United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Ohio Department of
Natural Resources,
Division of Soil and Water
Conservation; and Ohio
Agricultural Research and
Development Center

Soil Survey of Jefferson County, Ohio

How To Use This Soil Survey

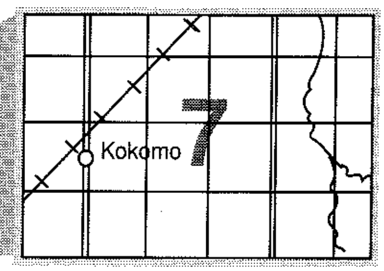
General Soil Map

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

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

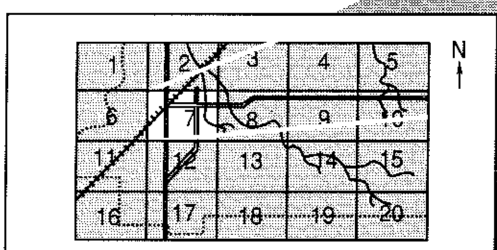
Detailed Soil Maps

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



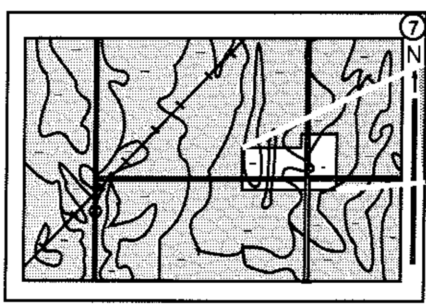
MAP SHEET

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



INDEX TO MAP SHEETS

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



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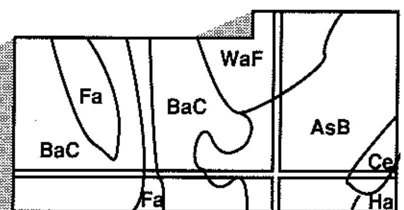

AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Natural Resources Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Jefferson Soil and Water Conservation District. Financial assistance was provided by the Jefferson 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.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Contour stripcropping in an area of Lowell silty clay loam, 15 to 25 percent slopes, eroded.

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Issued April 1995

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Summary of Tables

Foreword

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

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

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

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

Lawrence E. Clark
State Conservationist
Natural Resources Conservation Service

Soil Survey of Jefferson County, Ohio

By Linn E. Roth, Richard W. Buzard, and Timothy D. Gerber, Ohio Department of Natural Resources, Division of Soil and Water Conservation

Fieldwork by Linn E. Roth, Richard W. Buzard, and Timothy D. Gerber, Ohio Department of Natural Resources, Division of Soil and Water Conservation

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

General Nature of the County

JEFFERSON COUNTY is in the eastern part of Ohio (fig. 1). It has a total area of 262,848 acres, or 411 square miles. In 1980, the population of the county was 91,564 *(28)*. Steubenville, the county seat and the largest city in the county, had a population of 26,400. It is along the Ohio River, about midway between the northern and southern borders of Jefferson County.

About half of the people in the county reside in Steubenville or one of nine other towns along the Ohio River. The largest towns along the river are Toronto, Mingo Junction, Brilliant, and Tiltonsville. The largest villages not adjacent to the river are Wintersville and Smithfield.

The steel industry is the backbone of the local economy. Most of the steel factories and two major electric power plants are located along the river. Surface mining has affected the landscape in much of the southern half of the county. In 1982, about 29 percent of the acreage in the county was farmland *(29)*. Most of the farms are located in stream valleys and on ridges (fig. 2). The steep and very steep hillsides are wooded. Dairy products are the largest source of local farm revenue.

Figure 1.—Location of Jefferson County in Ohio.

Climate

Jefferson County has a continental climate with wide ranges in annual and daily temperatures. 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

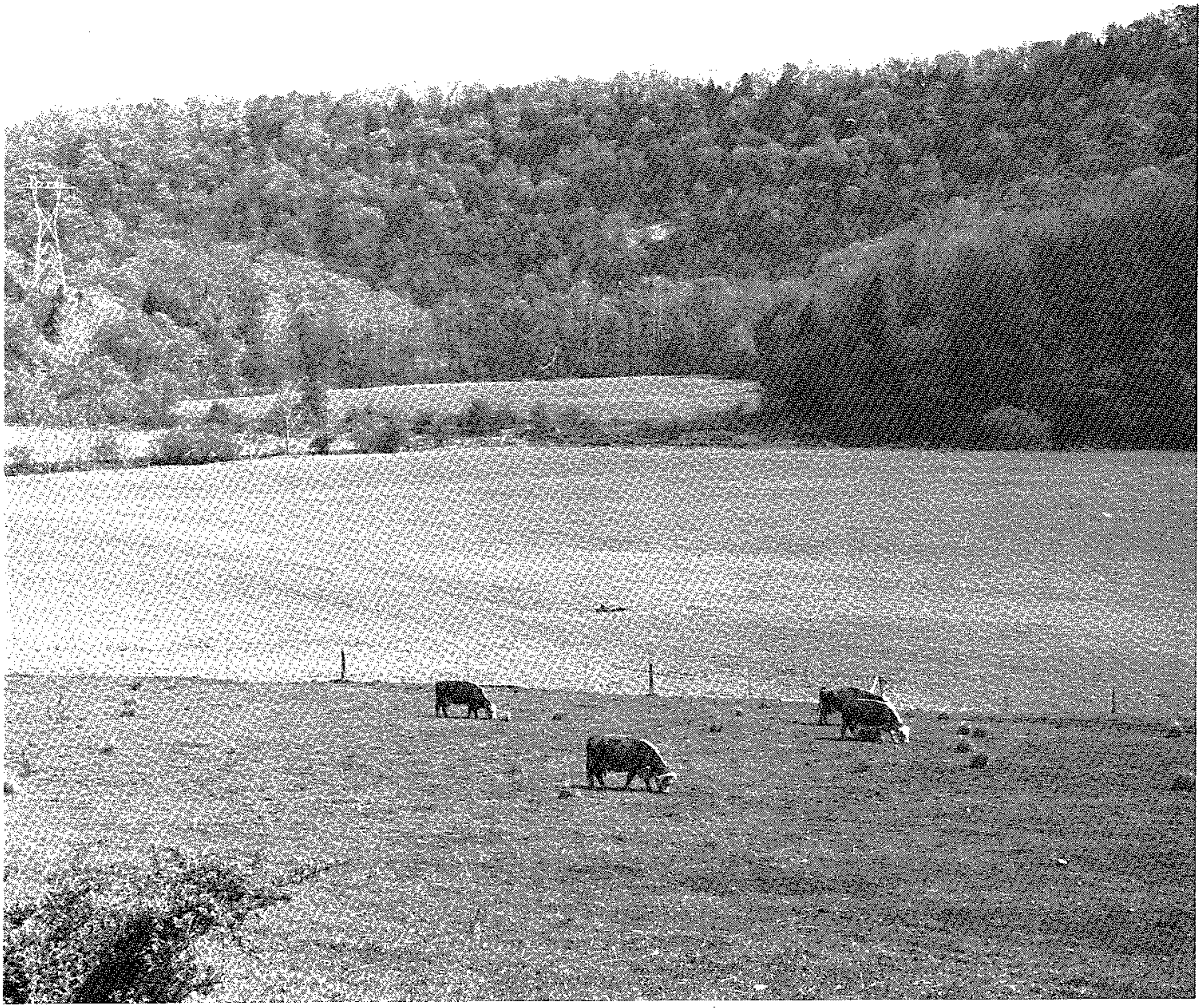

Figure 2.—A typical landscape in a stream valley. Tioga, Wheeling, and Omulga soils are in the foreground. Westmoreland and Berks soils are on the wooded slopes in the background.

season. Normal annual precipitation is adequate for all of the crops commonly grown in the county, but periods of moisture stress occur in some years. Summer temperatures and the length of the growing season in the valleys differ slightly from those at the higher elevations. The last freeze in the spring and the first freeze in the fall generally occur in the valleys because the 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 Cadiz, Ohio, in the period 1951 to 1984. 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 30 degrees F and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred at Cadiz on January 17, 1982, is -20 degrees.

In summer, the average temperature is 71 degrees and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 100 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 38 inches. Of this, about 22 inches, or 58 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 3.28 inches at Cadiz on July 22, 1980. Thunderstorms occur on about 35 days each year.

The average seasonal snowfall is 33.5 inches. The greatest snow depth at any one time during the period of record was 8 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Physiography, Drainage, and Relief

Jefferson County is in the unglaciated Allegheny Plateau region. The survey area has been extensively dissected by drainageways that empty into the Ohio River, which is the sinuous eastern border of the county.

The three main tributaries to the river are Yellow Creek in the northern part of the county, Short Creek in the southern part, and Cross Creek in the central part. The watersheds of these streams include about three-fourths of the survey area. The valleys of the watersheds are winding but generally run in an east-west direction, and the northern tributaries in the watersheds are more numerous than the southern tributaries. The watersheds of other streams that empty directly into the Ohio River are within the eastern half of the county. They include Island Creek, Wills Creek, and Rush Run. A small area in the southwest corner of the county drains southward into Wheeling Creek.

The elevation of the drainage divides is highest in the western part of the county and gradually descends to the east. Many large areas on the ridges in the northwestern part of the county, mostly in the Yellow Creek watershed, have elevations of more than 1,300 feet. Areas with such elevations are less common in the watersheds of Cross and Short Creeks. The ridges bordering the Ohio River are generally more than 1,200 feet in elevation along the northern one-third of the eastern border and 1,100 to 1,200 feet along the rest of the border.

Relief is generally greatest in the eastern part of the county. The average difference in elevation between the hilltops and the valleys along the Ohio River is about 520 feet *(15)*. The average local relief is about 360 feet in the central part of the county and about 250 feet at the western border. The highest elevation in the county is 1,388 feet on a hill about one-quarter mile south of Monroeville, near the northwest corner of the county. The lowest point, at Yorkville in the southeast corner of the county, is about 644 feet, which is the normal pool elevation of the Ohio River at this point.

Geology

The bedrock in Jefferson County is sedimentary rock laid down during the Pennsylvanian and Permian periods. Later, this rock was elevated with respect to sea level and then eroded. The rock strata are not horizontal or regularly sloping, but the dip generally is in a south-southeasterly direction. The average dip in this direction, on the Pittsburgh coal layer, is about 17 feet per mile *(9)*. There is a syncline in the Knoxville area and an anticline in the Annapolis area *(10)*.

Of the rocks belonging to the Pennsylvanian System, part of the Allegheny Formation and all of the Conemaugh and Monongahela Formations are represented in surface outcrops. The strata in the Allegheny Formation below the Lower Kittanning clay are not exposed in the county. The younger strata in this formation outcrop in the valleys of Yellow Creek and its tributaries and in the Ohio River valley north of the mouth of Island Creek. The Conemaugh Formation outcrops over much of the area north of Cross Creek and in the valleys south of that stream. Pittsburgh coal and the overlying strata belonging to the Monongahela Formation outcrop on ridgetops north of Cross Creek and over much of the area to the south.

Of the rocks belonging to the Permian System, only the lower 130 feet of the Dunkard Group is represented in surface outcrops. These outcrops are on ridgetops south of Short Creek and between Short Creek and Rush Run.

Shale, siltstone, and sandstone are the most common kinds of bedrock that outcrop in Jefferson County. The Allegheny and Conemaugh Formations have a higher proportion of sandstone and clay shale and a lower proportion of limestone than the Monongahela Formation and the Dunkard Group. The Conemaugh Formation has the lowest proportion of coal.

The basic drainage pattern has changed little since pre-Pleistocene time, except that the direction of streamflow has been reversed in what is now the Ohio River *(22, 23)*. During the time that the Teays River developed, the headwaters of this stream were about 40 miles south of the survey area and the floor of the valley was about 350 feet higher than the present level of the river. During the Pleistocene epoch, the floor level was lowered by about 450 feet and the meandering streams were entrenched. The direction of streamflow was reversed to the present condition during the deep stage of pre-Illinoian glaciation. Relicts of sedimentation during these stages are present along the streams at elevations as high as about 1,000 feet. The southern limit of glaciation during the Pleistocene epoch was about 10 miles north of the survey area.

Farming and Other Land Uses

About 29 percent of the land in Jefferson County is farmland *(29)*, but only about 16 percent of this land is used as cropland or pasture. The rest is used for woodlots or is idle. Some of the idle land has been affected by surface mining and has never been reclaimed. The number of acres in cropland, pasture, and woodlots on farms in the county is roughly equal. The total acreage of woodland, including woodlots, however, makes up about 57 percent of the county. About two-thirds of the cropland is used for hay, which is commonly grown in contour strips alternating with corn, oats, and wheat.

Almost half of the local farm income is from the sale of dairy products, and about one-fourth is from the sale of livestock, mainly beef *(12)*. Hogs, poultry, and sheep also are marketed. The sale of crops, mainly corn and hay, accounts for about one-fifth of the local farm income. Greenhouse products, fruits, and vegetables are other sources of income.

Most of the farms are managed by the owner, who typically resides on the farm. About two-thirds of the farmers work at least part of the time in jobs that are off the farm. In recent years, the number of farmers has increased slightly and the average size of active farms has remained about the same.

Almost three-fourths of the acreage in the county is not in farmland. About 60 percent of this acreage is woodland. About 8 percent of the acreage is within cities or villages, and about 9 percent is in residential areas outside of cities and villages *(14)*. The number of housing units in rural areas increased by about 30 percent between 1970 and 1980, and most new units were in Island Creek, Cross Creek, and Salem Townships *(28)*.

Recreation also is important in the county. The state-owned Brush Creek Wildlife Area and Jefferson Lake State Park occupy thousands of acres of woodland with rugged terrain in the northwestern part of the county. Much of the land between Cross Creek and McIntyre Creek has been affected by surface mining, and thousands of acres of this land is managed by sportsmen's clubs. Fernwood State Forest and the county fairgrounds also are in this general area. Other extensive areas of woodland are unmanaged.

Natural Resources

The most important natural resources in the county are soil, various bedrock layers that crop out on hillsides, sand, gravel, water, oil, and natural gas.

Coal mining is a very important part of the local economy. Deep mining activity began in the mid-1800's. Surface mining activity began after World War I and expanded during World War II. Most of the deposits of Pittsburgh (No. 8) coal have already been mined. The deposits of Pittsburgh coal north of State Route 151 were extracted mostly by surface mining, and the rest of the deposits were mostly deep mined. Surface mining activities for Waynesburg (No. 11) coal have been active in Mt. Pleasant, Warren, and Wells Townships for the past two decades. Coal from thinner or less extensive beds and limestone have also been extracted during excavation for Pittsburgh and Waynesburg coals.

Lower Kittanning (No. 5), Middle Kittanning (No. 6), and Lower Freeport and Upper Freeport (No. 7) coals have been mined underground and in the valleys in the northern part of the county. Clay from just below the Lower Kittanning coal bed was used in the clay industry that was once active in that part of the county. Harlem coal has been mined and Ames limestone has been quarried in the area southeast of Annapolis in Salem Township. Sand and gravel have been excavated from several places along the Ohio River.

The gravelly fill in the Ohio River valley can supply water for heavy industrial use. Wells in the fill of other valleys produce as much as about 25 gallons per minute, but the fill in those valleys is generally less than 40 feet thick and has been contaminated by mine waste in some places *(18, 19, 20)*. Most of the wells in the underlying sandstone layers of the Conemaugh, Allegheny, and Pottsville Formations are adequate for residential use, although some wells have been affected by nearby surface mining. Brine generally is deeper than 200 feet below valley level *(23)*. Most farms have one or more good springs suitable for watering livestock. Surface water is available from streams and ponds, but many of the streams have been contaminated by acid mine drainage.

Most of the oil and natural gas produced in the county is from wells in the Berea sands of the Mississippian System. The approximate depth of these wells is generally 1,300 to 1,800 feet, although wells in the valley of Yellow Creek are only 600 to 900 feet deep *(15)*. Most wells were drilled in the northeastern part of the county or in Cross Creek Township. They produced mostly oil. About 400 wells were in the county in 1930, but few remain active today.

History

Prior to 1795 when the Treaty of Greenville was signed, settlement in the survey area was limited to places along the Ohio River. Col. George Washington made a trip down the river from Ft. Pitt in 1770 and observed "about twenty cabins and seventy inhabitants of the Six Nations" at "Mingo Town, situated on the west side of the river, a little above Cross Creek" *(11)*. This Indian settlement remained until 1774. In 1786, Ft. Steuben was built at the site that would later become Steubenville. The fort was dismantled 8 years later *(13)*. Blockhouses were built at several places south of this site. The first European settlements were Tiltonsville and Warrenton. They were begun shortly after the ordinance calling for the survey of the Seven Ranges was passed in 1785.

Bezaleel Wells and James Ross first sold lots in Steubenville in 1797 *(7)*, and the Federal land office opened shortly thereafter. Gradually, the interior of the county was settled. Quakers moved into the Mt. Pleasant area in the southwestern part of the county. In the first half of the 19th century, roads were built along the river and westward from Steubenville to what is now Wintersville *(4)*. These roads were the forerunners of the major highways in the county. These highways are Ohio Route 7, which is along the Ohio River; U.S. Highway 22, which runs in a southwesterly direction; and Ohio Route 43, which runs in a northwesterly direction. Most manufacturing activities involved local agricultural products. Steubenville became a commercial center because of the easy access to the river and the roads. It was said to be the woolen fabric manufacturing center of the country during the middle of the 19th century *(5)*.

Industrial expansion occurred during the last half of the 19th century, and by 1904, more than 100 miles of railroad lines crisscrossed Jefferson County. Four lines headed northwest from the valleys of the Ohio River tributaries to Lake Erie and the factories of northern Ohio *(6)*. The mining of coal rapidly increased in extent during this period, first in Steubenville and then in the Dillonvale area. Steel mills were built along the river in Steubenville and Mingo Junction. Clay mining expanded and so did the towns of Toronto and Irondale where clay products were made. The population of the county increased by 50 percent during the last half of the 19th century, and the population of Steubenville more than doubled. At the turn of the century, the city limits included new residential areas on the hill overlooking the downtown area.

During the 20th century, residential development has expanded westward along the road linking Steubenville and Wintersville. Nearly every upland area between Permars Run and Wills Creek has been developed and is included in the city limits of Steubenville. The population of Steubenville doubled in the first two decades of this century and peaked in 1940. Although its population has decreased by 20 percent since then, Steubenville is still second only to Cincinnati in size among the Ohio cities along the Ohio River. The population of Wintersville increased at about the time that the population of Steubenville decreased. The population of the county increased from 1900 to 1940 and then stayed about the same for two decades. It has decreased by about 8 percent since 1960.

How This Survey Was Made

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

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

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

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

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

1. Lowell-Morristown-Brookside Association

Deep, moderately steep to very steep, well drained and moderately well drained soils formed in residuum and colluvium derived from limestone, shale, siltstone, and sandstone and in material mixed by surface mining; on uplands

This association consists of deeply dissected areas along and near the larger streams. Most of the areas are on long hillsides. Ridgetops are narrow or rounded and have knolls and saddles. Valley bottoms are less than one-quarter of a mile wide.

This association makes up about 7 percent of the county. It is about 30 percent Lowell soils, 20 percent Morristown soils, 15 percent Brookside soils, and 35 percent soils of minor extent.

The well drained Lowell soils are on steep and very steep side slopes. The surface layer is silty clay loam or silt loam. Permeability is moderately slow.

The well drained Morristown soils are steep and very steep and are in areas that have been surface mined for coal. The surface layer is shaly silty clay loam or silty clay loam. The organic matter content is very low. Permeability is moderately slow. Slips are common in most areas.

The moderately well drained Brookside soils are on moderately steep and steep foot slopes and benches. The surface layer is silty clay loam. Permeability is moderately slow. The seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. The shrink-swell potential is high. These soils are subject to slippage.

Of minor extent in this association are the Gilpin, Nolin, and Richland soils. The moderately deep Gilpin soils are on uplands. Richland soils are on colluvial foot slopes, fans, and toe slopes. They have less clay in the subsoil than the Lowell and Brookside soils and have a lower content of coarse fragments in the profile than the Morristown soils. Nolin soils formed in alluvium on flood plains in narrow valleys.

Most areas of this association are in woodland. Buildings and roads are generally constructed in the narrow stream valleys and on ridgetops. Most areas are generally unsuited to row crops, small grain, and hay and to most urban uses. The slope, the hazard of water erosion, the moderately slow permeability, a moderate or high shrink-swell potential, and the susceptibility to slippage in areas of the Morristown and Brookside soils are the major management concerns affecting most land uses.

Lowell and Brookside soils are well suited to woodland. Morristown soils are poorly suited to woodland because of droughtiness and the calcareous nature of the soil material. Coves and north- and east-facing slopes are better suited as woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures in these areas. These sites are less exposed to the drying effects of the prevailing wind and the sun. The slope limits the use of some planting and harvesting equipment.

2. Westmoreland-Lowell Association

Deep, very steep, well drained soils formed in colluvium and material weathered from shale, siltstone, limestone, and sandstone; on uplands

This association consists of deeply dissected areas along or near the larger streams. Most of the areas are on long hillsides. Ridgetops are narrow or rounded and have knolls and saddles. Valley bottoms are less than one-quarter of a mile wide.

This association makes up about 13 percent of the county. It is about 45 percent Westmoreland and similar soils, 25 percent Lowell and similar soils, and 30 percent soils of minor extent.

Westmoreland soils are on side slopes. The surface layer is silt loam. The organic matter content is moderately low. Permeability is moderate.

Lowell soils are on side slopes. The surface layer is silty clay loam or silt loam. The organic matter content is moderately low. Permeability is moderately slow. Some areas of these soils are subject to slippage.

Of minor extent in this association are the Morristown, Tioga, and Wheeling soils. Morristown soils are on side slopes in areas that have been surface mined for coal. They have a higher content of coarse fragments than the major soils. The nearly level Tioga soils are on narrow flood plains. They have less clay in the subsoil than the major soils and are subject to flooding. The nearly level Wheeling soils are on low terraces. They have a substratum of water-laid sand and gravel.

Most areas of this association are in woodland. Buildings and roads are generally constructed in the narrow stream valleys and on ridgetops. These soils are generally unsuited to row crops, small grain, hay, and pasture and to most urban uses, mainly because of the slope.

This association is moderately well suited to woodland. Coves and north- and east-facing slopes are better suited as woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures in these areas. These sites are less exposed to the drying effects of the prevailing wind and the sun. The slope limits the use of some harvesting and planting equipment.

3. Westmoreland-Hazleton-Berks Association

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

This association consists of deeply dissected areas along or near the larger streams. Most of the areas are on long hillsides. Ridgetops are narrow or rounded and have knolls and saddles. Valley bottoms are less than one-quarter of a mile wide.

This association makes up about 13 percent of the county. It is about 25 percent Westmoreland soils, 20 percent Hazleton soils, 15 percent Berks soils, and 40 percent soils of minor extent.

The deep Westmoreland soils are on strongly sloping to very steep side slopes and ridgetops. The surface layer is silt loam. The organic matter content is moderately low or moderate. Permeability is moderate.

The deep Hazleton soils are on the upper part of steep and very steep hillsides. The surface layer is channery loam. The organic matter content is moderately low. Permeability is rapid or moderately rapid.

The moderately deep Berks soils are on steep and very steep, convex and smooth side slopes. The surface layer is shaly silt loam. The organic matter content is moderately low. Permeability is moderate or moderately rapid.

Of minor extent in this association are the Fairpoint, Steinsburg, Summitville, and Tioga soils. Fairpoint soils are in areas that have been surface mined for coal. They have a higher content of coarse fragments than the Westmoreland soils, contain more clay than the Hazleton soils, and are deeper to bedrock than the Berks soils. Steinsburg soils are on uplands. They contain more sand in the subsoil than the Westmoreland and Berks soils and have a lower content of coarse fragments in the subsoil than the Hazleton soils. The moderately well drained Summitville soils are on benches. Tioga soils formed in alluvium on flood plains in narrow valleys.

Most areas of this association are in woodland. Buildings and roads are generally constructed on the narrow ridgetops and benches and in stream valleys. Most areas of these soils are generally unsuited to crops and to most urban uses because of the slope, but some included ridgetops are suited to these uses. The steep soils are poorly suited to pasture, and the very steep soils are generally unsuited. The low or very low available water-holding capacity of the Hazleton and Berks soils is a major limitation if the soils are used as cropland or pasture.

These soils are well suited or moderately well suited to woodland. Coves and north- and east-facing slopes are better suited as woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures in these areas. These sites are less exposed to the drying effects of the prevailing wind and the sun. The slope limits the use of some harvesting and planting equipment.

4. Gilpin-Berks-Steinsburg Association

Moderately deep, gently sloping to very steep, well drained soils formed in material weathered from shale, siltstone, and sandstone; on uplands

This association is on gently undulating to very hilly ridgetops and on side slopes dissected by intermittent drainageways. The soils on narrow ridgetops generally are strongly sloping, and those on the broader ridgetops are gently sloping and strongly sloping. The soils on the side slopes are moderately steep to very steep.

