burrowing animals make channels in the soil and 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 Variant and Chagrin. Crayfish channels are found in somewhat poorly drained Newark ponded soils.

The activities of man also affect soil formation. Man plows the soil, plants seeds, and introduces vegetation. He drains some areas, irrigates some, floods some, and adds and removes soil material from others for construction or surface mining. He adds lime and fertilizer, which neutralize acid soil reaction and add bases.

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 profile development. If the parent material weathers slowly, the profile forms slowly. In many places, however, factors other than time have been responsible for most of the differences in kind and distinctness of layers in the different soils.

Most soils in the county are old and have well-developed profiles. On the flood plains, deposits of fresh sediment periodically interrupt the soil forming process. Chagrin and Hartshorn soils do not have well-developed profiles.

processes of soil formation

Most soils in Belmont County have strongly expressed profile development because the processes of soil formation have distinctly changed in the parent material. These are the upland soils on ridgetops and side slopes, the colluvial soils on footslopes below steep side slopes, and the soils on terraces along the Ohio River and the major streams in the county. In contrast, the soils on the flood plains and in surface-mined areas are only slightly modified from the parent material.

All the factors of soil formation act in unison to control the processes that form different layers in the soil. These processes are (1) additions, (2) removals, (3) transfers, and (4) transformations (*8*). Some processes promote differences between the soil layers. Others retard or destroy differences that already exist.

In this survey area the most evident addition to the soil is organic matter in the surface layer. A thin layer of organic matter accumulates under woodland vegetation. If the soil is cleared and cultivated, or severely eroded, this organic matter is destroyed.

Leaching of carbonates from calcareous parent material is one of the most significant removals and precedes many other chemical changes in the soil. Limestone, limy shale, limy siltstone, and limy sandstone in undisturbed soils and combinations of these materials in surface-mined soils have a high carbonate content when first exposed to leaching conditions. Soils formed in residuum from limestone and calcareous shale bedrock, for example, Elba soils, still have carbonates 10 to 30 inches below the surface. Most other soils on uplands and terraces in Belmont County no longer have carbonates within 5 feet of the surface and are medium acid to extremely acid in the subsoil. Other minerals in the soil are subjected to chemical weathering that results from leaching, but their resistance is higher, and their removal is slower. Following the removal of carbonates, alteration of such minerals as biotite and feldspar results in changes of color within the subsoil. Free iron oxides are produced that may be segregated by a fluctuating high water table to produce gray colors and mottling, as in Fitchville, Newark, and Newark Variant soils. Unless the water table is seasonably high because of a limiting layer or fragipan, as in Otwell and Zanesville soils, brownish colors are typical in most soils in the county.

Seasonal wetting and drying of the soil is largely responsible for the transfer of clay from the surface layer to the surfaces of peds in the subsoil. The fine clays become suspended in percolating water moving through the surface layer and are deposited in the subsoil by drying or precipitation caused by free carbonates. This transfer of fine clay accounts for patchy or nearly continuous clay films on surfaces of peds in the subsoil of most soils on uplands and terraces in the county.

Transformations of mineral compounds occur in most soils. The results are most apparent if the formation of layers 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 layer lattice silicate clays. Most of the layer lattice clays remain in the subsoil.

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glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

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.

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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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.

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 fragment.

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.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

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 all or part of the 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 (or contour farming). 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.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. 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 for 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.

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 does not provide 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.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 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.

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.

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 7.5 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 (7.5 centimeters) in diameter.

Green manure (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 upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
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 A or B 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 Roman numeral II precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock 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.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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 (7.5 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.

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 areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

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).

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.

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 0.20 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, differences in slope, stoniness, and thickness.

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.

Ponding. Standing water on soils in closed depressions. 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 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

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.

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.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

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.

Slow intake (in tables). The slow movement of water into the soil.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 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 mm 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 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.

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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, A3) 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 horizon, includes all subdivisions of the horizon (A1, A2, A3).

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, 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.

Till plain. An extensive flat to undulating area underlain by glacial till.

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.

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.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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.