This association makes up about 6 percent of the county. It is about 30 percent Gilpin and similar soils, 25 percent Berks and similar soils, 15 percent Steinsburg soils, and 30 percent soils of minor extent.

Gilpin soils are on gently sloping to moderately steep side slopes and ridgetops. The surface layer is silt loam. The organic matter content is moderate or moderately low. Permeability is moderate.

Berks soils are on gently sloping to very steep side slopes and ridgetops. The surface layer is shaly silt loam. The organic matter content is moderately low or moderate. Permeability is moderate or moderately rapid.

Steinsburg soils are on strongly sloping and moderately steep side slopes and ridgetops. The surface layer is fine sandy loam. The organic matter content is moderately low. Permeability is moderately rapid.

Of minor extent in this association are the Coshocton, Guernsey, and Summitville soils. The deep, moderately well drained Coshocton and Guernsey soils are on ridgetops and side slopes. Guernsey soils have more clay in the subsoil than the major soils. They are subject to slippage. The deep, moderately well drained Summitville soils are on benches on steep hillsides.

Most of the gently sloping and strongly sloping areas are used as cropland, pasture, or woodland. The steeper areas are used as woodland. Buildings and roads are generally constructed on the gently sloping and strongly sloping ridgetops. The gently sloping and strongly sloping areas are well suited or moderately well suited to crops and pasture and to most urban uses, but the very steep areas are generally unsuited to these uses. The steep areas are poorly suited to hay and pasture and generally unsuited to crops and to most urban uses.

The hazard of water erosion, the slope, and a low water-holding capacity are the major management concerns affecting cropland and pasture. The slope and bedrock between depths of 20 and 40 inches are the major limitations affecting urban development.

These soils are well suited to woodland. Coves and north- and east-facing slopes are better suited as woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures in these areas. These sites are less exposed to the drying effects of the prevailing wind and the sun.

5. Gilpin-Steinsburg-Hazleton Association

Moderately deep and deep, gently sloping to steep, well drained soils formed in colluvium and material weathered from siltstone, sandstone, and shale; on uplands

This association is on gently undulating to very hilly ridgetops and on side slopes dissected by intermittent drainageways. The soils on narrow ridgetops generally are strongly sloping, and those on the broader ridgetops are gently sloping and strongly sloping. The soils on the side slopes are moderately steep and steep.

This association makes up about 3 percent of the county. It is about 35 percent Gilpin soils, 25 percent Steinsburg soils, 20 percent Hazleton soils, and 20 percent soils of minor extent.

The moderately deep Gilpin soils are on gently sloping to moderately steep ridgetops and side slopes. The surface layer is silt loam. The organic matter content is moderate or moderately low. Permeability is moderate.

The moderately deep Steinsburg soils are on gently sloping to moderately steep ridgetops and side slopes. The surface layer is fine sandy loam. The organic matter content is moderately low. Permeability is moderately rapid.

The deep Hazleton soils are on steep side slopes. The surface layer is channery loam. The organic matter content is moderately low. Permeability is rapid or moderately rapid.

Of minor extent in this association are the Berks, Guernsey, and Summitville soils. The moderately deep Berks soils are similar to the Hazleton soils. They are on ridgetops and side slopes. The moderately well drained Guernsey soils are on ridgetops, benches, and hillsides. They have more clay in the subsoil than the major soils and have a seasonal high water table at a depth of about 2.0 to 3.5 feet during extended wet periods. The moderately well drained Summitville soils are on benches below the Hazleton soils on side slopes. They have a seasonal high water table at a depth of about 3 to 6 feet during extended wet periods.

Most of the gently sloping and strongly sloping areas are used as cropland, pasture, or woodland. The steeper areas are used as woodland. Buildings and roads are generally constructed on the gently sloping and strongly sloping ridgetops. The gently sloping and strongly sloping areas are well suited or moderately well suited to row crops, small grain, hay, and pasture and to most urban uses. The steep areas are generally unsuited to crops and to urban uses and are poorly suited to pasture. The hazard of water erosion, the slope, and a low available water-holding capacity are the major management concerns affecting cropland and pasture. The slope and bedrock between depths of 20 and 40 inches in areas of the Gilpin and Steinsburg soils are the major limitations affecting some urban land development. The bedrock in areas of the Gilpin and Steinsburg soils is commonly rippable.

This association is well suited to woodland. Coves and north- and east-facing slopes are better suited as woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures in these areas. These sites are less exposed to the drying effects of the prevailing wind and the sun.

6. Gilpin-Lowell-Morristown Association

Moderately deep and deep, nearly level to very steep, well drained soils formed in residuum and colluvium derived from siltstone, shale, limestone, and sandstone and in material mixed by surface mining; on uplands

This association consists of gently undulating to very steep soils on ridgetops and on side slopes dissected by intermittent drainageways. The soils on narrow ridgetops generally are strongly sloping, and those on the broader ridgetops are gently sloping and strongly sloping. The soils on the side slopes are moderately steep to very steep.

This association makes up about 50 percent of the county. It is about 20 percent Gilpin soils, 20 percent Lowell soils, 20 percent Morristown soils, and 40 percent soils of minor extent.

The moderately deep Gilpin soils are on gently sloping to moderately steep ridgetops and side slopes. The surface layer is silt loam. The organic matter content is moderate or moderately low. Permeability is moderate.

The deep Lowell soils are on nearly level to strongly sloping ridgetops and moderately steep side slopes. The surface layer is silt loam or silty clay loam. The organic matter content is moderately low or moderate. Permeability is moderately slow.

The deep Morristown soils are on nearly level to very steep side slopes, ridgetops, and benches in areas that have been surface mined for coal. The surface layer is shaly silty clay loam or silty clay loam. The organic matter content is low. Permeability is moderately slow. These soils are subject to slippage.

Of minor extent in this association are the Berks, Coshocton, Keene, Richland, and Tioga soils. Berks soils are on ridgetops and side slopes. They have a higher content of coarse fragments in the subsoil than the Gilpin and Lowell soils. Richland soils are on colluvial foot slopes, fans, and toe slopes. They have less clay in the subsoil than the Lowell soils and have a lower content of coarse fragments than the Morristown soils. The moderately well drained Coshocton soils are on ridgetops, foot slopes, and hillsides. They have a perched seasonal high water table at a depth of 1.5 to 3.0 feet during extended wet periods. The moderately well drained Keene soils are on ridgetops. They have a perched seasonal high water table at a depth of 1.5 to 3.0 feet during extended wet periods and have a lower content of coarse fragments in the upper part of the profile than the major soils. Tioga soils formed in alluvium on flood plains in narrow valleys.

Most of the nearly level to strongly sloping areas are used as cropland, pasture, or woodland. The steeper areas are used as woodland. Buildings and roads are generally constructed on the nearly level to strongly sloping ridgetops. The nearly level to strongly sloping areas that have not been surface mined for coal are well suited or moderately well suited to row crops, small grain, hay, and pasture and to most urban uses. The hazard of erosion and the low available water-holding capacity of the Gilpin soils are the major management concerns affecting cropland and pasture. The hazard of water erosion, the slope, the moderately slow permeability of the Lowell and Morristown soils, the susceptibility to slippage in areas of the Morristown soils, and bedrock between depths of 20 and 40 inches in areas of the Gilpin soils are the major management concerns affecting nonagricultural uses.

The areas that have not been surface mined for coal are well suited to woodland. Coves and north- and east-facing slopes are better suited as woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures in these areas. These sites are less exposed to the drying effects of the prevailing wind and the sun.

7. Morristown-Gilpin Association

Deep and moderately deep, nearly level to very steep, well drained soils formed in material mixed by surface mining and in material weathered from siltstone, shale, and sandstone; on uplands

This association is in and around extensive areas that have been surface mined for coal. In places it consists of steep and very steep banks of spoil material that have been deposited parallel to a highwall, below a remnant of the original landscape. In other areas, regrading the spoil material has eliminated the highwall or the entire landscape above the coal has been moved during mining and then regraded. These areas generally are regraded to a nearly level to moderately steep slope.

This association makes up about 6 percent of the county. It is about 60 percent Morristown soils, 15 percent Gilpin soils, and 25 percent soils of minor extent.

The deep Morristown soils are in nearly level to very steep areas that have been surface mined for coal. The surface layer is shaly silty clay loam or silty clay loam. The organic matter content is very low. Permeability is moderately slow. These soils are subject to slippage. Some areas are bouldery.

The moderately deep Gilpin soils are on gently sloping to moderately steep ridgetops and side slopes above and below the Morristown soils. The surface layer is silt loam. The organic matter content is moderately low. Permeability is moderate.

Of minor extent in this association are the Elba and Lowell soils. Elba and Lowell soils are on ridgetops and the upper side slopes above the Morristown soils. Lowell soils also are on side slopes below the Morristown soils. Elba and Lowell soils have more clay in the subsoil than the Gilpin soils and have a lower content of coarse fragments than the Morristown soils. Lowell soils are subject to slippage.

Most of the regraded surface mined areas of this association are used for hay or pasture. The rest of the association is mostly woodland. Most of the surface mined areas are generally unsuited to row crops and small grain. The steep and the very steep surface mined areas also are generally unsuited to hay and pasture. The unmined areas are well suited, moderately well suited, or poorly suited to row crops, small grain, hay, and pasture and to most urban uses, depending on the slope. The areas that were mined and regraded are moderately well suited or poorly suited to hay and pasture and to most urban uses. Gilpin soils are well suited to woodland, and Morristown soils are poorly suited.

The hazard of water erosion, a low available water-holding capacity, and the slope are the main management concerns affecting cropland and pasture. The moderately slow permeability and the moderate shrink-swell potential of the Morristown soils, the susceptibility of slippage in areas of the Morristown soils, and bedrock between depths of 20 and 40 inches in areas of the Gilpin soils are the major limitations affecting urban development. Morristown soils are better suited to urban development after they have settled. Planting a permanent vegetative cover is the best means of controlling erosion and conserving moisture.

8. Urban land-Brookside-Omulga Association

Urban land and deep, nearly level to moderately steep, moderately well drained soils formed in colluvium, old alluvium, and loess; on uplands and terraces along streams

This association is on terraces and foot slopes that border the Ohio River. Most areas are long and narrow and generally are less than one-half of a mile wide.

This association makes up about 2 percent of the county. It is about 50 percent Urban land, 15 percent Brookside soils, 15 percent Omulga soils, and 20 percent soils of minor extent.

Urban land is covered with pavement, buildings, or other structures.

Brookside soils are on strongly sloping and moderately steep foot slopes and benches. The surface layer is silty clay loam. The organic matter content is moderately low. Permeability is moderately slow. These soils are subject to slippage.

Omulga soils are on nearly level to strongly sloping terraces. The surface layer is silt loam. The organic matter content is moderately low. Permeability is moderate above the fragipan and slow in the fragipan.

Of minor extent in this association are the Clarksburg, Lowell, and Nolin soils. Clarksburg soils are on foot slopes. They formed in colluvium. They have a fragipan and contain less clay in the subsoil than the Brookside soils. The well drained Lowell soils are on foot slopes and side slopes above the Brookside soils. The well drained Nolin soils formed in alluvium on flood plains.

Most areas of this association are used for roads, streets, homes, factories, railroads, or for other urban uses. A few areas are used as cropland. These soils are suited to lawns, vegetable and flower gardens, and shrubs and trees.

Omulga soils are better suited to most urban uses than the Brookside soils. The moderately slow or slow permeability, seasonal wetness, and the slope are limitations on sites for septic tank absorption fields. Controlling erosion during construction is a management concern in the more sloping areas. Omulga soils are moderately well suited to building site development. The seasonal wetness and the shrink-swell potential are limitations. Brookside soils are moderately well suited or poorly suited to building site development. A shrink-swell potential, the slope, and the hazard of slippage are concerns.

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 the heading "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 substratum, 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 substratum. 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, Lowell silt loam, 7 to 15 percent slopes, is a phase of the Lowell 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, or one or more soils and a miscellaneous area, 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. Gilpin-Lowell silt loams, 8 to 15 percent slopes, is an example.

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

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

BkB—Berks shaly silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is on ridgetops in the uplands. Most areas are long and narrow and range from 3 to 15 acres in size. In places the ridgetops are as wide as 700 feet and as large as 40 acres in size.

Typically, the surface layer is brown, friable shaly silt loam about 6 inches thick. The subsoil is yellowish brown, friable very shaly silt loam about 18 inches thick. Shale bedrock is at a depth of about 24 inches. In places, the subsoil has more sand and the soil is more than 40 inches deep.

Included with this soil in mapping are small areas of shallow soils near the edge of ridgetops. Also included are the deep, moderately well drained Coshocton and Guernsey soils in flat or concave areas. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil. Available water capacity is very low. Runoff is medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone generally is restricted by the moderate depth to bedrock.

Most areas are used as cropland or pasture. Some are wooded.

This soil is moderately well suited to corn and small grain. Droughtiness and erosion are management concerns. If the soil is cultivated or plowed during seedbed preparation, the hazard of erosion is moderate. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops conserve moisture, reduce the runoff rate, and help to control erosion. Shale fragments in the surface layer hinder tillage.

This soil is well suited to hay and pasture, but growth is slow in dry periods. If the soil is plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is moderate. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Timely applications of lime and fertilizer are needed.

This soil is well suited to woodland. Mulching around seedlings reduces the seedling mortality rate.

This soil is moderately well suited to building site development and septic tank absorption fields. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. The bedrock at a depth of 20 to 40 inches is a limitation on sites for buildings with basements, but it commonly is rippable. The depth to bedrock also is the major limitation on sites for septic tank absorption fields. The filtering capacity can be improved by adding suitable fill to the field.

This soil is only moderately well suited to camp areas because of the small flat stone fragments on the surface. Covering the surface with better suited material may be necessary. The soil is well suited to paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 4F. The pasture and hayland suitability group is F-1.

BkC—Berks shaly silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on rounded ridgetops in the uplands. Slopes are convex or smooth. Most areas are long and narrow or oval and range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable shaly silt loam about 6 inches thick. The subsoil is about 16 inches of light olive brown, friable very shaly silt loam and extremely shaly silt loam. Bedded shale bedrock is at a depth of about 22 inches. In some places the soil is less than 20 inches deep over bedrock. In other places, it is more than 40 inches deep over bedrock and the subsoil has a lower content of coarse fragments.

Included with this soil in mapping are small areas of Gilpin soils; small areas of shallow soils near the edge of ridgetops; and narrow bands of the deep, moderately well drained Coshocton and Guernsey soils. Gilpin soils have fewer shale fragments in the subsoil than the Berks soil. They are intermingled with areas of the Berks soil. Coshocton and Guernsey soils have more clay in the subsoil than the Berks soil. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil. Available water capacity is very low. Runoff is medium or rapid. The organic matter content is moderate in the surface layer, and tilth is good. The root zone generally is restricted by the moderate depth to bedrock.

Most areas are used as pasture or cropland. Some are wooded.

This soil is moderately well suited to corn and small grain. Droughtiness and erosion are management concerns. The hazard of erosion is severe if cultivated crops are grown. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops conserve moisture, reduce the runoff rate, and help to control erosion. The shale fragments in the surface layer hinder tillage.

This soil is well suited to hay and pasture, but growth is slow in dry periods. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Timely applications of lime and fertilizer are needed.

This soil is well suited to trees. Mulching around seedlings reduces the seedling mortality rate. Cutting and filling to a more desirable slope improve sites for log landings.

This soil is moderately well suited to building site development. The slope is the major limitation. Buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. Constructing local roads and streets on the contour and seeding road cuts help to control erosion. The bedrock at a depth of 20 to 40 inches is a limitation on sites for buildings with basements, but it commonly is rippable.

This soil is poorly suited to septic tank absorption fields because of the moderate depth to bedrock. The filtering capacity can be improved by adding suitable fill material to the field.

This soil is moderately well suited to camp areas. The slope and small flat stones on the surface are limitations. Grading the soil so that it has a more desirable slope and covering the surface with better suited material help to overcome these problems. The soil is well suited to paths and trails.

The land capability classification is IIIe. The woodland ordination symbol is 4F. The pasture and hayland suitability group is F-1.

BkD—Berks shaly silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, well drained soil is on ridgetops and side slopes in the uplands. Areas are oval or long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is brown, very friable shaly silt loam about 6 inches thick. The subsoil is yellowish brown, friable very shaly silt loam about 20 inches thick. Bedded shale bedrock is at a depth of about 26 inches.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils on slightly concave slopes; areas of shallow soils near the top of slopes; and areas of Gilpin soils. A few seeps and springs are in the areas of the Guernsey soils. Guernsey soils have more clay in the subsoil than the Berks soil. Gilpin soils are intermingled with areas of the Berks soil. They have fewer shale fragments in the subsoil than the Berks soil. Inclusions make up about 10 to 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil. Available water capacity is very low. Runoff is rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone generally is restricted by the moderate depth to bedrock.

Most areas are used as pasture. Some are used as cropland. Others are wooded.

This soil is poorly suited to corn and small grain. Droughtiness and erosion are management concerns. The hazard of erosion is very severe if cultivated crops are grown. A permanent plant cover is the best means of controlling erosion. A conservation tillage system that leaves crop residue on the surface, contour stripcropping, and cover crops conserve moisture, reduce the runoff rate, and help to control erosion. The slope hinders the use of some farm machinery. The shale fragments in the surface layer hinder tillage.

This soil is moderately well suited to pasture and hay. Growth is slow in dry periods. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Applications of lime and fertilizer are needed.

This soil is well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Establishing haul roads and skid trails on the contour facilitates the use of equipment. Mulching around seedlings reduces the seedling mortality rate. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is poorly suited to building site development because of the slope and the hazard of erosion. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. Buildings should be designed so that they conform to the natural slope of the land. The bedrock at a depth of 20 to 40 inches is a limitation on sites for buildings with basements, but it commonly is rippable.

Because of the depth to bedrock and the slope, this soil is poorly suited to septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. The filtering capacity can be improved by installing the absorption field in suitable fill material. Constructing roads and streets on the contour and seeding road cuts help to control erosion.

Because of the slope, this soil is poorly suited to camp areas and moderately well suited to paths and trails. Grading the soil so that it has a more desirable slope helps to overcome the slope in camp areas. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion.

The land capability classification is IVe. The woodland ordination symbol is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is F-1.

BmC—Berks-Guernsey complex, 8 to 15 percent slopes. These strongly sloping soils are on hillsides and narrow ridgetops in the uplands. The moderately deep, well drained Berks soil is commonly on the middle and upper parts of linear or convex side slopes and in linear or convex areas at the summit of ridges. The deep, moderately well drained Guernsey soil is commonly in smooth or concave areas at the summit of ridgetops and on side slopes. These soils are also in alternating bands on hillsides where the bands are associated with different bedrock strata. The hillside areas commonly are 200 to 600 feet wide. They range from 10 to several hundred acres in size. Most areas are long and narrow. They are generally above the more strongly sloping areas. The Berks soil makes up about 50 to 65 percent of the map unit, and the Guernsey soil makes up about 20 to 35 percent. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Berks soil has a surface layer of brown, very friable shaly silt loam about 6 inches thick. The subsoil is light olive brown and yellowish brown, friable very shaly silt loam about 16 inches thick. Bedded shale bedrock is at a depth of about 22 inches. In places the surface layer has fewer coarse fragments.

Typically, the Guernsey soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. It is yellowish brown, firm silty clay loam in the upper part and yellowish brown, mottled, firm silty clay and shaly silty clay in the lower part. The substratum is light olive brown, firm shaly silty clay. Bedded shale bedrock is at a depth of about 50 inches. In some eroded areas the surface layer is silty clay loam. In other areas the soil is better drained.

Included with these soils in mapping are small areas of Coshocton, Gilpin, and Westmoreland soils. These areas are generally less than 2 acres in size. Coshocton, Gilpin, and Westmoreland soils are less shaly than the Berks soil and less clayey than the Guernsey soil. They are intermingled with areas of the Berks and Guernsey soils. Coshocton and Westmoreland soils are deep over bedrock. Also included are small, seepy areas of somewhat poorly drained soils. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil and slow or moderately slow in the Guernsey soil. Available water capacity is very low in the Berks soil and moderate in the Guernsey soil. Runoff is medium or rapid on the Berks soil and rapid on the Guernsey soil. The organic matter content is moderate in the surface layer of both soils, and tilth is good. The rooting depth is moderately deep in the Berks soil and deep in the Guernsey soil, but root growth is restricted somewhat by the clayey subsoil. The Guernsey soil has a perched seasonal high water table between depths of 2.0 and 3.5 feet in winter, in spring, and during other extended wet periods. The shrink-swell potential is high in the lower part of the subsoil of the Guernsey soil and low in the Berks soil. The potential for frost action is high in the Guernsey soil and low in the Berks soil.

Most areas are used for corn or small grain. Some are used for pasture and hay. Some are wooded.

These soils are moderately well suited to corn and small grain. The hazard of erosion is a major management concern. If the soils are cultivated, the hazard of erosion is severe. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Conserving moisture is another major management concern in the droughty Berks soil. Installing random subsurface drains in seepy areas of the Guernsey soil helps to overcome the wetness. Shale fragments in the surface layer of the Berks soil hinder tillage. Tilling the Guernsey soil when it is wet results in soil compaction and the formation of clods.

These soils are well suited to pasture and hay. If the pasture is overgrazed or the soils are plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods minimizes compaction of the Guernsey soil.

These soils are well suited to woodland. Mulching around seedlings reduces the seedling mortality rate on the Berks soil. Cutting and filling to a more desirable slope improve sites for log landings on the Berks soil. Plant competition on the Guernsey soil can be controlled by removing vines and less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Guernsey soil.

These soils are moderately well suited to building site development. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil. Installing a drainage system in the seepy areas reduces this hazard. The Berks soil is better suited to buildings without basements than to buildings with basements. The bedrock underlying the Berks soil is commonly rippable. The wetness and the high shrink-swell potential of the Guernsey soil are limitations on sites for buildings, especially on those for buildings with basements. Waterproofing basement walls and installing drains at the base of footings in this soil help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, or by backfilling around foundations with material that has a low shrink-swell potential.

These soils are poorly suited to septic tank absorption fields because of the moderate depth to bedrock in the Berks soil and the wetness and the slow or moderately slow permeability in the Guernsey soil. Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. The filtering capacity of the Berks soil can be improved by adding suitable fill material to absorption fields. The effectiveness of the absorption fields can be improved in the Guernsey soil by installing curtain drains, increasing the size of the absorption area, or installing double absorption field systems.

Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets in areas of the Guernsey soil helps to prevent the damage caused by frost action and by shrinking and swelling.

These soils are moderately well suited to camp areas and to paths and trails. Establishing paths and trails on the contour in areas of the Guernsey soil reduces the hazard of erosion. Water bars and steps also reduce this hazard. The slope and the shaly surface layer are limitations in camp areas on the Berks soil. Grading the soil so that it has a more desirable slope and covering the surface with better suited material help to overcome these limitations. The slope, the wetness, and the slow or moderately slow permeability are limitations in camp areas on the Guernsey soil. Grading the soil so that it has a more desirable slope, installing a drainage system, and installing a large absorption field for the disposal of wastewater help to overcome these limitations.

The land capability classification is IIIe. The woodland ordination symbol is 4F in areas of the Berks soil and 4A in areas of the Guernsey soil. The pasture and hayland suitability group is F-1 in areas of the Berks soil and A-6 in areas of the Guernsey soil.

BmD—Berks-Guernsey complex, 15 to 25 percent slopes. These moderately steep soils are on side slopes in the uplands. The moderately deep, well drained Berks soil is generally on the middle and upper parts of linear or convex side slopes and on convex shoulder slopes on hillsides. The deep, moderately well drained Guernsey soil is in small, seepy areas on side slopes. These soils are also in alternating bands on hillsides where the bands are associated with different bedrock strata. Slips are common in areas of the Guernsey soil. Most areas of this unit are long and narrow. They are generally above the less sloping areas. They are generally 200 to 400 feet wide and range from about 5 to 100 acres in size. The Berks soil makes up about 50 to 65 percent of the unit, and the Guernsey soil makes up about 20 to 35 percent. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Berks soil has a surface layer of brown, very friable shaly silt loam about 5 inches thick. The subsoil is about 18 inches of brownish yellow and yellowish brown, friable very shaly silt loam and extremely shaly loam. Bedded shale bedrock is at a depth of about 23 inches. In places the surface layer has fewer coarse fragments.

Typically, the Guernsey soil has a surface layer of dark brown, friable silt loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is brownish yellow, friable silty clay loam, and the lower part is brown, light brown, and yellowish brown, mottled, firm silty clay. The substratum is light yellowish brown, mottled, firm silty clay loam. Bedded shale bedrock is at a depth of about 50 inches. In some eroded areas the surface layer is silty clay loam. In other areas the soil is better drained.

Included with these soils in mapping are small areas of Coshocton, Gilpin, and Westmoreland soils. These areas are generally less than 2 acres in size. Coshocton, Gilpin, and Westmoreland soils are less shaly than the Berks soil and less clayey than the Guernsey soil. They are intermingled with areas of the Berks and Guernsey soils. Also included are small areas of shallow soils near the top of slopes and seepy areas of somewhat poorly drained soils. Included soils make up about 5 to 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil and slow or moderately slow in the Guernsey soil. Available water capacity is very low in the Berks soil and moderate in the Guernsey soil. Runoff is rapid on the Berks soil and very rapid on the Guernsey soil. The organic matter content is moderately low in both soils. The rooting depth is moderately deep in the Berks soil and deep in the Guernsey soil. The Guernsey soil has a perched seasonal high water table between depths of 2.0 and 3.5 feet in winter, in spring, and during other extended wet periods. The shrink-swell potential is high in the lower part of the subsoil of the Guernsey soil and low in the Berks soil. The potential for frost action is high in the Guernsey soil and low in the Berks soil.

Some areas are used as cropland. Many are used as pasture. Many are wooded.

These soils are poorly suited to corn and small grain. A commonly used crop rotation includes a cultivated crop about once every 4 years. The hazard of erosion is a major management concern. Maintaining a permanent plant cover is the best means of controlling erosion. If the soils are cultivated, the hazard of erosion is very severe. A conservation tillage system that leaves crop residue on the surface, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. Conserving moisture is another major management concern in areas of the droughty Berks soil. Installing random subsurface drains in the seepy areas of the Guernsey soil helps to overcome the wetness. The slope hinders the use of some farm machinery. Shale fragments in the surface layer of the Berks soil hinder tillage. Tilling the Guernsey soil when it is wet results in soil compaction and the formation of clods.

These soils are moderately well suited to pasture and hay. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods minimizes compaction of the Guernsey soil.

These soils are well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Cutting and filling to a more desirable slope improve sites for log landings. Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Guernsey soil. Haul roads and log landings should not be located on active slips of the Guernsey soil. Mulching around seedlings reduces the seedling mortality rate on the Berks soil. Planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate on south and west aspects of the Guernsey soil. Special equipment is needed for site preparation and planting. Plant competition on the Guernsey soil can be controlled by removing vines and the less desirable trees and shrubs.

These soils are poorly suited to building site development because of the slope, the limited depth to bedrock in the Berks soil, and the wetness and the high shrink-swell potential in the Guernsey soil. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil. Installing a drainage system in the seepy areas reduces this hazard. The moderately deep Berks soil is better suited to buildings without basements than to buildings with basements. The bedrock underlying the Berks soil, however, is generally rippable. The wetness, the slope, and the high shrink-swell potential limit the Guernsey soil as a site for buildings, especially for buildings with basements. Waterproofing basement walls and installing drains at the base of footings in this soil help to keep basements dry. The harmful effects of shrinking and swelling in the Guernsey soil can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Building roads on the contour also helps to control erosion.

These soils are poorly suited to septic tank absorption fields. The slope, the moderate depth to bedrock in the Berks soil, and the wetness and the slow or moderately slow permeability in the Guernsey soil are limitations. Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. The filtering capacity of the Berks soil can be improved by installing the absorption field in suitable fill material. The effectiveness of the absorption fields in the Guernsey soil can be improved by installing curtain drains, increasing the size of absorption areas, or installing double absorption field systems. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets in areas of the Guernsey soil helps to prevent the damage caused by frost action and by shrinking and swelling.

These soils are moderately well suited to paths and trails and poorly suited to camp areas. The hazard of erosion and the slope are limitations on sites for paths and trails. Water bars, steps, and switchbacks reduce the angle of incline and the hazard of erosion. Establishing paths and trails on the contour also helps to overcome the limitations. The slope is a severe limitation on sites for camp areas. Grading the soils so that they have a more desirable slope helps to overcome this limitation. Also, the shaly surface layer of the Berks soil is a limitation on sites for camp areas.

The land capability classification is IVe. The woodland ordination symbol is 4R on north aspects of the Berks soil and 3R on south aspects. It is 4R in areas of the Guernsey soil. The pasture and hayland suitability group is F-1 in areas of the Berks soil and A-2 in areas of the Guernsey soil.

BmE—Berks-Guernsey complex, 25 to 40 percent slopes. These steep soils are on hillsides in the uplands. The moderately deep, well drained Berks soil is commonly on the middle and upper parts of linear or convex side slopes. The deep, moderately well drained Guernsey soil is commonly in linear or concave areas on side slopes. These soils are also in alternating bands on hillsides where the bands are associated with different bedrock strata. Seeps and slips are common in areas of the Guernsey soil. Most areas of this unit are long and are 100 to 500 feet wide. They range from 10 to 100 acres in size. They generally are above the less sloping areas. The larger areas are irregularly shaped. The Berks soil makes up about 50 to 65 percent of the unit, and the Guernsey soil makes up about 20 to 35 percent. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Berks soil has a surface layer of brown, very friable shaly silt loam about 6 inches thick. The subsoil is yellowish brown, friable very shaly silt loam about 19 inches thick. Bedded shale bedrock is at a depth of about 25 inches.

Typically, the Guernsey soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is light yellowish brown, friable silt loam in the upper part and yellowish brown, mottled, firm silty clay loam and silty clay in the lower part. The substratum is yellowish brown, friable shaly silty clay loam. Bedded shale bedrock is at a depth of about 50 inches. In places the soil is well drained.

Included with these soils in mapping are small areas of Coshocton, Gilpin, and Westmoreland soils. These areas are generally less than 2 acres in size. Coshocton, Gilpin, and Westmoreland soils are less shaly than the Berks soil and less clayey than the Guernsey soil. They are intermingled with areas of the Berks and Guernsey soils. Also included are small areas of shallow soils near the top of slopes and small, seepy areas of somewhat poorly drained soils. Included soils make up 5 to 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil and slow or moderately slow in the Guernsey soil. Available water capacity is very low in the Berks soil and moderate in the Guernsey soil. Runoff is rapid on the Berks soil and very rapid on the Guernsey soil. The organic matter content is moderately low in the surface layer of both soils. Tilth is good in the Berks soil and fair in the Guernsey soil. The rooting depth is moderately deep in the Berks soil and deep in the Guernsey soil. The Guernsey soil has a perched seasonal high water table between depths of 2.0 and 3.5 feet during extended wet periods. The shrink-swell potential is high in the Guernsey soil and low in the Berks soil. The potential for frost action is high in the Guernsey soil and low in the Berks soil.

Some areas are used as pasture or hayland. Most are wooded.

These soils are generally unsuited to corn and small grain because of the slope and the hazard of erosion.

These soils are poorly suited to pasture and hay. The hazard of erosion and the slope are the major management concerns. Droughtiness is an additional limitation on the Berks soil. If the soils are plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Restricting grazing during wet periods minimizes compaction of the Guernsey soil.

These soils are moderately well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Haul roads and log landings should not be located on active slips of the Guernsey soil. Cutting and filling to a more desirable slope improve sites for log landings. Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Guernsey soil. Mulching around seedlings reduces the seedling mortality rate on the Berks soil. Planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate on south and west aspects of the Guernsey soil. Special equipment is needed for site preparation and planting. Plant competition on the Guernsey soil can be controlled by removing vines and the less desirable trees and shrubs.

These soils are generally unsuited to building site development because of the slope. In areas of the Guernsey soil, the wetness, the high shrink-swell potential, and the hazard of slippage are additional limitations on sites for buildings, especially on those for buildings with basements. Cutting and filling to reduce the slope increase the hazard of hillside slippage.

These soils are generally unsuited to septic tank absorption fields, mainly because of the slope. The moderate depth to bedrock in the Berks soil and the wetness and the slow or moderately slow permeability in the Guernsey soil are additional limitations. Low strength, the slope, and frost action can result in damage to local roads and streets. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material and installing a drainage system help to prevent the damage caused by low strength and frost action in areas of the Guernsey soil.

These soils are generally unsuited to camp areas because of the slope. They are poorly suited to paths and trails because of the slope and the hazard of erosion. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion. Water bars, switchbacks, and steps also reduce the hazard of erosion.

The land capability classification is VIe. The woodland ordination symbol is 4R on north aspects of the Berks soil and 3R on south aspects. It is 4R in areas of the Guernsey soil. The pasture and hayland suitability group is F-2 in areas of the Berks soil and A-3 in areas of the Guernsey soil.

BnD—Bethesda silt loam, 8 to 25 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is on spoil ridges, benches, 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 areas of other 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 flat and less than 10 inches long. Slips are in some areas. Most areas are about 400 to 800 feet wide and 1,000 to 1,500 feet long. They range from 10 to 40 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown and light brownish gray, firm very shaly clay. In some areas the surface layer is loam or channery loam. In other areas the substratum is medium acid to mildly alkaline.

Included with this soil in mapping are areas of soils that are adjacent to the Bethesda soil. These soils are in the lower landscape positions. They were never excavated but have been affected by the mining operations and have been covered during reclamation. Included soils make up about 5 to 10 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Available water capacity is low. Runoff is rapid or very rapid. The organic matter content is very low in the surface layer, and tilth is fair. Depth of the root zone varies within short distances because of changes in the density of the material. The potential for frost action is moderate.

Most areas support grasses and legumes. Many of these areas, however, are neither grazed nor harvested for hay.

This soil is generally unsuited to corn and small grain and poorly suited to hay and pasture. It is droughty and low in fertility. Controlling erosion, conserving moisture, and maintaining tilth are the major management concerns. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods minimizes compaction and helps to keep the pasture in good condition. Soil tests are needed to determine specific nutrient needs.

This soil is moderately well suited to trees, but growth is generally slow because of the very low organic matter content and the low available water capacity. Haul roads and log landings should not be located on active slips. Grasses and legumes provide ground cover and help to control erosion during the establishment of trees. Establishing haul roads on the contour facilitates the use of equipment. Acid-tolerant species, such as black locust, grow best once they are established. Establishing logging roads and skid trails on the contour reduces the hazard of erosion. Water bars and vegetative cover also reduce this hazard. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

Once it has settled after reclamation, this soil is poorly suited to building site development, camp areas, and paths and trails. The slope, the susceptibility to hillside slippage, the moderately slow permeability, and the hazard of erosion are limitations. The soil is generally unsuited to septic tank absorption fields, even after it has settled, because of the moderately slow permeability, the slope, and the susceptibility to slippage. The strongly sloping areas are better suited to these uses than the steeper areas. Onsite investigation is needed to determine suitability. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system where water collects reduces this hazard. Constructing roads and streets on the contour and seeding road cuts help to control erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by frost action. Establishing trails on the contour and building steps reduce the hazard of erosion. Grading the soil so that it has a more desirable slope improves camp sites. Installing a large absorption field for the disposal of wastewater compensates for the moderately slow permeability in the soil.

The land capability classification is IVs. This soil is not assigned a woodland ordination symbol. The pasture and hayland suitability group is B-1.

BpC—Bethesda very channery clay loam, 3 to 15 percent slopes. This deep, gently sloping and strongly sloping, well drained soil is on spoil ridges, benches, and side slopes in areas that have been surface mined for coal and then regraded. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are mostly flat and less than 10 inches long. In most places stones 10 to 24 inches in diameter are 75 to 200 feet apart on the surface. Most areas are long and 200 to 800 feet wide. Areas range from 5 to 70 acres in size.

Typically, the surface layer is yellowish brown, friable very channery clay loam about 5 inches thick. The substratum to a depth of about 60 inches is brown, yellowish brown, and light brownish gray, friable very channery silty clay loam. In some areas the surface layer is shaly clay loam. In other areas the substratum is medium acid or slightly acid. In places the soil is a mixture of fireclay and coal that is so acid it is toxic to most plants.

Included with this soil in mapping are small intermittent and perennial ponds; long, narrow highwalls of exposed bedrock as high as about 40 feet; and areas of very steep soils on the side slopes of spoil banks. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Bethesda soil. Available water capacity is low. Runoff is medium or rapid. The organic matter content is very low in the surface layer, and tilth is poor. Depth of the root zone varies within short distances because of changes in the density of the material. The potential for frost action is moderate.

Most areas support broom sedge and other acid-tolerant grasses and brush. A few areas are grazed or harvested for hay.

This soil is generally unsuited to row crops. It is a poor medium for root development and is droughty and low in fertility. Controlling erosion, conserving moisture, and improving tilth are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. Stones and smaller rock fragments in the surface layer hinder tillage. Maintaining a permanent plant cover is the best means of controlling erosion.

This soil is poorly suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Restricting grazing during wet periods minimizes compaction and helps to keep the pasture in good condition. Soil tests are needed to determine specific nutrient needs. Ground cover and mulch help to control runoff and erosion and increase the rate of water infiltration.

This soil is poorly suited to trees. Growth is generally slow because of the very low organic matter content and the low available water capacity. Acid-tolerant species, such as black locust, grow best once they are established. Establishing haul roads and skid trails on the contour reduces the hazard of erosion. Water bars and vegetative cover also reduce this hazard. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves traction. Cutting and filling to a more desirable slope improve sites for log landings.

Once it has settled after reclamation, this soil is moderately well suited to building site development, septic tank absorption fields, and camp areas. It is well suited to paths and trails. The gently sloping areas are better suited to these uses than the more sloping areas. Onsite investigation is needed to determine suitability. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction.

The moderately slow permeability restricts the use of this soil for septic tank absorption fields. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent. In strongly sloping areas installing the leach lines of the absorption field on the contour reduces lateral seepage of effluent to the surface. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by frost action. The stoniness, the slope, and the moderately slow permeability are limitations affecting camp areas. Covering the surface with better suited material and grading the soil so that it has a more desirable slope help to overcome these problems. Installing a large absorption field for the disposal of wastewater compensates for the moderately slow permeability in the soil.

The land capability classification is VIs. This soil is not assigned a woodland ordination symbol. The pasture and hayland suitability group is B-1.

BpF—Bethesda very channery clay loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is on mine spoil side slopes in areas that management practices. Restricting grazing during wet periods minimizes compaction.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate on south- and west-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Haul roads and log landings should not be located on active slips. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is poorly suited to building site development because of the slope, the high shrink-swell potential, and the hazard of slippage. It is generally unsuited to septic tank absorption fields because of the slope, the moderately slow permeability, and the wetness. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Active slips should be avoided. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in areas where water collects reduces this hazard. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by low strength and by shrinking and swelling.

This soil is generally unsuited to camp areas because of the slope. It is poorly suited to paths and trails because of the hazard of erosion. Steps and switchbacks reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard.

The land capability classification is IVe. The woodland ordination symbol is 5R on north aspects and 4R on south aspects. The pasture and hayland suitability group is A-2.

BsE—Brookside silty clay loam, 25 to 40 percent slopes. This deep, steep, moderately well drained soil is on foot slopes and benches in the uplands. Most areas are 200 to 800 feet wide and range from 15 to 100 acres in size. Slips are in some areas.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is brown, firm silty clay, and the lower part is yellowish brown and brown, mottled, firm silty clay and silty clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay loam. In places bedrock is at a depth of less than 60 inches.

Included with this soil in mapping are small areas of Clarksburg and Richland soils. These soils are in landscape positions similar to those of the Brookside soil. They contain less clay in the subsoil than the Brookside soil. Clarksburg soils have a fragipan. Included soils make up about 10 to 15 percent of most areas.

Permeability is moderately slow in the Brookside soil. Available water capacity is moderate. Runoff is very rapid. The organic matter content is moderately low in the surface layer, and tilth is fair. The soil tends to dry out slowly and to crack at the surface. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil. A perched seasonal high water table is at a depth of 2.5 to 4.0 feet during extended wet periods. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate.

Most areas are wooded. Some are used as pasture or hayland.

This soil is poorly suited to pasture and hay. The hazard of erosion is the major management concern. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. The slope limits the use of equipment. Restricting grazing during wet periods minimizes compaction.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Planting seedlings that have been transplanted once reduces the seedling mortality rate on south- and west-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Haul roads and log landings should not be located on active slips. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is generally unsuited to camp areas, building site development, and septic tank absorption fields because of the slope, the moderately slow permeability, the wetness, the high shrink-swell potential, and the hazard of slippage. It is poorly suited to paths and trails because of the slope and the hazard of erosion. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in seepy areas minimizes this hazard. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Water bars, steps, or switchbacks also reduce the hazard of erosion. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion.

The land capability classification is VIe. The woodland ordination symbol is 5R on north aspects and 4R on south aspects. The pasture and hayland suitability group is A-3.

CkD—Clarksburg silt loam, 15 to 25 percent slopes. This deep, moderately steep, moderately well drained soil is on foot slopes and benches in the uplands. Most areas are long and narrow and are 200 to 600 feet wide. They range from 6 to 30 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown, friable and firm silt loam and channery silt loam; the next part is strong brown, mottled, firm channery silt loam; and the lower part is a fragipan of strong brown, mottled, very firm and brittle channery loam. The substratum to a depth of about 60 inches is yellowish brown, friable channery loam. In places the solum has a lower content of sand and coarse fragments.

Included with this soil in mapping are small areas of the fine textured Brookside and well drained Richland soils. These included soils are in landscape positions similar to those of the Clarksburg soil. They do not have a fragipan. They make up about 10 to 15 percent of most areas.

Permeability is moderate above the fragipan in the Clarksburg soil and slow or moderately slow in the fragipan and below. Available water capacity is moderate above the fragipan. Runoff is rapid. The organic matter content is moderate in the surface layer, and tilth is good. The root zone generally is restricted by the fragipan. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet in winter, in spring, and during other extended wet periods. The shrink-swell potential is moderate in the subsoil and substratum. The potential for frost action is moderate.

A few areas are used as cropland. Some are used as pasture. Most are wooded.

This soil is poorly suited to corn and small grain. If the soil is cultivated, the hazard of erosion is very severe. The hazard of erosion is a major management concern. Maintaining a permanent plant cover is the best means of controlling erosion. A conservation tillage system that leaves crop residue on the surface, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. The slope hinders the use of some farm machinery. Installing random subsurface drains in seepy areas helps to overcome the wetness. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas.

This soil is moderately well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads improves soil strength. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is poorly suited to building site development and generally unsuited to septic tank absorption fields because of the wetness, the slow or moderately slow permeability, and the slope. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Cutting and filling increase the hazard of hillside slippage in the included areas of the Brookside soils. Installing a drainage system in seepy areas reduces the hazard. Waterproofing walls and installing drains at the base of footings help to keep basements dry. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Constructing roads and streets on the contour and seeding road cuts also reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by low strength.

This soil is poorly suited to camp areas and to paths and trails. The slope is the main limitation in the camp areas. Grading the soil so that it has a more desirable slope helps to overcome this limitation. Steps and

Cutting and filling to a more desirable slope improve sites for log landings. Mulching around seedlings reduces the seedling mortality rate. Special equipment is needed for site preparation and planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes.

This soil is generally unsuitable as a site for buildings, septic tank absorption fields, and camping because of the slope, the depth to bedrock, and the rapid permeability. A suitable alternative site is needed. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion.

This soil is poorly suited to paths and trails because of the slope. Establishing paths and trails on the contour reduces the angle of incline.

The land capability classification is VIe. The woodland ordination symbol is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is F-2.

DkF—Dekalb channery loam, 40 to 70 percent slopes. This moderately deep, very steep, well drained soil is on hillsides in the uplands. In some areas it is dissected by deep drainageways. Most areas are long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, very friable channery loam about 5 inches thick. The subsoil is about 16 inches thick. It is strong brown and yellowish brown, very friable very channery sandy loam. Hard, fractured sandstone bedrock is at a depth of about 21 inches.

Included with this soil in mapping are small areas of the deep Westmoreland soils. These soils have a higher content of clay and a lower content of sandstone fragments in the subsoil than the Dekalb soil. They make up about 15 percent of most areas.

Permeability is rapid in the Dekalb soil. Available water capacity is very low. Runoff is very rapid. The root zone is moderately deep. The potential for frost action is low.

Most areas are wooded. This soil is generally unsuited to corn, small grain, hay, and pasture because of the slope, the hazard of erosion, and the very low available water capacity.

This soil is moderately well suited to woodland. Constructing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Mulching around seedlings reduces the seedling mortality rate. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes.

This soil generally is unsuited to building site development, camp areas, and septic tank absorption fields because of the slope, the depth to bedrock, and the rapid permeability. Erosion can be controlled by constructing local roads on the contour and by seeding road cuts.

This soil is poorly suited to paths and trails because of the slope. Establishing paths and trails on the contour reduces the angle of incline.

The land capability classification is VIIe. The woodland ordination symbol is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is H-1.

Ds—Dumps, mine. This map unit consists mostly of steep and very steep ridges on cone-shaped piles of waste material from deeply excavated coal mining areas. 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. It is locally referred to as mine gob, gob, or gob piles. Some areas have been 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 the top of the slopes have been graded so that they are nearly level to strongly sloping.

This material was acid when it was mined. The oxidized material is medium acid to neutral. Both burned material and unburned material have poor physical properties for plant growth, and most areas are barren. The content of organic carbon in mine gob is high, but the content of organic matter that is characteristic of natural soils is very low. The content of organic carbon is very low in oxidized material, and no organic matter has accumulated. Available water capacity is low or very low. Water percolating through the extremely acid material is a source of local stream pollution in many areas.

Abandoned areas of this unit should be reclaimed to prevent excessive erosion, sedimentation, and acid drainage. This reclamation generally involves covering the gob with soil material from a nearby area. The soil material used to cover these areas should be seeded with grasses or planted with trees that can withstand the fairly low available water capacity and the acid conditions.

Some areas could be developed as openland habitat.

The red dog is a source of surface material for many township roads and private driveways.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

EbC2—Elba silty clay loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on the upper part of side slopes and on narrow ridgetops in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are long and narrow. They are 150 to 500 feet wide and range from 4 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is yellowish brown and brown, firm silty clay about 38 inches thick. Limestone bedrock is at a depth of about 42 inches. In places the subsoil and substratum are reddish brown. In some areas, the substratum is slightly acid or neutral and the soil is deeper to carbonates. In other areas the surface layer is silty clay. In a few areas, the soil is moderately well drained and the subsoil has gray mottles.

Included with this soil in mapping are small areas of the moderately deep Berks and deep Westmoreland soils. These areas are generally less than 2 acres in size. Berks soils have more fragments in the subsoil than the Elba soil. Westmoreland soils have less clay than the Elba soil. Berks and Westmoreland soils are intermingled with areas of the Elba soil. They make up about 5 to 10 percent of most areas.

Permeability is slow in the Elba soil. Available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low, and tilth is fair. The soil tends to dry out slowly and to crack at the surface. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is moderately well suited to corn and small grain. Controlling erosion and maintaining tilth are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. Tilling the soil when it is wet results in soil compaction and the formation of clods.

This soil is well suited to pasture and hay. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Mowing for weed control and applying lime and fertilizer are good management practices. No-till seeding helps to control erosion. Restricting grazing during wet periods minimizes compaction.

This soil is well suited to woodland. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow.

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. The high shrink-swell potential, the slope, and the hazard of erosion are limitations on sites for buildings. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. The slope and slow permeability limit this soil for septic tank absorption fields. Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by low strength and by shrinking and swelling.

This soil is poorly suited to camp areas and to paths and trails. The slope and the slow permeability are limitations on sites for camp areas. Grading the soil so that it has a more desirable slope and providing large absorption areas for the disposal of wastewater help to overcome these problems. Establishing trails on the contour and building steps reduce the hazard of erosion.

The land capability classification is IIIe. The woodland ordination symbol is 3C. The pasture and hayland suitability group is A-1.

EbD2—Elba silty clay loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are long and narrow and are 150 to 350 feet wide. They range from 4 to 40 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 7 inches thick. The subsoil is yellowish brown and brown, firm silty clay about 21 inches thick. The substratum is olive brown, brown, and light olive brown, friable silty clay. Bedded shale bedrock is at a depth of about 72 inches. In some areas, the substratum is slightly acid or neutral and the soil is deeper to carbonates. In other areas the surface layer is silty clay. In a few areas, the soil is moderately well drained and the subsoil has gray mottles.

Included with this soil in mapping are small areas of the moderately deep Berks and deep Westmoreland soils. Westmoreland soils have less clay in the subsoil than the Elba soil. Included soils make up about 5 to 10 percent of most areas.

Permeability is slow in the Elba soil. Available water capacity is moderate. Runoff is very rapid. The organic matter content is moderately low, and tilth is fair. The soil tends to dry out slowly and to crack at the surface. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate.

Some areas are used as cropland. Some are used as pasture. A few are wooded.

This soil is poorly suited to corn and small grain. A commonly used crop rotation includes a cultivated crop about once every 4 years. The slope, the hazard of erosion, and the maintenance of tilth are the major management concerns. Maintaining a permanent plant cover is the best means of controlling erosion. If the soil is cultivated, the hazard of erosion is very severe. A conservation tillage system that leaves crop residue on the surface, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. The slope hinders the use of some farm machinery. Tilling the soil when it is wet results in soil compaction and the formation of clods.

This soil is moderately well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Rotation grazing helps to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods minimizes compaction.

This soil is well suited to woodland. Constructing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes.

This soil is poorly suited to building site development because of the slope, the high shrink-swell potential, and the hazard of erosion. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in areas where water collects reduces this hazard. The soil is generally unsuited to septic tank absorption fields because of the slope and the slow permeability. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by low strength and by shrinking and swelling.

This soil is poorly suited to camp areas and to paths and trails. Steps and switchbacks reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard. Grading the soil so that it has a more desirable slope improves camp sites.

The land capability classification is IVe. The woodland ordination symbol is 3R. The pasture and hayland suitability group is A-2.

FaC—Fairpoint silt loam, 3 to 15 percent slopes. This deep, gently sloping and strongly sloping, well drained soil is on spoil ridges, benches, 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 areas of other 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 shale and siltstone and smaller amounts of sandstone and coal. Slopes are smooth. Most areas are long and are 200 to 600 feet wide. They range from about 4 to 50 acres in size.

Typically, the surface layer is yellowish brown, friable silt loam about 5 inches thick. The substratum to a depth of about 60 inches is yellowish brown, dark grayish brown, and light brownish gray, firm very shaly silty clay loam and shaly silty clay loam. In some areas the surface layer is silty clay loam or shaly silt loam. In other areas the substratum is extremely acid, very strongly acid, strongly acid, mildly alkaline, or moderately alkaline.

Included with this soil in mapping are small depressions and pockets where water collects after periods of heavy rainfall. Also included are areas of soils that are adjacent to the Fairpoint soil. These soils are in the lower landscape positions. They were never excavated but have been affected by the mining operations and have been covered during reclamation. Inclusions make up 5 to 15 percent of most areas.

Permeability is moderately slow in the Fairpoint soil. Available water capacity is low. Runoff is medium or rapid. The organic matter content is very low in the surface layer, and tilth is fair. The depth of the root zone varies. The shrink-swell potential is moderate in the substratum. The potential for frost action also is moderate.

Most areas support grasses and legumes, but many of these areas are neither grazed nor harvested for hay.

This soil is poorly suited to corn and small grain. It is droughty and low in fertility. Controlling erosion, conserving moisture, and maintaining tilth are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. Rock-lined waterways reduce gully erosion (fig. 3). Shallow surface drains and grassed waterways remove excess water from small depressions and pockets where water collects. Tilling the soil when it is wet results in soil compaction and the formation of clods.

This soil is moderately well suited to pasture and hay. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Mowing for weed control and applying lime and fertilizer are good management practices. No-till seeding helps to control erosion. Restricting grazing during wet periods minimizes soil compaction and helps to keep the pasture in good condition.

This soil is moderately well suited to trees, but growth is generally slow because of the very low organic matter content and the low available water capacity. Mulching around seedlings reduces the seedling mortality rate. Grasses and legumes provide ground cover and help to control erosion during the establishment of trees. Water bars, vegetative cover, and other water-control practices reduce the hazard of erosion. Establishing logging roads and skid trails on or near the contour also reduces this hazard. Cutting and filling to a more desirable slope improve sites for log landings.

Once this soil has settled after reclamation, it is moderately well suited to building site development, paths and trails, and camp areas and is poorly suited to septic tank absorption fields. The gently sloping areas are better suited to these uses than the more sloping areas. Onsite investigation is needed to determine the suitability. Minimizing excavation and reseeding cuts reduce the hazard of erosion during construction. The moderately slow permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption areas or installing a double absorption field system improves the capacity of the field to absorb effluent. In strongly sloping areas installing the leach lines of absorption fields on the contour reduces lateral seepage of effluent to the surface. Stones in the substratum make it difficult to dig leach lines. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by shrinking and swelling and by frost action. Grading the soil so that it has a more desirable slope improves camp sites. Installing a large absorption field for the disposal of wastewater in camping areas compensates for the moderately slow permeability in the soil. Establishing trails on the contour and building steps reduce the hazard of erosion.

The land capability classification is IVs. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-1.

FbC—Fairpoint very shaly clay loam, 3 to 15 percent slopes. This deep, gently sloping and strongly sloping, well drained soil is on mine spoil ridges, benches, and side slopes in areas that have been surface mined for coal and then regraded. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are flat and less than 10 inches long. In most places a few large stones are on the surface. These stones are 75 to 200 feet apart. Areas generally are long and 200 to 800 feet wide. They range from 10 to 50 acres in size.

Typically, the surface layer is dark yellowish brown, friable very shaly clay loam about 4 inches thick. The

Figure 3.—A rock-lined waterway in an area of Fairpoint silt loam, 3 to 15 percent slopes.

substratum to a depth of about 60 inches is dark yellowish brown and grayish brown, friable very shaly clay loam. In some places the substratum is extremely acid to strongly acid. In other places it is mildly alkaline or moderately alkaline. In some areas the surface layer is channery clay loam or shaly clay loam. In a few areas the slope is 25 to 40 percent.

Included with this soil in mapping are small intermittent and perennial ponds; long, narrow highwalls of exposed bedrock as high as about 40 feet; and areas of very steep soils on the side slopes of spoil banks. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Fairpoint soil. Available water capacity is low. Runoff is medium or rapid. The organic matter content is very low in the surface layer, and tilth is poor. The depth of the root zone varies. The shrink-swell potential is moderate. The potential for frost action also is moderate.

Most areas support grasses and legumes. A few areas are grazed or harvested for hay.

This soil is generally unsuited to row crops. It is a poor medium for root development, and it is droughty and low in fertility. Controlling erosion, conserving moisture, and improving tilth are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. Stones and shale fragments in the surface layer hinder tillage.

This soil is poorly suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Restricting grazing during wet periods minimizes compaction and helps to keep the pasture in good condition.

This soil is moderately well suited to trees, but growth generally is slow because of the very low organic matter content and the low available water capacity. Grasses and legumes provide ground cover and help to control erosion during the establishment of trees. Water bars and vegetative cover reduce the hazard of erosion. Establishing logging roads and skid trails on or near the contour also reduces this hazard. Mulching around seedlings reduces the seedling mortality rate. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves traction. Cutting and filling to a more desirable slope improve sites for log landings.

This soil is moderately well suited to building site development once it has settled after reclamation. The gently sloping areas are better suited to this use than the more sloping areas. Onsite investigation is needed to determine suitability. Buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. Stones in the substratum make digging difficult.

The potential for frost action is a moderate limitation on sites for local roads and streets. Adding suitable base material helps to prevent the damage caused by frost action. Erosion can be controlled by constructing roads and streets on the contour and seeding road cuts.

This soil is poorly suited to septic tank absorption fields once it has settled. Enlarging the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent.

This soil is moderately well suited to paths and trails and poorly suited to camp areas. The stoniness is a limitation in camp areas. It can be overcome by covering the surface with better suited material. The hazard of erosion and the stoniness are limitations on sites for paths and trails. Establishing trails on the contour and adding better suited material to the surface help to overcome these limitations. Water bars and steps also help to overcome erosion.

The land capability classification is VIs. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-1.

FbF—Fairpoint very shaly clay loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is on spoil banks in areas surface mined for coal. It is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are mostly flat and less than 10 inches long. In most places a few large stones are on the surface. These stones are 75 to 200 feet apart. Most areas are long and narrow and have not been regraded and smoothed. Slips are in most areas. Areas are generally 200 to 500 feet wide and range from 10 to 50 acres in size. A few are as wide as 1,500 feet and as large as several hundred acres.

Typically, the surface layer is dark yellowish brown, very friable very shaly clay loam about 2 inches thick. The substratum to a depth of about 60 inches is variegated yellowish brown, brown, and strong brown, friable very shaly loam and very shaly clay loam. In some places the substratum is extremely acid to strongly acid. In other places it is mildly alkaline or moderately alkaline. In some areas the surface layer is channery clay loam or shaly clay loam. In a few areas the soil has a slope of 8 to 25 percent.

Permeability is moderately slow in the Fairpoint soil. Available water capacity is low. Runoff is very rapid. The organic matter content is very low in the surface layer, and tilth is poor. The depth of the root zone varies. The shrink-swell potential is moderate. The potential for frost action also is moderate.

Most areas are used as woodland. This soil is generally unsuited to corn, small grain, hay, and pasture because of the slope, droughtiness, and a very severe hazard of erosion.

This soil is poorly suited to trees. Most areas support black locust and aspen trees and have a considerable amount of undergrowth. Growth is generally slow because of the very low organic matter content, the low available water capacity, and the variable depth of the root zone. Mulching around seedlings reduces the seedling mortality rate. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Cutting and filling to a more desirable slope improves sites for log landings. Special equipment is needed for site preparation and planting. Haul roads and log landings should not be located on active slips.

This soil is generally unsuited to buildings and septic tank absorption fields because of the slope, the moderately slow permeability, the instability of the soil, and the susceptibility to hillside slippage. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in areas where water collects reduces this hazard.

This soil is generally unsuited to camp areas because of the slope and the stoniness. It is poorly suited to paths and trails because of the slope and the hazard of erosion. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion. Water bars, steps, and switchbacks also help to control erosion.

The land capability classification is VIIe. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is H-1.

FcB—Fitchville Variant silt loam, 1 to 6 percent slopes. This deep, nearly level and gently sloping, somewhat poorly drained soil is on alluvial fans and low terraces along streams. Most areas are long strips 200 to 600 feet wide and range from 5 to 30 acres in size. A few are irregularly shaped.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, mottled, friable and firm silt loam and silty clay loam. The lower part is brown, strong brown, and yellowish brown, mottled, firm clay loam and very gravelly clay loam. The substratum to a depth of about 80 inches is brown and yellowish brown, mottled, friable and firm very gravelly loam and silty clay loam. In some areas the subsoil has less gravel and more clay. In other areas it is grayer.

Included with this soil in mapping are small areas of Orrville and Melvin soils on narrow flood plains and the well drained Richland soils on the more sloping part of alluvial fans. Orrville and Melvin soils do not have a distinct subsoil. Melvin soils are poorly drained. Included soils make up 5 to 10 percent of most areas.

Permeability is moderately slow in the Fitchville Variant soil. Available water capacity is moderate or high. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. A perched seasonal high water table is at a depth of 1.0 to 2.5 feet during extended wet periods. The shrink-swell potential is moderate in the subsoil. The potential for frost action is high.

Most areas are pastured. Some are used as cropland, and some are used as woodland.

If drained, this soil is well suited to pasture and to a crop rotation of corn, small grain, and hay. Controlling erosion and reducing the wetness are the major management concerns. Erosion is a hazard if the soil is cultivated or plowed during seedbed preparation or if the pasture is overgrazed. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Grassed waterways, diversions, and open ditches help to overcome the wetness by moving runoff from the adjacent uplands to natural drainageways. Subsurface drains also help to overcome the wetness in areas where suitable outlets are available. A crust forms after periods of heavy rainfall. Shallow cultivation of intertilled crops breaks up this crust. Restricted grazing during wet periods minimizes compaction in pastured areas. The forage species that can tolerate the wetness grow well.

This soil is well suited to woodland. Logging should be done when the soil is frozen or during the drier part of the year. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and camp areas because of the wetness. Surface and subsurface drainage systems help to remove excess water from building sites and camp areas. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. Installing a drainage system improves the suitability of the soil for camp areas.

Because of the wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Installing perimeter drains helps to overcome the wetness if drainage outlets are available. Enlarging the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent.

Low strength and frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material help to prevent this damage.

This soil is moderately well suited to paths and trails. Installing a drainage system helps to overcome the wetness.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is C-1.

GnB—Gilpin silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil dominantly is on ridgetops in the uplands. Most areas are long and narrow. They are approximately 250 feet wide and range from 5 to 35 acres in size. Some areas are as wide as 650 feet.

Typically, the surface layer is brown, very friable silt loam about 6 inches thick. The subsoil is about 25 inches of brown and yellowish brown, friable silt loam and channery silty clay loam. Sandstone bedrock is at a depth of about 31 inches. In places the subsoil has more sand and less clay. In some areas the surface layer is loam. In other areas the soil is deep over bedrock.

Included with this soil in mapping are small areas of the deep, moderately well drained Coshocton soils and areas of Berks soils. Coshocton soils are generally less than 2 acres in size and are on broad ridgetops. Berks soils have more shale fragments in the subsoil than the Gilpin soil. They are near slope breaks and in the narrow part of some ridgetops. Included soils make up from 10 to 15 percent of most areas.

Permeability is moderate in the Gilpin soil. Available water capacity is low. Runoff is medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone and depth to bedrock are moderately deep. The potential for frost action is moderate.

Most areas are used as cropland. The principal crops are corn, small grain, and hay. Some areas are pastured. Others are wooded.

This soil is well suited to corn, small grain, and hay grown in rotation and to pasture. Controlling erosion and conserving moisture are the major management concerns. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is moderate. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour tillage, and cover crops help to maintain tilth and control runoff and erosion. Some crop yields are reduced because of insufficient moisture during the growing season. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas.

This soil is well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is moderate. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. Mowing for weed control and applying lime and fertilizer are also good management practices. No-till seeding is the most effective way to help control erosion.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to building site development and moderately well suited to septic tank absorption fields. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion on construction sites. The depth to bedrock is a limitation on sites for buildings with basements, but the bedrock is generally rippable. The moderate depth to bedrock is the major limitation on sites for septic tank absorption fields. Adding suitable fill material improves the filtering capacity of the absorption fields.

This soil is well suited to camp areas and to paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is F-1.

GnC—Gilpin silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on ridgetops in the uplands. Most areas are long and about 300 feet wide. They generally are 6 to 40 acres in size. Some areas are as wide as 800 feet or as large as 90 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 19 inches of yellowish brown, friable silt loam and silty clay loam. Sandstone bedrock is at a depth of about 27 inches. In some areas the subsoil contains more sand and less clay. In other areas the surface layer is loam. In places the soil is deep over bedrock.

Included with this soil in mapping are small concave areas of the deep, moderately well drained Coshocton soils and areas of Berks soils near slope breaks. Berks soils have more shale fragments in the subsoil than the Gilpin soil. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate in the Gilpin soil. Available water capacity is low. Runoff is medium or rapid. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is moderately deep. The potential for frost action is moderate.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is moderately well suited to corn and small grain. It is droughty. Because of the limited available water capacity, the soil is better suited to crops that mature early in the growing season than to crops that mature late in summer. Controlling erosion and conserving moisture are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Some crop yields are reduced because of insufficient moisture during the growing season. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation of intertilled crops breaks up this crust. Crusting is not so much of a problem in no-till areas.

This soil is well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. Mowing for weed control and applying lime and fertilizer are also good management practices. No-till seeding is the most effective way to help control erosion.

This soil is well suited to woodland (fig. 4). Cutting and filling to a more desirable slope improve sites for log landings. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development. The slope is the main limitation. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Establishing local roads and streets on the contour and seeding road cuts also help to control erosion. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. The bedrock at a depth of 20 to 40 inches is a limitation on sites for buildings with basements, but it generally is rippable. The soil is poorly suited to septic tank absorption fields because of the moderate depth to bedrock. Installing the leach lines on the contour reduces lateral seepage of effluent to the surface. The filtering capacity can be improved by adding suitable fill material.

This soil is well suited to paths and trails. It is moderately well suited to camp areas. Grading the soil so that it has a more desirable slope improves camp areas.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is F-1.

GnD—Gilpin silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, well drained soil is on side slopes in the uplands. The side slopes are 150 to 400 feet long. Most areas are long and narrow and range from 5 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, friable silt loam about 18 inches thick. The substratum is yellowish brown, firm, very channery silt loam. Bedded shale bedrock is at a depth of about 32 inches. In places the subsoil has more sand and less clay. In some areas the surface layer is loam or channery loam. In other areas the soil is deep over bedrock.

Included with this soil in mapping are areas of Berks soils near slope breaks; small areas of the deep Lowell soils; and small, seepy areas of the deep, moderately well drained Coshocton soils. Berks soils have more shale fragments in the subsoil than the Gilpin soil.

Figure 4.—A wooded area of Gilpin silt loam, 8 to 15 percent slopes.

Lowell soils have more clay in the subsoil than the Gilpin soil. They are intermingled with areas of the Gilpin soil. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate in the Gilpin soil. Available water capacity is low. Runoff is rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone is moderately deep. The potential for frost action is moderate.

Most areas are used as pasture. Some are used as cropland. Some are wooded.

This soil is poorly suited to corn and small grain. A commonly used crop rotation includes a cultivated crop about once every 4 years. Droughtiness is a limitation. Because of the limited available water capacity, the soil is better suited to crops that mature early in the growing season than crops that mature late in summer. Controlling erosion and conserving moisture are the major management concerns. If the soil is cultivated, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. A conservation tillage system that leaves crop residue on the surface, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. The slope hinders the use of some farm machinery. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas.

This soil is moderately well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and septic tank absorption fields because of the limited depth to bedrock and the slope. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Constructing roads and streets on the contour and seeding road cuts also help to control erosion. Because the bedrock is within a depth of 20 inches in some areas, the soil is better suited to buildings without basements than to buildings with basements. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. The filtering capacity can be improved by adding suitable fill material.

This soil is poorly suited to camp areas because of the slope. Grading the soil so that it has a more desirable slope improves camp sites. The soil is moderately well suited to paths and trails because of the slope. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion.

The land capability classification is IVe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is F-1.

GoC—Gilpin-Coshocton silt loams, 8 to 15 percent slopes. These strongly sloping soils are on hillsides and narrow ridgetops in the uplands. The moderately deep, well drained Gilpin soil is generally in smooth, convex areas at the summit of ridges and on the upper part of hillsides. The deep, moderately well drained Coshocton soil is generally in smooth, concave areas near slope breaks on ridgetops and on the lower part of side slopes. These soils are also in alternating, parallel bands on hillsides where the bands are associated with different bedrock strata. The Gilpin soil makes up about 50 percent of the map unit, and the Coshocton soil makes up about 40 percent. Individual areas are generally 150 to 500 feet wide. They range from 10 to 100 acres in size. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, friable silt loam about 20 inches thick. The substratum is yellowish brown, firm channery silt loam. Bedded shale bedrock is at a depth of about 33 inches. In places the subsoil has more sand and less clay. In some areas the surface layer is loam. In other areas the soil is deep over bedrock.

Typically, the Coshocton soil has a surface layer of brown, friable silt loam about 9 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, mottled, friable and firm silty clay loam; and the lower part is yellowish brown, mottled, firm shaly clay loam preparation and planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Cutting and filling to a more desirable slope improve sites for log landings.

These soils are poorly suited to building site development and septic tank absorption fields. The slope, the depth of bedrock in the Gilpin soil, and the seasonal high water table and the slow or moderately slow permeability in the Coshocton soil are limitations. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Constructing roads on the contour also helps to control erosion. Grading the soils so that they have a more desirable slope improves areas for building sites and septic tank absorption fields. Cutting and filling increase the hazard of hillside slippage in the included areas of the Guernsey soils. Installing a drainage system in seepy areas reduces this hazard. Because the bedrock is within a depth of 20 inches in some areas of the Gilpin soil, the Gilpin soil is better suited to buildings without basements than to buildings with basements. The wetness and the moderate shrink-swell potential of the Coshocton soil are limitations on sites for buildings, especially on those for buildings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. The effectiveness of absorption fields in the Coshocton soil can be improved by installing curtain drains, increasing the size of absorption areas, or installing double absorption field systems. The effectiveness of absorption fields also can be improved by using suitable fill material, particularly in areas of the Gilpin soil. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by frost action and by shrinking and swelling in areas of the Coshocton soil.

These soils are poorly suited to camp areas because of the slope. Grading the soils so that they have a gentler slope improves camp areas. Installing a large absorption field for the disposal of wastewater compensates for the restricted permeability in the Coshocton soil. The soils are moderately well suited to paths and trails. The slope is the main limitation. Establishing paths and trails on the contour reduces the angle of incline. Water bars, steps, and switchbacks reduce the hazard of erosion.

The land capability classification is IVe. The woodland ordination symbol is 4R on the Gilpin soil. It is 4R on north aspects of the Coshocton soil and 3R on south aspects. The pasture and hayland suitability group is F-1 in areas of the Gilpin soil and A-2 in areas of the Coshocton soil.

GpC—Gilpin-Lowell silt loams, 8 to 15 percent slopes. These well drained, strongly sloping soils are on hillsides and narrow ridgetops in the uplands. The moderately deep Gilpin soil is generally in smooth areas on the edge of ridgetops and on the upper part of slopes. The deep Lowell soil is generally in smooth or convex areas at the summit of ridges and on the lower part of hillsides. These soils are also in alternating bands on hillsides where the bands are associated with different bedrock strata. The hillside areas generally are 150 to 600 feet wide and range from 10 to several hundred acres in size. The Gilpin soil makes up about 55 percent of the map unit, and the Lowell soil makes up about 35 percent. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, friable silt loam about 21 inches thick. Bedded shale bedrock is at a depth of about 28 inches. In some areas the soil is deep over bedrock.

Typically, the Lowell soil has a surface layer of brown, friable silt loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is strong brown and yellowish brown, firm silty clay. The subsoil is mottled below a depth of about 30 inches. The substratum is light olive brown, firm silty clay loam. Hard limestone bedrock is at a depth of about 48 inches. In some areas the surface layer is silty clay loam. In other areas the upper part of the subsoil has less clay and more silt. In places, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with these soils in mapping are areas of Berks soils on slope breaks, the crest of knolls, and narrow ridgetops. These included soils have more shale fragments in the subsoil than the Gilpin and Lowell soils. They make up about 10 percent of most areas.

Permeability is moderate in the Gilpin soil and moderately slow in the Lowell soil. Available water capacity is low in the Gilpin soil and moderate in the Lowell soil. Runoff is medium or rapid on the Gilpin soil and rapid on the Lowell soil. The organic matter content is moderate in the surface layer of both soils, and tilth is good. The root zone is deep in the Lowell soil, but root growth is restricted somewhat by the clayey subsoil. The root zone of the Gilpin soil is moderately deep. The shrink-swell potential is moderate in the Lowell soil and low in the Gilpin soil. The potential for frost action is moderate in both soils.

Most areas are used as cropland or pasture. Some are wooded.

These soils are moderately well suited to corn and small grain. The hazard of erosion is a major management concern on both soils. If these soils are cultivated, the hazard of erosion is severe. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. Conserving moisture is another major management concern in areas of the droughty Gilpin soil. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas. Tilling soils that are wet and have a surface layer of silty clay loam results in soil compaction and the formation of clods.

These soils are well suited to pasture and hay. If the pasture is overgrazed or the soils are plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods minimizes compaction, especially in areas where the surface layer is silty clay loam.

These soils are well suited to woodland. Plant competition can be controlled by removing the less desirable trees and shrubs. Cutting and filling to a more desirable slope improve sites for log landings. Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Lowell soil.

These soils are moderately well suited to building site development because of the slope and the depth to bedrock in both soils and the shrink-swell potential of the Lowell soil. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Because the bedrock is within a depth of 20 inches in some areas of the Gilpin soil and within a depth of 40 inches in some areas of the Lowell soil, these soils are better suited to buildings without basements than to buildings with basements. The harmful effects of shrinking and swelling in areas of the Lowell soil can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

These soils are poorly suited to septic tank absorption fields because of the slope, the depth to bedrock in the Gilpin soil, and the moderately slow permeability in the Lowell soil. Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent in areas of the Lowell soil. Mounding the site with suitable fill material improves filtration in areas of the moderately deep Gilpin soil. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage to local streets caused by frost action in both soils and by low strength in areas of the Lowell soil.

These soils are moderately well suited to camp areas. The slope and the moderately slow permeability in the Lowell soil are limitations. Installing a large absorption field for the disposal of wastewater in camping areas compensates for the moderately slow permeability in the Lowell soil. Camp areas can be regraded to a more desirable slope. The soils are well suited to paths and trails. Establishing paths and trails on the contour in areas of the Lowell soil reduce the hazard of erosion. Water bars, steps, and switchbacks also reduce this hazard.

The land capability classification is IIIe. The woodland ordination symbol is 4A in areas of the Gilpin soil and 5A in areas of the Lowell soil. The pasture and hayland suitability group is F-1 in areas of the Gilpin soil and A-1 in areas of the Lowell soil.

GpD—Gilpin-Lowell silt loams, 15 to 25 percent slopes. These well drained, moderately steep soils are on side slopes and foot slopes at the base of the steeper slopes in the uplands. The moderately deep Gilpin soil is generally on the middle and upper parts of smooth or convex side slopes and on convex shoulder slopes on hillsides. The deep Lowell soil is generally on the lower part of the side slopes. These soils are also in alternating bands on hillsides where the bands are associated with different bedrock strata. Areas are generally 150 to 500 feet wide and range from 10 to 100 acres in size. The Gilpin soil makes up about 55 percent of the map unit, and the Lowell soil makes up about 35 percent. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Gilpin soil has a surface layer of dark brown, friable silt loam about 6 inches thick. The subsoil is about 27 inches thick. It is yellowish brown, friable silt loam and channery silt loam. Hard, fine grained sandstone bedrock is at a depth of about 33 inches. In some areas the soil is deep over bedrock.

Typically, the Lowell soil has a surface layer of 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; the next part is yellowish brown, firm silty clay; and the lower part is yellowish brown, mottled, firm silty clay. The substratum to a depth of 61 inches is light olive brown and yellowish brown, mottled, firm shaly silty clay loam and shaly silty clay. In some areas the surface layer is silty clay loam. In other areas the upper part of the subsoil has less clay and more silt. In places, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with these soils in mapping are areas of the Berks soils near the upper part of slopes. These included soils have more shale fragments in the subsoil than the Gilpin and Lowell soils. They make up about 10 percent of most areas.

Permeability is moderate in the Gilpin soil and moderately slow in the Lowell soil. Available water capacity is low in the Gilpin soil and moderate in the Lowell soil. Runoff is rapid on the Gilpin soil and very rapid on the Lowell soil. The organic matter content is moderate in the surface layer of both soils, and tilth is good. The root zone of the Lowell soil is deep, but root growth is restricted somewhat by the clayey subsoil. The root zone of the Gilpin soil is moderately deep. The shrink-swell potential is moderate in the Lowell soil and low in the Gilpin soil. The potential for frost action is moderate in both soils.

Some areas are used as cropland. Most are in pasture or woodland.

These soils are poorly suited to corn and small grain. A commonly used crop rotation includes a cultivated crop about once every 4 years. The slope and the hazard of erosion are the major management concerns on both soils. If the soils are cultivated, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. A conservation tillage system that leaves crop residue on the surface, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion (fig. 5). Conserving moisture is another management concern on the droughty Gilpin soil. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas. Tilling soils that are wet and have a surface layer of silty clay loam results in soil compaction and the formation of clods.

These soils are moderately well suited to pasture and hay. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods minimizes compaction, especially in areas where the surface layer is silty clay loam.

These soils are well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Lowell soil. Cutting and filling to a more desirable slope improve sites for log landings. Log landings and haul roads should not be located on active slips in areas of the Lowell soil. Special equipment is needed for site preparation and planting. Mulching around seedlings reduces the seedling mortality rate on south and west aspects of the Gilpin soil. Planting techniques that spread the roots of seedlings and increase soil-root contact reduce the seedling mortality rate on south and west aspects of the Lowell soil. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are poorly suited to building site development, mainly because of the slope. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Constructing roads on the contour also helps to control erosion. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Cutting and filling increase the hazard of hillside slippage in areas of the Lowell soil. Installing a drainage system in areas where water collects reduces this hazard. Because the bedrock is within a depth of 20 inches in some areas of the Gilpin soil and within a depth of 40 inches in some areas of the Lowell soil, these soils are better suited to buildings without basements than to buildings with basements. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with

Figure 5.—Stripcropping in an area of Gilpin-Lowell silt loams, 15 to 25 percent slopes.

concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

The Gilpin soil is poorly suited to septic tank absorption fields, and the Lowell soil is generally unsuited to septic tank absorption fields. The slope, the depth to bedrock in the Gilpin soil, and the moderately slow permeability in the Lowell soil are limitations. Installing the leach lines of septic tank absorption fields on the contour reduces lateral seepage of effluent to the surface. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent in the Lowell soil. Mounding the site with suitable fill material improves filtration in areas of the moderately deep Gilpin soil. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage to local streets caused by frost action in areas of both soils and by low strength in areas of the Lowell soil.

These soils are poorly suited to camp areas and moderately well suited to paths and trails. The slope and the hazard of erosion are limitations. Establishing paths and trails on the contour reduces the hazard of erosion and the angle of incline. Water bars, steps, or switchbacks also reduce the hazard of erosion. Grading the soils so that they have a more desirable slope improves camp sites.

The land capability classification is IVe. The woodland ordination symbol is 4R in areas of the Gilpin soil and 5R in areas of the Lowell soil. The pasture and hayland suitability group is F-1 in areas of the Gilpin soil and A-2 in areas of the Lowell soil.

GsB—Glenford silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on slack water terraces along streams. It generally occurs in circular or elongated areas at the base of slope breaks in the uplands. Most areas range from 5 to 10 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of Pekin soils in landscape positions similar to those of the Glenford soil. These soils have a fragipan. They make up about 15 percent of most areas.

Permeability is moderately slow in the Glenford soil. Available water capacity is moderate or high. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The shrink-swell potential is moderate in the upper part of the subsoil. The potential for frost action is high.

Most areas are used for row crops or for hay and pasture. A few are wooded.

This soil is well suited to corn, soybeans, small grain, hay, and pasture. The hazard of erosion is the major management concern. Erosion is a hazard if the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. The surface layer crusts after periods of heavy rainfall, especially in tilled areas. Shallow cultivation between rows of intertilled crops breaks up this crust. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. The wetness and the shrink-swell potential are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material help to prevent this damage. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction.

This soil is moderately well suited to septic tank absorption fields. The wetness and the moderately slow permeability are limitations. Installing perimeter drains helps to overcome the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the moderately slow permeability.

This soil is well suited to paths and trails. It is moderately well suited to camp areas. The seasonal high water table and the moderately slow permeability are limitations in camp areas. Installing a drainage system and installing a large absorption field for the disposal of wastewater help to overcome these limitations.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-6.

GsC—Glenford silt loam, 7 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on slack water terraces along streams. Most areas are long and narrow and range from 5 to 10 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown, friable silt loam about 43 inches thick. It is mottled below a depth of about 12 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam.

Included with this soil in mapping are small areas of Pekin soils in landscape positions similar to those of the Glenford soils. These soils have a fragipan. They make up about 15 percent of most areas.

Permeability is moderately slow in the Glenford soil. Available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The shrink-swell potential is moderate in the upper part of the subsoil. The potential for frost action is high.

Most areas are used for row crops or for hay and pasture. A few are wooded.

This soil is moderately well suited to corn and small grain. The hazard of erosion is the major management concern. If the soil is cultivated, the hazard of erosion is severe. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. The surface layer crusts after periods of heavy rainfall, especially in tilled areas. Shallow cultivation of intertilled crops breaks up this crust.

This soil is well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing helps to control weeds. Timely applications of lime and fertilizer are needed.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. The wetness, the slope, and the shrink-swell potential are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Buildings should be designed so that they conform to the natural slope of the land. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material help to prevent this damage. Constructing local roads and streets on the contour and seeding road cuts help to control erosion.

This soil is moderately well suited to septic tank absorption fields. The wetness, the moderately slow permeability, and the slope are limitations. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Installing perimeter drains helps to overcome the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the moderately slow permeability.

This soil is moderately well suited to paths and trails. Establishing paths and trails on the contour reduces the hazard of erosion. Water bars and steps also reduce this hazard.

This soil is moderately well suited to camp areas. The slope, the seasonal high water table, and the moderately slow permeability are limitations. Installing a drainage system, grading the soil so that it has a more desirable slope, and installing a large absorption field for the disposal of wastewater help to overcome these limitations.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-6.

GuB—Guernsey silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on ridgetops and benches in the uplands. Most areas are long and narrow and range from 3 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 27 inches thick. It is mottled and firm. The upper part is yellowish brown silty clay loam; the next part is yellowish brown and strong brown silty clay and clay; and the lower part is light olive brown silty clay. The substratum is light olive brown, mottled, firm silty clay. Limestone bedrock is at a depth of about 59 inches. In places the subsoil is thicker and has a higher content of coarse fragments.

Included with this soil in mapping are small areas of Keene soils on the concave part of ridges and small, scattered areas of somewhat poorly drained soils in slight depressions. Keene soils have less clay and more silt in the subsoil than the Guernsey soil. Included soils make up about 15 percent of most areas.

Permeability is slow or moderately slow in the Guernsey soil. Available water capacity is moderate. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The shrink-swell potential is high in the lower part of the subsoil. The potential for frost action is high.

Most areas are used as cropland or pasture. Some are wooded.

This soil is well suited to corn, small grain, hay, and pasture. Controlling erosion and maintaining tilth are the major management concerns. Erosion is a hazard if the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed. The soil tends to dry out slowly and crack at the surface. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered areas of the wetter included soils. Tilling when the soil is wet results in surface compaction and cloddiness. The surface layer crusts after periods of heavy rainfall. Shallow cultivation of intertilled crops breaks up this crust. Restricted grazing during wet periods minimizes compaction and helps to keep the pasture in good condition.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. The wetness and the high shrink-swell potential are limitations on sites for dwellings, especially on those for dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

Because of the wetness and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Installing perimeter drains helps to overcome the wetness. Enlarging the absorption area helps to overcome the slow or moderately slow permeability. Shrinking and swelling, frost action, and low strength can cause damage to local roads and streets. Providing suitable base material and installing a drainage system help to prevent this damage.

This soil is moderately well suited to camp areas and to paths and trails. The seasonal high water table and the slow or moderately slow permeability are limitations affecting camp areas. Installing a drainage system and installing a large absorption field for the disposal of wastewater help to overcome these limitations. Installing a drainage system also helps to overcome the wetness on paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-6.

GvC2—Guernsey silty clay loam, 7 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on upland ridgetops, hillsides, and benches. Erosion has removed most of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material that has a higher content of clay than the original surface layer. Most areas are long and narrow or irregularly shaped and range from 3 to 100 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 4 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, friable silty clay loam. The lower part is yellowish brown and dark yellowish brown, mottled, firm silty clay loam and silty clay. The substratum is mottled, firm silty clay. Grayish brown, hard limestone bedrock is at a depth of about 55 inches. In some areas the surface layer is silt loam. In other areas, the substratum is calcareous and is closer to the surface and the soil is better drained.

Included with this soil in mapping are small, convex areas of the well drained Berks and Westmoreland soils on the higher part of ridges and Coshocton soils near slope breaks. The included soils contain less clay in the subsoil than the Guernsey soil. They make up about 15 percent of most areas.

Permeability is slow or moderately slow in the Guernsey soil. Available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer, and tilth is fair. The soil tends to dry out slowly and crack at the surface. The root zone is deep. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The shrink-swell potential is high in the lower part of the subsoil. The potential for frost action is high.

Most areas are used as pasture or cropland. Some are wooded.

This soil is moderately well suited to corn and small grain. The hazard of erosion is the major management concern. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. Tilling the soil when it is wet results in soil compaction and the formation of clods.

This soil is well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Restricted grazing during wet periods minimizes compaction.

This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. The wetness and the high shrink-swell potential are limitations on sites for buildings, especially on those for buildings with basements. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in the seepy areas reduces the hazard.

Because of the wetness and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Installing perimeter drains helps to overcome the wetness. Enlarging the absorption area helps to overcome the slow or moderately slow permeability.

Shrinking and swelling, frost action, and low strength can result in damage to local roads and streets. Adding suitable base material and installing drains help to prevent this damage. Constructing roads and streets on the contour and seeding road cuts help to control erosion.

This soil is moderately well suited to camp areas and to paths and trails. The slope, the seasonal high water table, and the slow or moderately slow permeability are limitations affecting camp areas. Grading the soil so that it has a more desirable slope and installing a drainage system and a large absorption area for the disposal of wastewater help to overcome these limitations. Establishing paths and trails on the contour reduces the hazard of erosion. Water bars, steps, and switchbacks also reduce this hazard.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-6.

HfE—Hazleton-Summitville complex, 15 to 40 percent slopes. These moderately steep and steep, deep soils are in the uplands. The well drained Hazleton soil is generally on the upper part of side slopes where the slope is 25 to 40 percent. The moderately well drained Summitville soil is on midslope benches and on the lower side slopes where the slope is 15 to 25 percent. The upper side slopes in this complex are generally 200 to 300 feet long, and slopes on the benches are generally 100 to 200 feet long. Most areas extend for several miles along the sides of major valleys and are several hundred acres in size. They are about 50 percent Hazleton soil and 30 percent Summitville soil. The two soils occur as areas so intricately mixed or so small in size that it was not practical to separate them in mapping.

Typically, the Hazleton soil has a surface layer of very dark grayish brown, very friable channery loam about 5 inches thick. The subsurface layer is dark yellowish brown, very friable channery loam about 3 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and brownish yellow, very friable sandy loam and channery sandy loam, and the lower part is yellowish brown, very friable very channery sandy loam. The substratum is yellowish brown, loose very channery loamy sand. Sandstone bedrock is at a depth of about 53 inches. In some areas the surface layer is loam. In a few areas the bedrock is at a depth of 20 to 40 inches. In places the subsoil has more silt.

Typically, the Summitville soil has a surface layer of dark brown, very friable silt loam about 2 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish red and reddish brown, friable and firm silt loam and silty clay loam; the next part is yellowish red and reddish brown, firm and very firm silty clay; and the lower part is mostly reddish brown, weak red, and strong brown, mottled, very firm silty clay. Soft clay shale bedrock is at a depth of about 49 inches. In some areas the surface layer is sandy loam. In a few areas, the soil is better drained and the lower part of the subsoil does not have gray mottles.

Included with these soils in mapping are areas of fine textured, moderately deep soils on shoulder slopes and areas of Rigley soils on the upper side slopes. Rigley soils have fewer sandstone fragments in the subsoil than the Hazleton soil and contain less clay than the Summitville soil. Individual areas of the included soils are less than 20 acres in size. Included soils make up about 20 percent of most areas.

Permeability is rapid or moderately rapid in the Hazleton soil and moderately slow in the Summitville soil. Available water capacity is low in the Hazleton soil and moderate in the Summitville soil. Runoff is very rapid on the Hazleton soil and rapid on the Summitville soil. The organic matter content is moderately low in the surface layer of both soils, and tilth is good. The root zone is deep. The Summitville soil has a perched seasonal high water table between depths of 3 and 6 feet in winter, in spring, and during other extended wet periods. The shrink-swell potential is moderate in the Summitville soil and low in the Hazleton soil. The potential for frost action is moderate in both soils.

Some areas are used as pasture. Most are wooded. Some areas that were once pastured are reverting to woodland (fig. 6).

These soils are poorly suited to pasture and hay. The slope and the hazard of erosion are the major management concerns, especially in the steep areas of the Hazleton soil. Maintaining a permanent plant cover is the best means of controlling erosion. If the soils are plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are difficult in the steep areas of the Hazleton soil.

These soils are well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion on the Summitville soil. Water bars and vegetative cover also help to control erosion on the Summitville soil. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Mulching around seedlings reduces the seedling mortality rate on the Hazleton soil. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Summitville soil. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are generally unsuited to building site development, septic tank absorption fields, and camp areas, mainly because of the slope. The wetness and the moderately slow permeability of the Summitville soil are additional limitations on sites for absorption fields. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Cutting and filling increase the hazard of hillside slippage in areas of the Summitville soil. Installing a drainage system in seepy areas reduces this hazard. Adding suitable base material to local roads and streets in areas of the Summitville soil helps to prevent the damage caused by frost action and by shrinking and swelling. These soils are poorly suited to paths and trails because of the slope and the hazard of erosion. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion. Water bars, steps, and switchbacks also reduce the hazard of erosion.

The land capability classification is VIe. The woodland ordination symbol is 4R on north aspects of the Hazleton soil and 3R on south aspects. It is 4R on the Summitville soil. The pasture and hayland suitability group is B-2 in areas of the Hazleton soil and A-3 in areas of the Summitville soil.

HgE—Hazleton-Westmoreland complex, 25 to 40 percent slopes. These deep, steep, well drained soils are on side slopes in the uplands. Generally, the Hazleton soil is on the upper part of side slopes and the Westmoreland soil is on the lower part. Slopes are generally 200 to 500 feet long. Most areas range from 40 to several hundred acres in size and are about 55 percent Hazleton soil and 30 percent Westmoreland soil. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Hazleton soil has a surface layer of very dark grayish brown, very friable channery loam about 4 inches thick. The subsoil is about 46 inches thick. The upper part is light yellowish brown and yellowish brown, friable channery loam and very channery sandy loam, and the lower part is yellowish brown, friable very channery sandy loam. The substratum is yellowish brown, loose extremely channery sandy loam. Sandstone bedrock is at a depth of about 58 inches. In some areas the surface layer is loam. In a few areas the bedrock is at a depth of 20 to 40 inches.

Typically, the Westmoreland soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsoil is brown, firm and friable channery silty clay loam about 34 inches thick. The substratum is yellowish brown, firm very channery silty clay loam. Bedded shale bedrock is at a depth of about 46 inches. In some areas, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with these soils in mapping are small areas of the moderately well drained Summitville soils, small areas of Lowell soils, and areas of Rigley soils. Summitville and Lowell soils are on the lower part of side slopes. Lowell soils have more clay in the subsoil than the Hazleton and Westmoreland soils. Rigley soils are on the upper part of side slopes. They have fewer

Figure 6.—A wooded area of Hazleton-Summitville complex, 15 to 40 percent slopes, which was once used as pasture.

sandstone fragments in the subsoil than the Hazleton soil and less clay than the Westmoreland soil. Included soils make up about 15 percent of most areas.

Permeability is rapid or moderately rapid in the Hazleton soil and moderate in the Westmoreland soil. Available water capacity is low in the Hazleton soil and moderate in the Westmoreland soil. Runoff is very rapid on both soils. The organic matter content is moderately low in the surface layer of the Hazleton soil and moderate in the surface layer of the Westmoreland soil. Tilth is good in both soils. The root zone is deep. The potential for frost action is moderate.

A few areas are used as pasture. Most areas are wooded.

These soils are generally unsuited to corn and small grain because of the slope and the hazard of erosion. They are poorly suited to pasture and hay. The slope and the hazard of erosion are the major management concerns. Droughtiness is also a limitation on the Hazleton soil. Maintaining a permanent plant cover is the best means of controlling erosion. If the soils are plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. The slope limits the use of equipment.

These soils are well suited to woodland. Plant competition is severe on the Westmoreland soil. It can be controlled by removing vines and the less desirable trees and shrubs. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Constructing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion on the Westmoreland soil. Water bars and vegetative cover also help to control erosion on the Westmoreland soil. Mulching around seedlings reduces the seedling mortality rate on south and west aspects of the Hazleton soil. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are generally unsuited to building site development, camp areas, and septic tank absorption fields and are poorly suited to paths and trails because of the slope and the hazard of erosion. A poor filtering capacity in the Hazleton soil is an additional limitation on sites for absorption fields. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Cutting and filling increase the hazard of hillside slippage in the included areas of the Lowell and Summitville soils. Establishing paths and trails on the contour reduces the angle of incline and the hazard of erosion. Water bars, steps, and switchbacks also reduce this hazard.

The land capability classification is VIe. The woodland ordination symbol is 4R on north aspects of the Hazleton soil and 3R on south aspects. It is 4R on the Westmoreland soil. The pasture and hayland suitability group is B-2 in areas of the Hazleton soil and A-3 in areas of the Westmoreland soil.

HgF—Hazleton-Westmoreland complex, 40 to 70 percent slopes. These deep, very steep, well drained soils are on side slopes in the uplands. Generally, the Hazleton soil is on the upper part of side slopes and the Westmoreland soil is on the lower part. Slopes are generally 200 to 500 feet long. Most areas are 1 to several miles long and are as much as several hundred acres in size. These larger areas are along the major drainageways leading into the larger valleys. Some small areas are 100 feet wide and range from only 10 to 20 acres in size. Most areas contain about 55 percent Hazleton soil and 30 percent Westmoreland soil. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Hazleton soil has a surface layer of very dark grayish brown, very friable channery loam about 3 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, very friable channery sandy loam, and the lower part is yellowish brown, very friable very channery sandy loam and extremely channery sandy loam. The substratum is yellowish brown, loose extremely channery loamy sand. Sandstone bedrock is at a depth of about 44 inches. In some areas the surface layer is loam. In a few areas the bedrock is at a depth of 20 to 40 inches.

Typically, the Westmoreland soil has a surface layer of very dark grayish brown, friable silt loam about 3 inches thick. The subsoil is 27 inches of yellowish brown, firm silt loam and channery silt loam. The substratum is yellowish brown, firm extremely shaly silt loam. Bedded shale bedrock is at a depth of about 42 inches. In some areas, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with these soils in mapping are small areas of the moderately well drained Summitville soils on benches, areas of Lowell soils on the lower part of side slopes, and areas of Rigley soils on the upper part of side slopes. Lowell soils have more clay in the subsoil than the Hazelton and Westmoreland soils. Rigley soils have fewer sandstone fragments in the subsoil than the Hazleton soil and less clay than the Westmoreland soil. Included soils make up about 15 percent of most areas.

Permeability is rapid or moderately rapid in the Hazleton soil and moderate in the Westmoreland soil. Available water capacity is low in the Hazleton soil and moderate in the Westmoreland soil. Runoff is very rapid on both soils. The organic matter content is moderately low in the surface layer of the Hazleton soil and moderate in the surface layer of the Westmoreland soil.

Tilth is good in both soils. The root zone is deep. The potential for frost action is moderate.

Most areas are wooded. These soils are generally unsuited to cropland and pasture because of the slope and the hazard of erosion.

These soils are well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Establishing logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Mulching around seedlings reduces the seedling mortality rate on south and west aspects on the Hazleton soil. Plant competition is severe on the Westmoreland soil. It can be controlled by removing vines and the less desirable trees and shrubs. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are generally unsuited to building site development, septic tank absorption fields, and camp areas and poorly suited to paths and trails because of the slope and the hazard of erosion. Constructing roads and streets on the contour and seeding road cuts help to control erosion. Cutting and filling increase the hazard of hillside slippage in the included areas of the Lowell and Summitville soils. Establishing paths and trails on the contour reduces the hazard of erosion and the angle of incline. Water bars, steps, and switchbacks also reduce the hazard of erosion.

The land capability classification is VIIe. The woodland ordination symbol is 4R on north aspects of the Hazleton soil and 3R on south aspects. It is 4R on the Westmoreland soil. The pasture and hayland suitability group is H-1.

KeB—Keene silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on ridges in the uplands. Most areas are long and narrow and range from 3 to 25 acres in size. Some of the larger areas are irregularly shaped.

Typically, the surface layer is brown, very friable silt loam about 8 inches thick. The subsoil is about 46 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is yellowish brown and strong brown, mottled, firm silty clay loam. The substratum is yellowish brown and dark yellowish brown, mottled silty clay loam and silty clay. Bedded shale bedrock is at a depth of about 84 inches. In some areas, the soil is better drained and the lower part of the subsoil does not have gray mottles.

Included with this soil in mapping are small, scattered areas of Guernsey and Coshocton soils. These soils are in landscape positions similar to those of the Keene soil. Guernsey soils have more clay in the subsoil than the Keene soil. Coshocton soils have more sand in the subsoil than the Keene soil. Also included are areas of the moderately deep Gilpin soils near slope breaks. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately slow in the surface layer and in the upper part of the subsoil of the Keene soil and moderately slow or slow in the lower part of the subsoil and in the substratum. Available water capacity is moderate or high. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. A perched seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. The shrink-swell potential is moderate. The potential for frost action is high.

Most areas are used as cropland. A few are used as pasture or woodland.

This soil is well suited to corn and small grain. The hazard of erosion and surface crusting are the major management concerns. Erosion is a hazard if the soil is cultivated or plowed during seedbed preparation. No-till planting or another system of conservation tillage that leaves crop residue on the surface, contour stripcropping, grassed waterways, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. The surface layer crusts after periods of heavy rainfall. Shallow cultivation of intertilled crops breaks up this crust. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas.

This soil is well suited to pasture and hay. If the soil is plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is moderate. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. The wetness is a limitation on sites for dwellings, especially on those for dwellings with basements. The moderate shrink-swell potential of the subsoil is also a limitation. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

Because of the wetness and the slow or moderately slow permeability, this soil is only moderately well suited to septic tank absorption fields. Installing perimeter drains helps to overcome the wetness. Increasing the size of the absorption area helps to overcome the slow or moderately slow permeability. Low strength and frost action can result in damage to local roads and streets. Adding suitable base material and installing drains help to prevent this damage.

This soil is moderately well suited to camp areas. The seasonal high water table and the moderate or moderately slow permeability are limitations. Installing a drainage system and installing a large absorption field for the disposal of wastewater help to overcome these limitations. The soil is well suited to paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-6.

LnB—Lowell silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, well drained soil is on ridgetops in the uplands. Most areas are long and narrow, are 200 to 400 feet wide, and range from 3 to 15 acres in size. Some larger areas, however, are irregularly shaped and are as large as 25 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 4 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown, firm silty clay loam. The lower part is yellowish brown, mottled, firm silty clay and silty clay loam. The substratum is yellowish brown, mottled, firm silty clay. Limestone bedrock is at a depth of about 70 inches. In some places the surface layer is silty clay loam. In other places the upper part of the subsoil has less clay and more silt.

Included with this soil in mapping are small, scattered areas of the moderately well drained Keene soils, areas of Upshur soils, and areas of the moderately deep Gilpin soils near slope breaks. Upshur soils are redder in the subsoil than the Lowell soil. Gilpin soils have less clay in the subsoil than the Lowell soil. Included soils make up 10 to 15 percent of most areas.

Permeability is moderately slow in the Lowell soil. Available water capacity is moderate. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil. The shrink-swell potential is moderate in the subsoil. The potential for frost action also is moderate.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is well suited to corn, small grain, hay, and pasture. The hazard of erosion is the major management concern. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, erosion is a hazard. No-till planting or another system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Crusting of the surface layer slows moisture penetration and the movement of air, especially in tilled areas. Shallow cultivation of intertilled crops breaks up this crust.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. The depth to bedrock and the moderate shrink-swell potential in the lower part of the subsoil are limitations on sites for buildings, especially on those for buildings with basements. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

Because of the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Enlarging the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent. Adding suitable base material to local roads and streets helps to prevent the damage caused by low strength.

This soil is moderately well suited to camp areas and to paths and trails. Installing a large absorption field for the disposal of wastewater in camping areas compensates for the moderately slow permeability in the soil.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-1.

LnC—Lowell silt loam, 7 to 15 percent slopes. This deep, strongly sloping, well drained soil is on the upper part of side slopes and on narrow ridgetops in the uplands. Most areas are long and narrow. They are 150 to 500 feet wide and range from 3 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown, light olive brown, and brownish yellow, firm silty clay about 39 inches thick. The substratum is light yellowish brown, mottled, firm silty clay. Limestone bedrock is at a depth of about 59 inches. In some areas the subsoil is thinner. In other areas the surface layer is silty clay loam or silty clay. In places the lower part of the subsoil has gray mottles.

Included with this soil in mapping are small areas of the moderately deep Berks and deep Westmoreland soils near slope breaks and areas of soils that have seeps and springs. Berks and Westmoreland soils have less clay in the subsoil than the Lowell soil. Inclusions make up about 10 to 15 percent of most areas.

Permeability is moderately slow in the Lowell soil. Available water capacity is moderate. Runoff is rapid. The organic matter content is moderate, and tilth is fair. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil. The shrink-swell potential in the subsoil is moderate. The potential for frost action also is moderate.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is moderately well suited to corn and small grain. Controlling erosion and maintaining tilth are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to maintain tilth and control runoff and erosion. Crusting of the surface layer slows moisture penetration and the movement of air, especially in tilled areas. Shallow cultivation of intertilled crops breaks up this crust.

This soil is well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are good management practices. Restricting grazing during wet periods helps to keep the pasture in good condition. The included seeps and springs can be developed as sources of water for livestock.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. The slope, the moderate shrink-swell potential, and the depth to bedrock are limitations on sites for buildings, especially on those for buildings with basements. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with a low shrink-swell material. Cutting and filling during construction increase the hazard of hillside slippage. Installing a drainage system in areas where water collects reduces this hazard.

The slope and the moderately slow permeability are limitations on sites for septic tank absorption fields. Installing the leach lines of absorption fields on the contour reduces lateral seepage of effluent to the surface. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by low strength.

This soil is moderately well suited to camp areas and to paths and trails. The moderately slow permeability and the slope are limitations in camp areas. Installing a large absorption field for the disposal of wastewater in camping areas compensates for the moderately slow permeability. Grading the soil so that it has a more desirable slope improves camp sites. Establishing paths and trails on the contour reduces the hazard of erosion. Water bars, steps, and switchbacks also reduce this hazard.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-1.

LoD2—Lowell silty clay loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, well drained soil is on side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Slips are in some areas. Most areas are long and narrow and are 150 to 400 feet wide. They range from 5 to 150 acres in size.

Typically, the surface layer is dark brown, friable silty clay loam about 6 inches thick. The subsoil is 38 inches of yellowish brown, friable and firm silty clay loam and silty clay. The substratum is light olive brown, firm silty clay. Limestone bedrock is at a depth of about 50 inches. In some areas the surface layer is silty clay. In other areas the lower part of the subsoil has gray mottles.

local roads and streets helps to prevent the damage caused by low strength.

This soil is generally unsuited to camp areas and poorly suited to paths and trails because of the slope and the hazard of erosion. Water bars, steps, and switchbacks reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard. Although the soil has severe limitations for most recreational uses, most areas of the soil have natural scenic beauty and value.

The land capability classification is VIIe. The woodland ordination symbol is 5R. The pasture and hayland suitability group is H-1.

Me—Melvin silt loam, ponded. This deep, nearly level, poorly drained soil is on flood plains along small streams. It is subject to ponding and is frequently flooded for very long periods. The slope is 0 to 2 percent. Most areas are long and narrow. They range from 20 to 190 acres in size.

Typically, the surface layer is a dark reddish brown undecomposed mat of cattails and sedges about 4 inches thick. The subsurface layer is olive gray, friable silt loam about 6 inches thick. The substratum to a depth of about 60 inches is dark gray and dark grayish brown, mottled, friable silt loam. It has a thin layer of channery silt loam in the lower part.

Included with this soil in mapping are small, slightly convex areas of somewhat poorly drained soils. Also included are small intermittent and perennial ponds. Inclusions make up about 10 to 15 percent of most areas.

Permeability is moderate in the Melvin soil. Available water capacity is high. Runoff is ponded. The organic matter content is high in the surface layer, and tilth is good. The seasonal high water table is near or above the surface during extended wet periods. The shrink-swell potential is low. The potential for frost action is high.

Most areas support sedges, reeds, and cattails. This soil is generally unsuited to corn, small grain, pasture, and hay because of the ponding. Undrained areas are too wet for the crops commonly grown in the county. The flooding and the wetness are the main management concerns. They delay spring planting in most years. The flooding also damages small grain. Surface and subsurface drainage systems help to overcome the wetness, but outlets are not available in many areas. Grasses and legumes that are tolerant of the wetness and the flooding should be selected for seeding. The floodwater deposits sediments on hayland and pasture. The forage commonly is not suitable for hay when it is covered with this sediment. Grazing when the soil is wet and soft causes surface compaction and poor tilth, damages plants, and hinders air and water movement in the soil.

This soil is poorly suited to woodland. Logging should be done when the soil is frozen or during the drier part of the year. Woodland harvesting and planting should be completed during the periods when flooding does not occur. Site preparation and planting should be done during dry periods. The soil is suited only to the species that are tolerant of the wetness. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is generally unsuited to building site development, camp areas, paths and trails, and septic tank absorption fields because of the ponding and the hazard of flooding. Local roads and street can be constructed on fill material, above the expected high flood levels.

The land capability classification is Vw. The woodland ordination symbol is 5W. The pasture and hayland suitability group is C-3.

MnA—Morristown silty clay loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on mine spoil ridgetops in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone or shale with smaller amounts of siltstone, sandstone, and coal. Slopes are smooth. Most areas are long and narrow or blocky. They range from 5 to 200 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 8 inches thick. The substratum to a depth of about 60 inches is brown, light brownish gray, and yellowish brown, firm very channery clay loam.

Included with this soil in mapping are small depressions and pockets where water collects after periods of heavy rainfall. Also included are areas of soils that are adjacent to the Morristown soil, in lower landscape positions. These soils were never excavated but have been affected by the mining operations and have been covered during reclamation. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Morristown soil. Available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is slow. The organic matter content is very low, and tilth is fair. The depth of the root zone varies. The shrink-swell potential is moderate. The potential for frost action also is moderate.

Most of the acreage supports grasses and legumes for hay and pasture. Some areas are used for small grain.

This soil is poorly suited to corn and small grain and is moderately well suited to hay and pasture. Droughtiness is a limitation. The soil is well suited to no-till seeding. A cropping sequence that includes grasses and legumes, incorporation of crop residue into the surface layer, cover crops, contour tillage, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and increase the rate of water infiltration. Because of uneven grading or settling, surface drains are needed in some areas.

This soil is moderately well suited to woodland. Grasses and legumes provide ground cover during the establishment of trees. Mulching around seedlings reduces the seedling mortality rate. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves traction.

Once it has settled, this soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigation is needed to determine the suitability for these uses. The moderate shrink-swell potential is a limitation on sites for dwellings. It can be overcome by backfilling around foundations with material that has a low shrink-swell potential and by supporting the walls with large spread footings. The moderately slow permeability is a limitation on sites for septic tank absorption fields. Enlarging the absorption area improves the filtering capacity. If the soil is used for lawns, drought is a hazard during dry periods.

This soil is moderately well suited to camp areas and poorly suited to paths and trails. Installing a large absorption field for the disposal of wastewater in camp areas compensates for the moderately slow permeability in the soil. A protective surface on paths and trails reduces the hazard of erosion.

The land capability classification is IIIs. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-1.

MnC—Morristown silty clay loam, 3 to 15 percent slopes. This deep, gently sloping and strongly sloping, well drained soil is on mine spoil ridgetops, benches, and side slopes in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone or shale with smaller amounts of siltstone, sandstone, and coal. Most areas are elongated. They range from 5 to 200 acres in size.

Typically, the surface layer is dark yellowish brown, friable silty clay loam about 7 inches thick. The substratum to a depth of about 60 inches is gray, yellowish brown, and brownish yellow, firm very channery clay loam. In some areas the soil is eroded.

Included with this soil in mapping are small depressions and pockets where water collects after periods of heavy rainfall. Also included are areas of soils that are adjacent to the Morristown soil. These soils are in the lower landscape positions. They were never excavated but have been affected by the mining operations and have been covered during reclamation. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Morristown soil. Available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is medium or rapid, and the organic matter content is very low. The depth of the root zone varies. The shrink-swell potential is moderate in the substratum. The potential for frost action also is moderate.

Most of the acreage is used for grasses and legumes for hay and pasture. Some areas are used for small grain.

This soil is poorly suited to corn and small grain. It is moderately well suited to pasture and hay. Erosion is a hazard. Droughtiness is a limitation. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is severe. A cropping sequence that includes grasses and legumes, incorporation of crop residue into the surface layer, contour stripcropping, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and increase the rate of water infiltration. Timely applications of fertilizer are needed to maintain a good stand of the key forage plants. In the pastured areas, proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion.

This soil is moderately well suited to woodland. Mulching around seedlings reduces the seedling mortality rate. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves traction. Cutting and filling to a more desirable slope improve sites for log landings.

Once it has settled, this soil is moderately well suited to buildings and poorly suited to septic tank absorption fields. The slope, the moderate shrink-swell potential, and the moderately slow permeability are limitations. Onsite investigation is needed to determine the suitability for these uses. Erosion is a management concern. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Land shaping is needed in some areas. Buildings should be designed so that they conform to the natural slope of the land. The moderate shrink-swell potential is a limitation on sites for dwellings. It can be overcome by backfilling around foundations with material that has a low shrink-swell potential and by supporting the walls with large spread footings. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the filtering capacity. If the soil is used for lawns, the drought is a hazard during dry periods.

This soil is moderately well suited to camp areas and poorly suited to paths and trails. The slope, the moderately slow permeability, and the hazard of erosion are limitations. Grading the soil so that it has a more desirable slope improves camp sites. Installing a large absorption area for the disposal of wastewater in camp areas compensates for the moderately slow permeability in the soil. Establishing paths and trails on the contour and building steps reduce the hazard of erosion.

The land capability classification is IVs. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-1.

MnE—Morristown silty clay loam, 15 to 40 percent slopes. This deep, moderately steep and steep, well drained soil is on mine spoil ridgetops, benches, and side slopes in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone or shale with a small amount of siltstone, sandstone, and coal. Some areas have slips. Most areas are oblong. They range from 5 to 15 acres in size.

Typically, the surface layer is yellowish brown, friable silty clay loam about 8 inches thick. The substratum to a depth of about 60 inches is grayish brown and yellowish brown, firm very channery clay loam. In some areas the soil is eroded.

Included with this soil in mapping are small areas of soils that are adjacent to the Morristown soil. These soils are in the lower landscape positions. They were never excavated but have been affected by the mining operations and have been covered during reclamation. They make up about 5 to 10 percent of most areas.

Permeability is moderately slow in the Morristown soil. Available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is very rapid. The organic matter content is very low, and tilth is fair. The depth of the root zone varies. The shrink-swell potential is moderate in the substratum. The potential for frost action also is moderate.

Most areas have been seeded to grasses. Some are used as pasture.

This soil is generally unsuited to corn and small grain. It is poorly suited to hay and pasture. Erosion is a very severe hazard. Droughtiness is a limitation. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. The slope hinders the use of some farm machinery. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion.

This soil is moderately well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Haul roads and log landings should not be located on active slips. Special equipment is needed for site preparation and planting. Water bars and vegetative cover help to control erosion. Mulching around seedlings reduces the seedling mortality rate.

This soil generally is unsuited to building site development and septic tank absorption fields because of the slope, the moderately slow permeability, the instability of the soil, and susceptibility to hillside slippage. Cutting and filling increase the hazard of slippage. Installing a drainage system in areas where water concentrates reduces this hazard.

This soil is poorly suited to paths and trails and generally unsuited to camp areas because of the slope and the hazard of erosion. Establishing paths and trails on the contour reduces the hazard of erosion and the angle of incline. Water bars, steps, and switchbacks also help to control erosion.

The land capability classification is VIe. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-2.

MoA—Morristown shaly silty clay loam, 0 to 3 percent slopes, stony. This deep, nearly level, well drained soil is on ridges in areas that have been surface mined for coal and then regraded. 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 limestone and shale with smaller amounts of siltstone, sandstone, and coal. In most places stones 10 to 24 inches in diameter are 30 to 100 feet apart on the surface. Most areas are irregularly shaped and range from 15 to several hundred acres in size. A few of the larger areas are long and are 400 to 1,000 feet wide.

Typically, the surface layer is brown, friable shaly silty clay loam about 4 inches thick. The substratum to a depth of about 60 inches is yellowish brown and gray, friable very shaly clay loam. In some areas the surface layer is very shaly silty clay loam. In other areas the substratum is extremely acid to neutral.

Included with this soil in mapping are small, scattered depressions and pockets where water collects after periods of heavy rainfall. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Morristown soil. Available water capacity is low. Runoff is slow. The organic matter content is very low in the surface layer, and tilth is poor. The depth of the root zone varies. The shrink-swell potential is moderate in the substratum. The potential for frost action also is moderate.

Most areas support grasses and legumes. Many of these areas, however, are neither grazed nor harvested for hay.

This soil is generally unsuited to row crops. It is poorly suited to hay. It is a poor medium for root development. It is droughty and low in fertility. If the soil is cultivated or plowed during seedbed preparation, the hazard of erosion is severe. Conserving moisture and improving tilth are the major management concerns. The stone and shale fragments in the surface layer hinder tillage.

This soil is moderately well suited to pasture. Proper stocking rates and pasture rotation help to prevent overgrazing. If the soil is plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is severe. Mowing for weed control and applying fertilizer are good management practices. No-till seeding helps to control erosion. Restricting grazing during wet periods minimizes compaction and helps to keep the pasture in good condition.

This soil is moderately well suited to woodland. Mulching around seedlings reduces the seedling mortality rate. The surface layer is sticky when wet. Applying gravel or crushed stone on haul roads and log landings improves traction.

Once it has settled, this soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. Onsite investigation is needed to determine suitability. The ponding in depressions and the moderate shrink-swell potential are limitations affecting building site development. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Frost action and shrinking and swelling can cause damage to local roads and streets. Providing suitable base material helps to prevent this damage. The moderately slow permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent.

This soil is moderately well suited to camp areas and well suited to paths and trails. The stoniness and the moderately slow permeability are limitations in camp areas. Removing the stones improves camp sites. Installing a large absorption area for the disposal of wastewater in camp areas compensates for the moderately slow permeability in the soil.

The land capability classification is VIs. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-1.

MoC—Morristown shaly silty clay loam, 3 to 15 percent slopes, stony. This deep, gently sloping and strongly sloping, well drained soil is on ridges, benches, and side slopes in areas that have been surface mined for coal and then regraded. 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 limestone and shale with smaller amounts of siltstone, sandstone, and coal. In most places stones 10 to 24 inches in diameter are 30 to 100 feet apart on the surface. Most areas are long and are 200 feet to a quarter of a mile wide. They range from 5 to several hundred acres in size.

Typically, the surface layer is brown, friable shaly silty clay loam about 6 inches thick. The substratum to a depth of about 60 inches is yellowish brown, dark yellowish brown, and grayish brown, friable very shaly clay loam. In some areas the surface layer is very shaly silty clay loam. In other areas the substratum is extremely acid to neutral.

Included with this soil in mapping are small intermittent and perennial ponds; long, narrow highwalls of exposed bedrock that are as high as about 40 feet; and areas of very steep soils on the side slopes of spoil banks. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Morristown soil. Available water capacity is low. Runoff is medium or rapid. The organic matter content is very low in the surface layer, and tilth is poor. The depth of the root zone varies. The shrink-swell potential is moderate in the substratum. The potential for frost action also is moderate.

Most areas support grasses and legumes. Only a few of these areas, however, are grazed or harvested for hay.

This soil is generally unsuited to row crops. It is poorly suited to hay. It is a poor medium for root development. It is droughty and low in fertility. Controlling erosion, conserving moisture, and improving tilth are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. The stones and shale fragments on the surface hinder tillage.

This soil is moderately well suited to pasture. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying fertilizer are good management practices. Restricted grazing during wet periods minimizes compaction and helps to keep the pasture in good condition.

This soil is moderately well suited to woodland. Mulching around seedlings reduces the seedling mortality rate. The surface layer is sticky when wet. Applying crushed stone or gravel on haul roads and log landings improves traction. Cutting and filling to a more desirable slope improve sites for log landings.

Once it has settled, this soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. The gently sloping areas are better suited to these uses than more sloping areas. Onsite investigation is needed to determine suitability. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. The soil is limited as a homesite because of the moderate shrink-swell potential in the substratum. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential.

The moderately slow permeability is a limitation affecting septic tank absorption fields. Increasing the size of the absorption area or installing a double absorption field system improves the capacity of the field to absorb effluent. In the strongly sloping areas, installing the leach lines of absorption fields on the contour reduces lateral seepage of effluent to the surface. The stones in the substratum make digging leach lines difficult. Constructing roads and streets on the contour and seeding road cuts reduce the hazard of erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by shrinking and swelling and by frost action.

This soil is moderately well suited to camp areas. The slope, the stoniness, and the moderately slow permeability are limitations affecting camp areas. Grading the soil so that it has a more desirable slope and removing the small stones improve camp sites. Installing a large absorption area for the disposal of wastewater in camp areas compensates for the moderately slow permeability in the soil. The soil is well suited to paths and trails.

The land capability classification is VIs. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is B-1.

MrF—Morristown shaly silty clay loam, 25 to 70 percent slopes, bouldery. This deep, steep and very steep, well drained soil is on side slopes in areas surface mined for coal. It is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are mostly subrounded limestone, shale, and siltstone that vary widely in size. In most places, boulders 24 to 72 inches in diameter are 50 to 100 feet apart on the surface and stones 10 to 24 inches in diameter are 30 to 100 feet apart on the surface. Most areas have slips. Some areas consist of very steep continuous banks about 40 to 100 feet high. Other areas consist of a series of spoil banks less than about 40 feet high. Most areas are commonly 200 to 1,500 feet wide. They range from 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silty clay loam about 2 inches thick. The substratum to a depth of about 60 inches is yellowish brown, brown, brownish yellow, and grayish brown, friable very shaly silty clay loam. In some places the substratum is extremely acid to neutral. In other places the surface layer is channery clay loam or channery silty clay loam.

Included with this soil in mapping are small intermittent and perennial ponds; long, narrow highwalls of exposed bedrock that are as high as about 80 feet; and areas of strongly sloping soils on spoil ridges. Inclusions make up about 5 to 15 percent of most areas.

Permeability is moderately slow in the Morristown soil. Available water capacity is low. Runoff is very rapid. The organic matter content is very low, and tilth is poor in the surface layer. The depth of the root zone varies. The shrink-swell potential is moderate. The potential for frost action also is moderate.

Most areas are wooded. They support black locust and aspen trees. This soil is generally unsuited to row crops, small grain, hay, and pasture because of the slope, droughtiness, and a very severe hazard of erosion.

This soil is poorly suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Mulching seedlings reduces the seedling mortality rate. Haul roads and log landings should not be located on active slips. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is generally unsuited to building site development, septic tank absorption fields, paths and trails, and camp areas because of the slope, the moderately slow permeability, the instability of the soil, and the susceptibility to hillside slippage. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in areas where water collects reduces the slippage hazard.

The land capability classification is VIIe. A woodland ordination symbol has not been assigned. The pasture and hayland suitability group is H-1.

No—Nolin silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. The slope is 0 to 3 percent. Most areas are long and narrow. They range from 4 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is brown and dark yellowish brown, friable silt loam about 45 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, friable silt loam. In some places the subsoil and substratum have more sand. In other places the surface layer is thicker and darker. In some areas the lower part of the subsoil has mottles.

Included with this soil in mapping are narrow areas of Tioga soils adjacent to streams. These soils are coarser textured in the lower part of the subsoil than the Nolin soil. Also included are areas of soils on small, gently sloping alluvial fans. The soils on the alluvial fans are gravelly in the subsoil. Included soils make up about 10 to 15 percent of most areas.

Permeability is moderate in the Nolin soil. Available water capacity is high. Runoff is slow. The organic matter content is moderate in the surface layer, and tilth is good. The seasonal high water table is at a depth of 3 to 6 feet during extended wet periods. The root zone is deep. The shrink-swell potential is low.

Most areas are used as cropland. Some are used as pasture. A few are wooded.

This soil is well suited to corn, small grain, hay, and pasture. Winter grain crops are limited by the flooding. The soil is better suited to crops that can be planted after the normal period of flooding than to crops planted early in spring. The surface layer crusts after periods of heavy rainfall. No-till planting or another system of conservation tillage that leaves crop residue on the surface helps to prevent excessive soil loss and surface crusting. Floodwater sometimes leaves sediment on hayland and pasture. The forage commonly is not suitable for hay when it is covered with this sediment. Pasture rotation and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to woodland. Logging should be done during the drier part of the year. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil generally is unsuited to building site development, camp areas, and septic tank absorption fields because of the flooding (fig. 7). It is well suited to paths and trails. Local roads and streets can be constructed on fill material, above the expected high flood levels.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-5.

OmB—Omulga silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on high terraces and low terraces. Most areas are long strips 200 feet to 500 feet wide. They range from 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is a fragipan of yellowish brown, very firm, brittle silt loam. The subsoil is mottled below a depth of about 25 inches. The upper part of the substratum is yellowish brown, mottled, firm silt loam. The lower part to a depth of about 70 inches is yellowish brown, stratified, firm silty clay loam and loam. In places the mottles are closer to the surface.

Included with this soil in mapping are small areas of Coshocton soils near breaks to other soils. Coshocton soils have a higher content of coarse fragments in the subsoil and substratum than the Omulga soil and do not have a fragipan. Also included are small areas of somewhat poorly drained soils in seeps and slight depressions. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. Available water capacity is moderate above the fragipan. Runoff is slow or medium. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone generally is restricted by the fragipan. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The shrink-swell potential is moderate in the subsoil and the substratum. The potential for frost action is high.

Figure 7.—Flooding in an area of Nolin silt loam, occasionally flooded.

Most areas are used for cropland or for hay and pasture. Corn, small grain, and hay are the principal crops. Some areas are wooded.

This soil is well suited to a rotation of corn, small grain, hay, and pasture. Controlling erosion and maintaining tilth are the major management concerns. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. Harvesting procedures that do not leave the remaining trees widely spaced or isolated reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites. The wetness and the shrink-swell potential are limitations on sites for dwellings, especially on those for dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Shrinking and swelling, frost action, and low strength can cause damage to local roads and streets. Adding a suitable base material and installing a drainage system help to prevent this damage.

This soil is poorly suited to septic tank absorption fields because of the slow permeability in the fragipan and the wetness. Installing perimeter drains helps to overcome the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the slow permeability.

This soil is moderately well suited to camp areas. Installing a large absorption area for the disposal of wastewater in camp areas compensates for the slow permeability in the fragipan. The soil is well suited to paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 4D. The pasture and hayland suitability group is F-3.

OmC—Omulga silt loam, 7 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on high terraces and low terraces. Most areas are long strips 200 to 400 feet wide. They range from 5 to 15 acres in size. A few are as large as 90 acres in size and are irregularly shaped.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is a fragipan of yellowish brown, mottled, very firm, brittle silty clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm silt loam and silty clay loam. In places the upper part of the subsoil is mottled.

Included with this soil in mapping are small areas of Coshocton soils near slope breaks. Coshocton soils have a higher content of coarse fragments in the subsoil and substratum than the Omulga soil and do not have a fragipan. Also included are areas of well drained soils on convex slopes. These well drained soils have a higher content of coarse fragments in the subsoil and substratum than the Omulga soil. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. Available water capacity is moderate above the fragipan. Runoff is medium or rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone generally is restricted by the fragipan. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The shrink-swell potential is moderate in the subsoil and substratum. The potential for frost action is high.

Most areas are used as cropland or pasture. Some are wooded.

This soil is moderately well suited to corn and small grain. The hazard of erosion is the major management concern. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. The surface layer crusts after periods of heavy rainfall, especially in tilled areas. Shallow cultivation breaks up this crust.

This soil is well suited to pasture and hay. If the pasture is overgrazed or is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing helps to control weeds. Applications of lime and fertilizer are needed. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. Harvesting procedures that do not leave the remaining trees widely spaced or isolated reduce the windthrow hazard. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development because of the slope, the wetness, and a moderate shrink-swell potential. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. The wetness is a severe limitation on sites for buildings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed.

Frost action and low strength can cause damage to local roads and streets. Adding suitable base material helps to prevent this damage. Constructing roads and streets on the contour and reseeding road cuts help to control erosion during construction.

Because of the wetness and the slow permeability in the fragipan, this soil is poorly suited to septic tank absorption fields. Installing leach lines on the contour helps to prevent seepage of the effluent to the surface. Installing perimeter drains helps to overcome the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the slow permeability.

This soil is moderately well suited to camp areas. The slope, the wetness, and the slow permeability in the fragipan are the main limitations. Installing a large absorption area for the disposal of wastewater compensates for the slow permeability in the fragipan. Grading the soil so that it has a more desirable slope and installing a drainage system also improve camp areas.

This soil is poorly suited to paths and trails because of the severe hazard of erosion. Water bars and steps reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard.

The land capability classification is IIIe. The woodland ordination symbol is 4D. The pasture and hayland suitability group is F-3.

Or—Orrville silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains along small streams. The slope is 0 to 3 percent. Most areas are long and narrow. They range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 31 inches thick. The upper part is brown and grayish brown, mottled, friable silt loam, and the lower part is dark yellowish brown, mottled, friable loam. The substratum to a depth of about 60 inches is gray, strong brown, and brown, mottled, friable loam and gravelly sandy loam. In places the subsoil contains less clay and more sand and gravel.

Included with this soil in mapping are small areas of moderately well drained soils in the slightly higher landscape positions, small areas of the poorly drained Melvin soils in depressions, and areas of Fitchville Variant soils on small gently sloping alluvial fans. Fitchville Variant soils are less permeable than the Orrville soil. They also are not subject to flooding. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Orrville soil. Available water capacity also is moderate. Runoff is slow. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The seasonal high water table is at a depth of 1.0 to 2.5 feet during extended wet periods. The shrink-swell potential is low. The potential for frost action is high.

Most areas are used as pasture or woodland. Some are used as cropland.

If drained, this soil is well suited to corn and small grain. Row crops can be grown year after year if the soil is adequately drained and if the flooding is controlled or the crops are planted after the normal period of flooding. Subsurface drains help to control the wetness in areas where drainage outlets are available. Grassed waterways also help to overcome the wetness by moving runoff from the adjacent uplands to natural drainageways or ditches. A surface crust forms after periods of heavy rainfall, especially in tilled areas. Shallow cultivation breaks up this crust.

This soil is well suited to pasture and hay. Restricted grazing during wet periods minimizes compaction in the pastured areas. Because of the wetness and the potential for frost action, the soil is better suited to red clover and ladino clover than to alfalfa.

This soil is well suited to woodland. Woodland harvesting and planting should be completed during the periods when flooding does not occur. Plant competition can be controlled by removing vines and the less desirable shrubs and trees.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding and the wetness. Local roads and streets can be constructed on fill material, above the expected high flood levels. Adding suitable base material to local roads and streets helps to prevent the damage caused by frost action.

This soil is generally unsuited to camp areas because of the wetness and the flooding. It is only moderately well suited to paths and trails because of the wetness. Installing a drainage system helps to overcome the wetness.

The land capability classification is IIw. The woodland ordination symbol is 5A. The pasture and hayland suitability group is C-3.

PeB—Pekin silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, moderately well drained soil is on terraces along streams and high terraces. Most areas are long, 200- to 600-foot-wide strips at the base of moderately steep or steep upland side slopes or are circular in shape near the confluence of streams. They generally range from 5 to 20 acres in size, but some areas are as large as 75 acres.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silt loam. The next part is yellowish brown and light brownish gray, mottled, friable silt loam. The lower part is a fragipan of yellowish brown, mottled, very firm, brittle silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm loam. In some places the subsoil is loam or clay loam. In other places the soil is better drained.

Included with this soil in mapping are small areas of somewhat poorly drained soils in slight depressions. These areas are generally less than 2 acres in size. Included soils make up about 10 to 15 percent of most areas.

Permeability is moderate above and below the fragipan in the Pekin soil and very slow in the fragipan. The available water capacity is moderate. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone generally is restricted by the fragipan. A perched seasonal high water table is between depths of 2 and 6 feet in winter, in spring, and during other extended wet periods. The shrink-swell potential is low. The potential for frost action is high.

Most areas are used as cropland or pasture. Some are wooded.

This soil is well suited to pasture and to corn, small grain, and hay in a crop rotation. The hazard of erosion is a major management concern. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, erosion is a hazard. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour tillage, and cover crops help to maintain tilth, control runoff, and prevent excessive soil loss. The wetness delays planting in some areas. Subsurface drains are needed in areas of the included soils, but the water moves slowly into the drains. The surface layer crusts after periods of heavy rainfall. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. The windthrow hazard can be reduced by harvesting procedures that do not leave the remaining trees isolated or widely spaced. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields. The wetness is the main limitation affecting building site development and septic tank absorption fields. The slow permeability in the fragipan is an additional limitation on sites for absorption fields. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The effectiveness of the absorption field can be improved by installing perimeter drains or a double absorption field system or by increasing the size of the absorption area, but the very slow permeability in the fragipan severely limits the effectiveness of any system. Installing a drainage system and adding suitable base material to local roads and streets reduce the damage caused by low strength and frost action.

This soil is moderately well suited to camp areas and well suited to paths and trails. The slow permeability in the fragipan is a limitation in camp areas. Installing a large absorption area for the disposal of wastewater in camp areas compensates for the very slow permeability in the fragipan.

The land capability classification is IIe. The woodland ordination symbol is 4D. The pasture and hayland suitability group is F-3.

RcB—Richland silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, well drained soil is on foot slopes, fans, and toe slopes at the base of hillsides. Most areas are on both sides of streams in narrow valleys. They are 100 to 600 feet wide, are as much as several miles long, and are as large as 100 acres in size. Other areas in broad valleys are round in shape and range from 3 to 15 acres in size.

Typically, the surface layer is brown, very friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam and channery loam, and the lower part is yellowish brown, firm channery loam and loam. The substratum to a depth of about 60 inches is dark yellowish brown, firm very channery loam. In some places, particularly in the southern part of the county, the surface layer is clay loam or silty clay loam. In other places the subsoil has less clay and more sand and coarse fragments.

Included with this soil in mapping are narrow areas of the Tioga and the somewhat poorly drained Orrville soils on flood plains. Tioga soils have less clay in the subsoil than the Richland soil. Also included are small concave areas of the somewhat poorly drained Fitchville Variant soils near foot slopes. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate in the Richland soil. Available water capacity also is moderate. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The seasonal high water table is at a depth of 3 to 6 feet during extended wet periods. The shrink-swell potential is moderate in the subsoil. The potential for frost action also is moderate.

Many areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is well suited to corn, small grain, pasture, and hay. The hazard of erosion is a major management concern. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, erosion is a hazard. No-till planting or another system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Crusting of the surface layer slows moisture penetration and the movement of air, especially in tilled areas. Shallow cultivation breaks up this crust.

This soil is well suited to woodland. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development and poorly suited to septic tank absorption fields, except in narrow areas on flood plains where it is generally unsuited to these uses. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. The wetness and the moderate shrink-swell potential are additional limitations on sites for dwellings, especially on those for dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. The wetness is a limitation on sites for septic tank absorption fields. Installing perimeter drains around absorption fields helps to overcome the wetness.

Frost action and low strength can cause damage to local roads and streets. Adding suitable base material helps to prevent this damage.

Although this soil is moderately well suited to camp areas, the stoniness is a limitation affecting development. The stone fragments can be easily removed by construction equipment. The soil is well suited to paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-1.

RcC—Richland silt loam, 7 to 15 percent slopes. This deep, strongly sloping, well drained soil is on dissected colluvial foot slopes and fans. Most areas are long strips 150 to 500 feet wide. They range from 4 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable channery silt loam and channery silty clay loam, and the lower part is dark yellowish brown, firm channery clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, firm channery clay loam. In places the subsoil has less clay and more sand and coarse fragments.

Included with this soil in mapping are small areas of the moderately well drained Brookside soils. Brookside soils have more clay in the subsoil than the Richland soil. They are intermingled with areas of the Richland soil. Also included are areas of the moderately well drained Omulga soils on small gently sloping terrace remnants and the moderately well drained Clarksburg soils on foot slopes. Omulga and Clarksburg soils have a fragipan in the lower part of the subsoil. Included soils make up 10 to 15 percent of most areas.

Permeability is moderate in the Richland soil. Available water capacity also is moderate. Runoff is medium or rapid. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The seasonal high water table is at a depth of 3 to 6 feet during extended wet periods. The shrink-swell potential in the subsoil is moderate. The potential for frost action also is moderate.

Some areas are used as cropland or for hay and pasture. Many are wooded.

This soil is moderately well suited to corn and small grain. The hazard of erosion is the major management concern. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. The surface layer crusts after periods of heavy rainfall, especially in tilled areas. Shallow cultivation breaks up this crust.

This soil is well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing helps to control weeds. Applications of lime and fertilizer are needed. Restricted grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Cutting and filling to a more desirable slope improve sites for log landings.

This soil is moderately well suited to building site development. The wetness, the slope, and the shrink-swell potential are limitations on sites for buildings, especially on those for buildings with basements. Mulching and reseeding as soon as possible help to control erosion during construction. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Buildings should be designed so that they conform to the natural slope of the land. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, or by backfilling around foundations with material that has a low shrink-swell potential. Because of the wetness, the soil is poorly suited to septic tank absorption fields. Installing perimeter drains around the absorption area helps to overcome the wetness. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

Constructing roads and streets on the contour and seeding road cuts help to control erosion. Frost action and low strength can cause damage to local roads and streets. Adding suitable base material helps to prevent this damage.

This soil is moderately well suited to camp areas and to paths and trails. Sites for camp areas can be improved by grading the soil so that it has a more desirable slope and by removing the small stones from the surface. Water bars and steps reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard.

The land capability classification is IIIe. The woodland ordination symbol is 5A. The pasture and hayland suitability group is A-1.

RgC—Rigley sandy loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops and hillsides in the uplands. The areas generally are long and narrow or circular. They range from 5 to 50 acres in size.

Typically, the surface layer is brown, friable sandy loam about 10 inches thick. The subsoil is yellowish brown, friable sandy loam about 41 inches thick. The substratum is yellowish brown, very friable sandy loam and loamy sand. Hard sandstone bedrock is at a depth of about 62 inches. In places it is at a depth of less than 62 inches.

Permeability is moderately rapid. Available water capacity is moderate. Runoff is medium or rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The soil can be easily tilled throughout a wide range in moisture content. The root zone is deep. The shrink-swell potential is low.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is moderately well suited to corn, small grain, and hay. Erosion and droughtiness are the major management concerns. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to prevent excessive soil loss, reduce the runoff rate, and conserve moisture. Timely applications of lime and fertilizer are needed because plant nutrients are lost through leaching.

This soil is well suited to pasture, but growth is slow during dry periods. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent excessive erosion. No-till seeding also helps to prevent excessive erosion.

This soil is well suited to trees. Cutting and filling to a more desirable slope improve sites for log landings.

This soil is moderately well suited to building site development, camp areas, and septic tank absorption fields. The slope is the main limitation. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Erosion can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover on construction sites. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface. Building local roads and streets on the contour and seeding road cuts help to control erosion. Adding suitable base material to local roads and streets helps to prevent the damage caused by frost action. Grading the soil so that it has a more desirable slope improves camp sites. The soil is well suited to paths and trails.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-1.

RgD—Rigley sandy loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on ridgetops and hillsides in the uplands. Most areas are long and narrow or circular. They range from 5 to 15 acres in size.

Typically, the surface layer is brown, very friable sandy loam about 10 inches thick. The subsoil is about 32 inches of yellowish brown, friable sandy loam and channery sandy loam. The substratum is yellowish brown and light yellowish brown, friable channery loamy sand. Hard sandstone bedrock is at a depth of about 64 inches. In places it is at a depth of less than 64 inches.

Permeability is moderately rapid. Available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The soil can be easily tilled throughout a wide range in moisture content. The root zone is deep. The shrink-swell potential is low.

A few areas are used as cropland. Some are used as pasture. Some are wooded.

This soil is poorly suited to corn, small grain, and hay. The slope, droughtiness, and the hazard of erosion are the major management concerns. If the soil is cultivated, the hazard of erosion is very severe. Maintaining a permanent plant cover is the best means of controlling erosion. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and cover crops help to prevent excessive soil loss, reduce the runoff rate, and conserve moisture. The slope hinders the use of farm machinery. Timely applications of lime and fertilizer are needed because plant nutrients are lost through leaching.

This soil is moderately well suited to pasture. Growth is slow during dry periods. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Planting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south- and west-facing slopes. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and the sun as the south- and west-facing slopes. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

This soil is poorly suited to building site development and septic tank absorption fields because of the slope. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface. Constructing local roads and streets on the contour and seeding road cuts also help to control erosion.

This soil is moderately well suited to paths and trails and poorly suited to camp areas because of the slope. Establishing paths and trails on the contour reduces the angle of incline. Grading the soil so that it has a more desirable slope improves camp sites.

The land capability classification is IVe. The woodland ordination symbol is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is A-2.

StB—Steinsburg-Rigley Variant fine sandy loams, 3 to 8 percent slopes. These gently sloping, well drained soils are on ridgetops in the uplands. The moderately deep Steinsburg soil is in convex, more sloping areas. The deep Rigley Variant soil is commonly in smooth or concave, less sloping areas. Most areas are 200 to 400 feet wide. They range from 3 to 5 acres in size. They are 50 to 70 percent Steinsburg soil and 10 to 30 percent Rigley Variant soil. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Steinsburg soil has a surface layer of dark grayish brown, friable fine sandy loam about 7 inches thick. The subsoil is about 16 inches of yellowish brown, friable fine sandy loam and channery sandy loam. The substratum is yellowish brown very channery loamy sand. Weathered sandstone bedrock is at a depth of about 30 inches. In places the surface layer is loam.

Typically, the Rigley Variant soil has a surface layer of brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 36 inches of yellowish brown, friable sandy loam and channery sandy loam. The substratum is yellowish brown sand. Sandstone bedrock is at a depth of about 43 inches.

Included with these soils in mapping are small areas of Dekalb and Gilpin soils. These included soils are in landscape positions similar to those of the Steinsburg and Rigley Variant soils. Dekalb soils have a higher content of coarse fragments in the subsoil than the Steinsburg and Rigley Variant soils. Gilpin soils have more silt and clay in the subsoil than the Steinsburg and Rigley Variant soils. Included soils make up about 15 to 20 percent of most areas.

Permeability is moderately rapid in the Steinsburg and Rigley Variant soils. Available water capacity is low in the Steinsburg soil and moderate in the Rigley Variant soil. Runoff is medium on both soils. The organic matter content is moderately low in the surface layer, and tilth is good. The Steinsburg soil has a moderately deep root zone, and the Rigley Variant soil has a deep root zone. The shrink-swell potential is low in the subsoil of both soils.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

These soils are moderately well suited to corn and small grain. The hazard of erosion and droughtiness are the major management concerns. If the soils are cultivated or plowed during seedbed preparation, the hazard of erosion is moderate. No-till planting or another system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate, help to prevent excessive soil loss, and conserve moisture. Applying small amounts of lime and fertilizer in a timely manner minimizes the amount of nutrients lost by leaching.

These soils are well suited to hay and pasture, but growth is slow in dry periods. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is moderate. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion.

These soils are well suited to woodland. Mulching around seedlings reduces the seedling mortality rate on the Steinsburg soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

These soils are moderately well suited to building site development and septic tank absorption fields. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. The depth to bedrock is a limitation on sites for buildings with basements, but the bedrock is generally rippable. The shallow depth to bedrock is a limitation on sites for absorption fields. The filtering capacity can be improved by adding suitable fill material.

These soils are well suited to camp areas and to paths and trails.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is F-1 in areas of the Steinsburg soil and A-1 in areas of the Rigley Variant soil.

StC—Steinsburg-Rigley Variant fine sandy loams, 8 to 15 percent slopes. These strongly sloping, well drained soils are on narrow ridgetops and on side slopes just below the ridgetops in the uplands. The side slopes are 200 to 500 feet long. The moderately deep Steinsburg soil is in the convex, more sloping areas, and the deep Rigley Variant soil is commonly in the smooth or concave, less sloping areas. Most areas are 150 to 400 feet wide. They range from 3 to 60 acres in size. They are 50 to 65 percent Steinsburg soil and 10 to 25 percent Rigley Variant soil. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Steinsburg soil has a surface layer of dark yellowish brown, very friable fine sandy loam about 4 inches thick. The subsoil is about 21 inches of yellowish brown, friable fine sandy loam, sandy loam, and channery sandy loam. Weathered sandstone bedrock is at a depth of about 25 inches.

Typically, the Rigley Variant soil has a surface layer of dark yellowish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 38 inches of yellowish brown, friable fine sandy loam and channery fine sandy loam. Weathered sandstone bedrock is at a depth of about 45 inches. Hard sandstone bedrock is at a depth of about 52 inches.

Included with these soils in mapping are small areas of Dekalb and Gilpin soils. These included soils are in landscape positions similar to those of the Steinsburg and Rigley Variant soils. Dekalb soils have a higher content of coarse fragments in the subsoil than the Steinsburg and Rigley Variant soils. Gilpin soils have more silt and clay in the subsoil than the Steinsburg and Rigley Variant soils. Included soils make up about 15 to 20 percent of most areas.

Permeability is moderately rapid in the Steinsburg and Rigley Variant soils. Available water capacity is low in the Steinsburg soil and moderate in the Rigley Variant soil. Runoff is medium on both soils. The organic matter content is moderately low in the surface layer of both soils, and tilth is good. The Steinsburg soil has a moderately deep root zone, and the Rigley Variant soil has a deep root zone. The potential for frost action is moderate in both soils.

Most areas are used as cropland. Some are used as pasture. Some are wooded.

These soils are moderately well suited to corn and small grain. The hazard of erosion and the droughtiness of the Steinsburg soil are the major management concerns. If the soils are cultivated or plowed during seedbed preparation, the hazard of erosion is severe. No-till planting or another system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate, help to prevent excessive soil loss, and conserve moisture. Applying small amounts of lime and fertilizer in a timely manner minimizes the loss of nutrients by leaching.

These soils are well suited to hay and pasture, but growth is slow in dry periods. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion.

These soils are well suited to woodland. Mulching around seedlings reduces the seedling mortality rate on the Steinsburg soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Cutting and filling to a more desirable slope improve sites for log landings.

These soils are moderately well suited to building site development and septic tank absorption fields. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. The depth to bedrock is a limitation on sites for buildings with basements, but the bedrock is generally rippable. Buildings should be designed so that they conform to the natural slope of the land. The slope and the depth to bedrock are limitations on sites for septic tank absorption fields. The filtering capacity can be improved by adding suitable fill material. Installing leach lines on the contour reduces lateral seepage of effluent to the surface. The slope is a limitation on sites for local roads and streets. Constructing roads and streets on the contour and seeding road cuts help to control erosion.

These soils are moderately well suited to camp areas and well suited to paths and trails. Camp areas can be improved by grading the soils so that they have a gentler slope.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is F-1 in areas of the Steinsburg soil and A-1 in areas of the Rigley Variant soil.

StD—Steinsburg-Rigley Variant fine sandy loams, 15 to 25 percent slopes. These moderately steep, well drained soils are on side slopes in the uplands. They are in alternating bands on hillsides. Most areas are 150 to 300 feet wide. They range from 5 to 50 acres in size. The moderately deep Steinsburg soil makes up about 50 to 70 percent of the map unit, and the deep Rigley Variant soil makes up about 10 to 30 percent. The two soils occur as areas so intricately mixed or so small in size that it is not practical to separate them in mapping.

Typically, the Steinsburg soil has a surface layer of dark yellowish brown, friable fine sandy loam about 4 inches thick. The subsoil is yellowish brown, friable channery sandy loam about 24 inches thick. The substratum is yellowish brown loamy sand. Weathered sandstone bedrock is at a depth of about 37 inches. In places the surface layer is loam.

Typically, the Rigley Variant soil has a surface layer of dark yellowish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 33 inches of yellowish brown, friable and very friable loam and channery sandy loam. The substratum is yellowish brown very channery loamy sand. Sandstone bedrock is at a depth of about 44 inches.

Included with these soils in mapping are small areas of Dekalb and Gilpin soils. These included soils are in landscape positions similar to those of the Steinsburg and Rigley Variant soils. Dekalb soils have a higher content of coarse fragments in the subsoil than the Steinsburg and Rigley Variant soils. Gilpin soils have more silt and clay in the subsoil than the Steinsburg and Rigley Variant soils. Included soils make up 15 to 20 percent of most areas.

Permeability is moderately rapid in the Steinsburg and Rigley Variant soils. Available water capacity is low in the Steinsburg soil and moderate in the Rigley Variant soil. Runoff is rapid on both soils. The organic matter content is moderately low in the surface layer, and tilth is good. The Steinsburg soil has a moderately deep root zone, and the Rigley Variant soil has a deep root zone. The shrink-swell potential is low in the subsoil of both soils. The potential for frost action is moderate.

A few areas are used as cropland. Some are used as pasture. Many are wooded.

These soils are poorly suited to corn and small grain. The hazard of erosion and droughtiness are the major management concerns. If the soils are cultivated or plowed during seedbed preparation, the hazard of erosion is very severe. Maintaining a permanent plant cover is the best means of controlling erosion. No-till planting or another system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate, help to prevent excessive soil loss, and conserve moisture. Applying small amounts of lime and fertilizer in a timely manner minimizes the loss of nutrients by leaching.

These soils are moderately well suited to hay and pasture. If the pasture is overgrazed or the soils are plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion.

These soils are well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and sun. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Mulching around seedlings reduces the seedling mortality rate on the Steinsburg soil and on the south and west aspects of the Rigley Variant soil. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting.

These soils are poorly suited to building site development because of the slope. Buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. These soils are poorly suited to septic tank absorption fields because of the slope and the moderate depth to bedrock in the Steinsburg soil. The filtering capacity of the Steinsburg soil can be improved by adding suitable fill material. Installing leach lines on the contour reduces lateral seepage of effluent to the surface. The slope is a limitation on sites for local roads and streets. Constructing roads and streets on the contour and seeding road cuts help to control erosion.

These soils are moderately well suited to camp areas and to paths and trails. Camp areas can be improved by grading the soils so that they have a more desirable slope. Establishing paths and trails on the contour reduces the angle of incline.

The land capability classification is IVe. The woodland ordination symbol is 4R on north aspects and 3R on south aspects. The pasture and hayland suitability group is F-1 in areas of the Steinsburg soil and A-2 in areas of the Rigley Variant soil.

Tf—Tioga loam, rarely flooded. This deep, nearly level, well drained soil is on flood plains along the major streams. The slope is 0 to 3 percent. Most areas are 150 to 400 feet wide and extend along streams for a distance of as much as about half of a mile. They range from 3 to 40 acres in size.

Typically, the surface layer is dark yellowish brown, very friable loam about 5 inches thick. The subsoil is about 29 inches of yellowish brown, friable and very friable loam, sandy loam, and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose very gravelly loamy sand. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Wheeling soils and small areas of Richland soils near slope breaks. Wheeling soils are in slightly higher positions on the landscape than the Tioga soil. Wheeling and Richland soils have a thicker subsoil than that of the Tioga soil and a higher available water capacity. They are not flooded. Included soils make up about 5 to 10 percent of most areas.

Permeability is moderate or moderately rapid in the Tioga soil. Available water capacity is low or moderate. Runoff is slow. The organic matter content is moderate, and tilth is good. The root zone is deep. The seasonal high water table is between depths of 3 and 6 feet in winter, in spring, and during other extended wet periods. The potential for frost action is moderate.

Most areas are used as cropland. Many are pastured. Some are wooded.

This soil is well suited to corn and small grain. Row crops can be grown year after year if improved or intensive management practices are applied. The soil is well suited to a conservation tillage system that leaves crop residue on the surface.

This soil is well suited to hay and pasture. Mowing improves pasture stands.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting. Plant competition can be controlled by removing vines and less desirable trees and shrubs.

Because it is subject to flooding, this soil is generally unsuited to building site development. It is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground-water supplies. The wetness also is a problem. Installing perimeter drains helps to overcome the wetness. The potential for frost action and the flooding are limitations on sites for local roads and streets. Local roads and streets should be constructed on suitable fill material, above the expected high flood levels. Safety precautions are needed to prevent cutbanks from caving in during excavation.

This soil is well suited to paths and trails. It is generally unsuited to camp sites because of the flooding.

The land capability classification is I. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-5.

Tg—Tioga silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. The slope is 0 to 3 percent. Most areas are long and narrow. They range from 20 to 500 acres in size.

Typically, the surface layer is brown, very friable silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is brown and dark yellowish brown, friable silt loam in the upper part and yellowish brown, very friable fine sandy loam with thin lenses of silt loam and loamy fine sand in the lower part. The substratum to a depth of about 60 inches is yellowish brown and brown, loose loamy sand and very gravelly loamy sand. In places the surface layer is loam.

Included with this soil in mapping are small areas of moderately well drained soils in slight depressions and old meander channels and areas of soils on small gently sloping alluvial fans. The soils on the alluvial fans are gravelly in the subsoil. Included soils make up about 10 to 15 percent of most areas.

Permeability is moderate or moderately rapid in the Tioga soil. Available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The seasonal high water table is at a depth of 3 to 6 feet during extended wet periods.

Most areas are used as cropland or pasture. Some are wooded.

This soil is well suited to corn, small grain, hay, and pasture. It is better suited to the crops planted after the normal period of flooding than to the crops planted early in spring. Row crops can be grown year after year if the soil is intensively managed and if flooding is controlled or the crops are planted after the normal period of flooding. The soil is well suited to no-till planting and to other systems of conservation tillage that leave crop residue on the surface. Floodwater sometimes leaves sediment on hay and pasture. The forage commonly is not suitable for hay when it is covered with this sediment. Pasture rotation and restricted grazing during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Woodland harvesting and planting should be completed during the periods when flooding does not occur. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuited to building site development, camp areas, and septic tank absorption fields because of the flooding. It is well suited, however, to paths and trails. Local roads and streets are subject to flood damage (fig. 8). They can be constructed on fill material, above the expected high flood levels. Safety precautions are needed to prevent cutbanks from caving in during excavation.

The land capability classification is IIw. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-5.

Ub—Udorthents, loamy. These soils are in areas where the natural soil has been altered by cutting and filling. In areas that have been cut, the remaining soil material is similar to the subsoil and substratum of adjacent soils. In fill or disposal areas, the soil material has more variable characteristics because it usually consists of varying amounts of material from the subsoil and substratum of several nearby soils. The slope dominantly ranges from 40 to 70 percent. It is 3 to 25 percent in some areas that have been graded. Most areas are long and narrow and are 200 to 600 feet wide. They range from 20 to several hundred acres in size.

Typically, these soils are a mixture of rock fragments and silty clay loam, silt loam, and fine-earth material from areas of natural soil.

Included in this unit in mapping are bedrock escarpments, small areas of soils that have not been excavated, and Urban land consisting of concrete and asphalt road surfaces. Inclusions make up about 10 to 15 percent of most areas.

Permeability varies greatly in the Udorthents but is commonly moderate or moderately slow. Available water capacity is low or very low. The organic matter content is very low. Reaction varies with the different material making up the soils.

These soils are generally unsuited to row crops, small grain, hay, and pasture because of the slope, droughtiness, and a very severe hazard of erosion.

Most areas support grasses, trees, and brush. Some are bare or only sparsely covered with broom sedge and other acid-tolerant plants. This soil is moderately well suited to trees that can withstand the low available water capacity. Erosion can be controlled during timber harvesting by building logging roads on the contour and by providing water bars. The use of equipment is restricted in many places because of the slope.

These soils are generally unsuited to building site development, septic tank absorption fields, camp areas, and paths and trails because of the slope and a susceptibility to hillside slippage. Cutting and filling increase the hazard of slippage. Installing a drainage system in areas where water concentrates reduces the hazard.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

Uc—Udorthents-Pits complex. This map unit is in areas that recently have been surface mined for coal. These areas are about 70 percent Udorthents and 20 percent Pits. The Udorthents are gently sloping to very steep soils around the Pits. The Pits are in nearly level areas between vertical highwalls and the Udorthents.

Typically, the Udorthents are a mixture of rock fragments and material weathered from bedrock. This mixture is in cone-shaped piles 10 to 70 feet high.

Included in this unit in mapping are moderately deep and deep soils around the edge of the areas that have been mined or in small, scattered spots within these mined areas. Included soils make up about 10 percent of most areas.

Most areas of this unit are being regraded to the landscape condition that was present before mining. In areas of the Udorthents where the surface is bare, the

Udorthents are mainly in the cut and filled areas. The areas of the Udorthents and Urban land are so small or so long and narrow that mapping them separately is not practical.

Typically, the upper 60 inches of the Udorthents is a mixture of rock fragments and silty clay loam, silt loam, loam, and fine-earth material from areas of natural soil.

Typically, the Urban land is covered with concrete or asphalt, which is over subgrade material.

Included in this unit in mapping are bedrock escarpments along highways. Inclusions make up about 10 percent of most areas.

Permeability varies greatly in the Udorthents, ranging from very slow to rapid. Available water capacity is low or very low. The organic matter content is very low.

Uneven settling has occurred in places. Steep and very steep areas are subject to hillside slippage. A plant cover should be maintained in areas of the Udorthents in order to help control runoff and erosion. Most unpaved areas support grasses and shrubs.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

UpC2—Upshur silty clay loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, well drained soil is on ridgetops, benches, and side slopes in the uplands. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and subsoil material. Most areas are circular or irregularly shaped. They range from 3 to 20 acres in size.

Typically, the surface layer is dark reddish brown, firm silty clay loam about 3 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish red, firm clay. The next part is dark red, very firm and very plastic clay. The lower part is dark red, mottled, firm silty clay. The substratum also is dark red, mottled, firm silty clay. Bedded shale bedrock is at a depth of about 82 inches. In some areas, the soil is wetter and the lower part of the subsoil has gray mottles. In other areas the surface layer is silty clay.

Included with this soil in mapping are small, scattered areas of Lowell and Elba soils and scattered concave areas of the moderately well drained Guernsey and the moderately deep Berks soils. Lowell and Elba soils are in landscape positions similar to those of the Upshur soil. They are yellower throughout than the Upshur soil. Guernsey and Berks soils are near slope breaks. Included soils make up about 15 percent of most areas.

Permeability is slow in the Upshur soil. Available water capacity is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer, and tilth is fair. The soil tends to dry out slowly and to crack at the surface. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil. The shrink-swell potential is high in the subsoil. The potential for frost action is moderate.

Most areas are used for pasture and hay. A few are used for corn or small grain. Some are wooded.

This soil is poorly suited to corn and small grain. Erosion is the main management concern. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss. Tilling when the soil is wet results in surface compaction and the formation of clods.

This soil is moderately well suited to pasture and hay. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. Restricted grazing during wet periods minimizes compaction.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. The surface layer is sticky when wet. Because of this stickiness, logging should be done when the soil is frozen or during the drier part of the year and tilling and planting should be done during dry periods. Applying gravel or crushed stone on haul roads and log landings improves traction and soil strength. Compaction wheels on planters firm up the soil around the roots of seedlings.

This soil is moderately well suited to building site development. The high shrink-swell potential is the main limitation. Designing walls that have pilasters and that are reinforced with concrete, supporting the walls with large spread footings, and backfilling around foundations with material that has a low shrink-swell potential help to prevent the damage to buildings caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land. Erosion on construction sites can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover. Cutting and filling increase the hazard of hillside slippage. Installing a drainage system in areas where water collects reduces the hazard.

Because of the slow permeability, this soil is poorly suited to septic tank absorption fields. Enlarging the absorption area helps to overcome the slow permeability. Shrinking and swelling and the low strength can cause damage to local roads and streets.

Adding suitable base material helps to prevent this damage. Constructing roads and streets on the contour and seeding road banks help to control erosion.

This soil is moderately well suited to camp areas. The slope and the slow permeability are the main limitations. Grading the soil so that it has a more desirable slope and installing large absorption areas for the disposal of wastewater help to overcome these limitations. The soil is poorly suited to paths and trails because of the hazard of erosion. Water bars and steps reduce the hazard of erosion. Establishing trails on the contour also reduces this hazard.

The land capability classification is IVe. The woodland ordination symbol is 3C. The pasture and hayland suitability group is A-1.

Ur—Urban land. This map unit consists of areas where more than 80 percent of the surface is covered by asphalt, concrete, buildings, or other manufactured material, such as waste from steel mills. It includes parking lots, shopping and business centers, and industrial areas. These areas are 40 acres or more in size and generally are nearly level or gently sloping. Runoff is increased in volume and rate because most surfaces in these extensive areas are impervious to water.

Included in this unit in mapping are small areas of natural soils that have not been covered by asphalt, concrete, or buildings and small areas of Udorthents where soil material that supports vegetation was used for fill. Inclusions make up 10 to 20 percent of most areas.

Examination and identification of soils in this unit are impractical. Onsite investigation is needed to determine the suitability and limitation for any proposed use.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

UsA—Urban land-Chavies complex, 0 to 3 percent slopes. This map unit consists of nearly level areas of Urban land and a deep, well drained Chavies soil on terraces. Most areas are long and are 800 to 1,800 feet wide. They range from 40 to 180 acres in size. About 65 percent of the unit is Urban land, and 35 percent is Chavies soil. The Urban land and Chavies soil occur as areas so intricately mixed that it is not practical to map them separately.

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

Typically, the surface layer of the Chavies soil is dark yellowish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 39 inches thick. It is friable fine sandy loam. The upper part is yellowish brown, the next part is brown, and the lower part is dark brown. The substratum to a depth of about 60 inches is yellowish brown, loose loamy sand and gravelly loamy sand. In places the subsoil has a higher content of silt.

Permeability is moderately rapid in the Chavies soil. Available water capacity is moderate. Runoff is medium. The organic matter content is moderately low in the surface layer, and tilth is good. The soil can be easily tilled throughout a wide range in moisture content. The root zone is deep. The shrink-swell potential is low. The potential for frost action is moderate.

Many areas of the Chavies soil are used as building sites or for lawns or gardens. This soil is well suited to lawns, vegetable and flower gardens, shrubs, and trees. Plant nutrients are rapidly leached from the soil. Applying small amounts of lime and fertilizer in a timely manner minimizes the loss of nutrients by leaching.

The Chavies soil is well suited to building site development and to septic tank absorption fields. Safety precautions are needed to prevent cutbanks from caving in during excavation. The soil readily absorbs but does not adequately filter the effluent in absorption fields. Adding suitable fill material helps to prevent the pollution of streams, lakes, and shallow wells that can result from the poor filtering capacity. Sanitary facilities should be connected to central sewers and treatment facilities in areas that have a high density of houses.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

UtC—Urban land-Gilpin-Lowell complex, 8 to 15 percent slopes. This map unit consists of strongly sloping, well drained soils and areas of Urban land on hillsides and ridgetops in the uplands. The moderately deep Gilpin soil generally is in smooth positions at the edge of ridgetops and on the upper part of slopes. The deep Lowell soil generally is in smooth or convex positions at the summit of ridges and on the lower part of hillsides. These soils also are in alternating bands on hillsides where the bands are associated with different bedrock strata. The mapped areas are about 40 percent Urban land, 35 percent Gilpin soil, and 25 percent Lowell soil. They are commonly 200 to 600 feet wide. They range from 30 to several hundred acres in size. The areas of the two soils and Urban land are so intricately mixed or so small in size that it is not practical to separate them in mapping. In some areas the upper layer of the soil has been removed. In other areas the soil has been covered with fill.

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

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown, firm silt loam about 27 inches thick. Bedded shale bedrock is at a depth of about 33 inches. In places the soil is deep over bedrock.

Typically, the Lowell soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is yellowish brown, firm silty clay that has mottles below a depth of about 24 inches. The substratum is yellowish brown, firm silty clay. Bedded shale bedrock is at a depth of about 50 inches. In some areas the surface layer is silty clay loam. In other areas the upper part of the subsoil has less clay and more silt.

Permeability is moderate in the Gilpin soil and moderately slow in the Lowell soil. Available water capacity is low in the Gilpin soil and moderate in the Lowell soil. Runoff is medium or rapid on the Gilpin soil and rapid on the Lowell soil. The organic matter content is moderate in the surface layer of both soils, and tilth is good. The root zone is deep in the Lowell soil, but root growth is restricted somewhat by the clayey subsoil. The root zone is moderately deep in the Gilpin soil. The shrink-swell potential is moderate in the Lowell soil and low in the Gilpin soil. The potential for frost action is moderate in both soils.

The Gilpin and Lowell soils are used for lawns, flower and vegetable gardens, shrubs, and trees. Because erosion is a hazard if the soils are disturbed or the surface is bare, these soils are only moderately well suited to such uses. The surface layer crusts after periods of heavy rainfall. Regular additions of organic material increase the rate of water infiltration, minimize crusting, and reduce the hazard of erosion. The operation of lawn sprinklers helps to maintain vegetation on the Gilpin soil during dry periods in the summer. The cut and filled areas are not well suited to lawns and gardens because the content of organic matter in the exposed subsoil material is very low. If the subsoil is exposed in areas of the Lowell soil, the soil is sticky when wet and hard when dry.

The Gilpin and Lowell soils are moderately well suited to building site development if proper design and installation procedures are followed. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. Because the depth to bedrock is within 20 inches in some areas of the Gilpin soil, the Gilpin soil is better suited to buildings without basements than to buildings with basements. The harmful effects of shrinking and swelling in areas of the Lowell soil can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Sanitary facilities should be connected to central sewers and treatment facilities if possible since both soils are poorly suited to septic tank absorption fields.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

UtD—Urban land-Gilpin-Lowell complex, 15 to 25 percent slopes. This map unit consists of moderately steep, well drained soils and areas of Urban land on hillsides and ridgetops in the uplands. The moderately deep Gilpin soil is commonly on the middle and upper parts of smooth or convex side slopes and on convex shoulder slopes on hillsides. The deep Lowell soil is commonly on the lower part of side slopes. These two soils also are in alternating bands on hillsides where the bands are associated with different bedrock strata. Seepy spots and slips are common in areas of the Lowell soil. The mapped areas are about 40 percent Urban land, 35 percent Gilpin soil, and 25 percent Lowell soil. The areas of the two soils and Urban land are so intricately mixed or so small in size that it is not practical to separate them in mapping. In some areas the upper layer of the soil has been removed. In other areas the soil has been covered with fill.

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

Typically, the Gilpin soil has a surface layer of brown, friable silt loam about 5 inches thick. The subsoil is about 22 inches of yellowish brown, friable silt loam and silty clay loam. Bedded shale bedrock is at a depth of about 27 inches. In some areas the soil is deep over bedrock.

Typically, the Lowell soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown, friable silty clay loam, and the lower part is dark brown and yellowish brown, firm silty clay that has mottles below a depth of about 33 inches. Bedded shale bedrock is at a depth of about 48 inches. In some areas the surface layer is silty clay loam. In other areas the upper part of the subsoil has less clay and more silt.

Permeability is moderate in the Gilpin soil and moderately slow in the Lowell soil. Available water capacity is low in the Gilpin soil and moderate in the Lowell soil. Runoff is rapid on the Gilpin soil and very rapid on the Lowell soil. The organic matter content is moderate in the surface layer of both soils, and tilth is good. The root zone is deep in the Lowell soil, but root growth is restricted somewhat by the clayey subsoil. The root zone is moderately deep in the Gilpin soil. The shrink-swell potential is moderate in the Lowell soil and low in the Gilpin soil. The potential for frost action is moderate in both soils.

The Gilpin and Lowell soils are used for lawns, flower and vegetable gardens, shrubs, and trees. Because erosion is a severe hazard if the soils are disturbed or the surface is bare, these soils are poorly suited to such uses. The surface layer crusts after periods of heavy rainfall. Regular additions of organic material increase the rate of water infiltration and reduce crusting and the hazard of erosion. The operation of lawn sprinklers helps to maintain vegetation on the Gilpin soil during dry periods in the summer. The cut and filled areas are not well suited to lawns and gardens because the content of organic matter in the exposed subsoil material is very low. If the subsoil is exposed in areas of the Lowell soil, the soil is sticky when wet and hard when dry. Trees, vines, and ground cover help to control erosion in the steep and very steep cut and filled areas.

The Gilpin and Lowell soils are poorly suited to further building site development because of the slope. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Constructing roads on the contour also helps to control erosion. Cutting and filling increase the hazard of hillside slippage on the Lowell soil. Installing a drainage system where water collects reduces this hazard. Because the bedrock is within a depth of 20 inches in some areas of the Gilpin soil, the Gilpin soil is better suited to buildings without basements than to buildings with basements. The harmful effects of shrinking and swelling in areas of the Lowell soil can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Sanitary facilities should be connected to central sewers and treatment facilities if possible since the Gilpin soil is poorly suited and the Lowell soil is generally unsuited to septic tank absorption fields.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

UvC—Urban land-Omulga complex, 3 to 15 percent slopes. This map unit generally consists of areas of Urban land and a deep, gently sloping and strongly sloping, moderately well drained Omulga soil. These areas are on high terraces along the Ohio River (fig. 9). Most areas are long strips 300 to 600 feet wide. They range from 20 to 70 acres in size. About 60 percent of the map unit is Urban land, and 40 percent is Omulga soil. The areas of this map unit in Brilliant and Toronto, Ohio, generally are more strongly sloping. The areas of Urban land and the Omulga soil are so intricately mixed that it is not practical to map them separately.

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

Typically, the surface layer of the Omulga soil is brown, friable silt loam about 7 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is a fragipan of yellowish brown, mottled, very firm, brittle silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silt loam. In some areas the upper part of the subsoil has mottles. Some areas have been radically altered by cutting, filling, or smoothing.

Permeability is moderate above the fragipan in the Omulga soil and slow in the fragipan. Available water capacity is moderate. Runoff is medium or rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone generally is restricted by the fragipan. A perched seasonal high water table is at a depth of 2.0 to 3.5 feet in winter, in spring, and during other extended wet periods. The shrink-swell potential is moderate in the subsoil and substratum. The potential for frost action is high.

Many areas of the Omulga soil are used as building sites and for lawns or gardens. This soil is well suited to lawns, vegetable and flower gardens, shrubs, and trees. The hazard of erosion is the major management concern in areas used for lawns and gardens. Incorporating plant residue and leaf litter into the surface layer and planting cover crops help to maintain tilth and control erosion. Subsurface drains are needed in scattered seepy areas. The surface layer crusts after periods of heavy rainfall, especially in tilled areas. Shallow cultivation breaks up this crust.

The Omulga soil is moderately well suited to building site development. Erosion can be controlled in gently sloping areas by removing as little vegetation as possible, mulching, and establishing a temporary plant cover during construction. Additional erosion-control measures are needed in strongly sloping areas. Building local roads and streets on the contour and seeding road cuts reduce the hazard of erosion.

The wetness, the moderate shrink-swell potential, and the slope are limitations on sites for dwellings, especially on those for dwellings with basements. Waterproofing basement walls and installing drains at

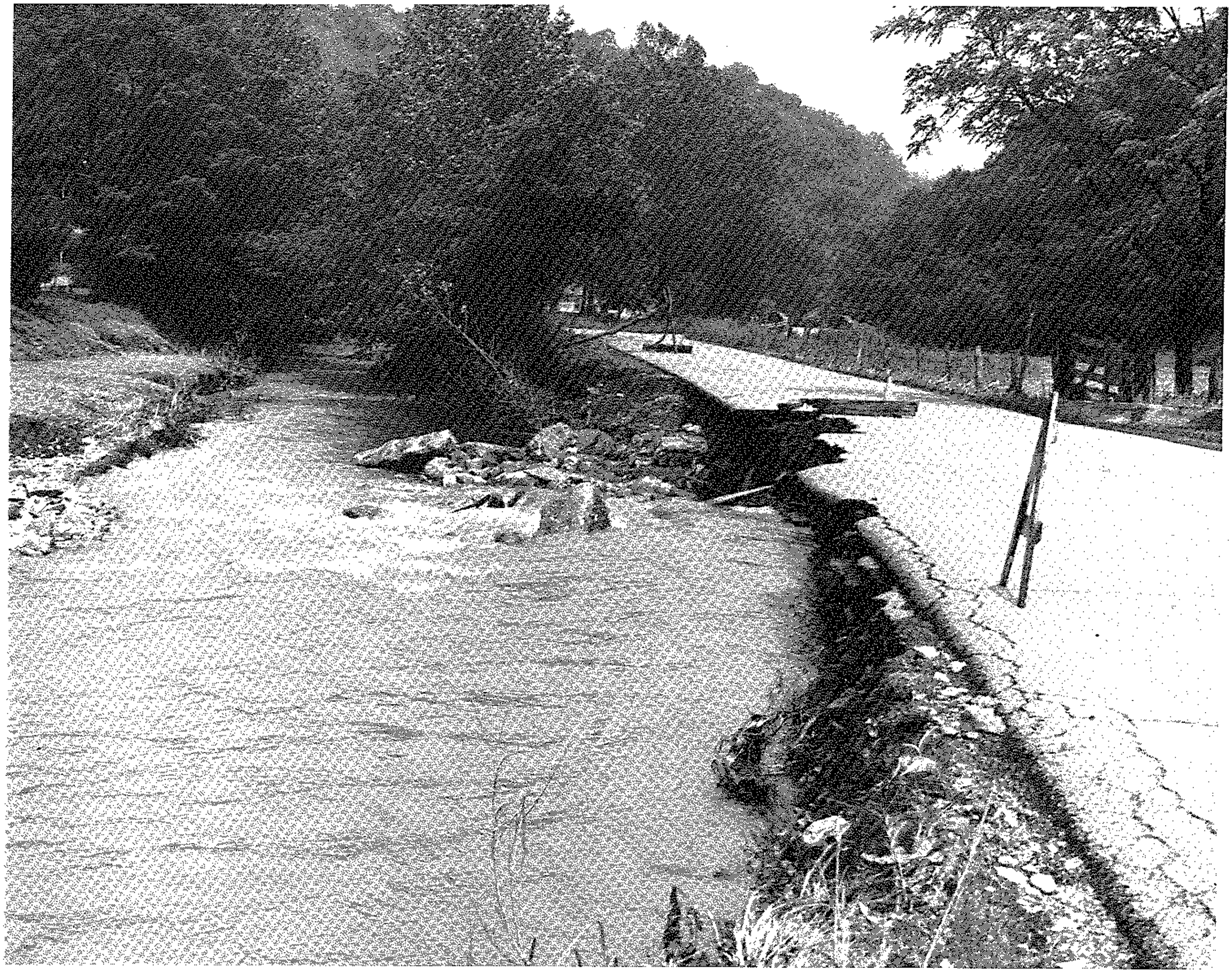

Figure 8.—A road in an area of Tioga silt loam, occasionally flooded, damaged by streambank erosion.

hazard of erosion is severe. A suitable plant cover is needed to control erosion. Available water capacity varies throughout the profile of the Udorthents but is dominantly low or very low in the root zone. Reaction in the root zone also varies, but it is dominantly neutral to moderately alkaline.

If the area is reclaimed by grading and by blanketing the surface with a layer of natural soil material, this map unit is moderately well suited to hay, pasture, and woodland. If the area is regraded to a gently sloping condition and the soils are allowed to settle, the unit is moderately well suited to building site development. After the unit is regraded, the suitability for septic tank absorption fields varies, depending on how much the material is compacted during regrading and blanketing operations. Onsite investigation is needed to determine the limitations for any proposed uses.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been 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 30 percent Urban land. The Urban land is covered with pavement. The

UwB—Urban land-Steinsburg complex, 3 to 8 percent slopes. This map unit consists of Urban land and a moderately deep, gently sloping, well drained Steinsburg soil on ridgetops and side slopes in the uplands. It is in the city of Steubenville. The unit occurs as one irregularly shaped area about 340 acres in size. It is about 60 percent Urban land and 30 percent Steinsburg soil. The Urban land and Steinsburg soil are so intricately mixed that it is not practical to map them separately.

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

Typically, the surface layer of the Steinsburg soil is brown, very friable fine sandy loam about 5 inches thick. The subsoil is about 20 inches of yellowish brown and brown, friable fine sandy loam and sandy loam. Weathered sandstone bedrock is at a depth of about 25 inches. In some areas the subsoil has more sandstone fragments. In other areas it has more clay. In places the surface layer is loam. Some areas have been radically altered by cutting, filling, or smoothing.

Included in this map unit are areas of strongly sloping soils near slope breaks and small, scattered areas of the deep Wellston soils. Included soils make up about 10 percent of most areas.

Permeability is moderately rapid in the Steinsburg soil. Available water capacity is low. Runoff is medium or rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone is moderately deep. The potential for frost action is moderate.

Many areas of the Steinsburg soil are used as building sites and for lawns or gardens. This soil is only moderately well suited to lawns, vegetable and flower gardens, shrubs, and trees because it is droughty. Controlling erosion and conserving moisture are management concerns in areas used for lawns and gardens. Incorporating plant residue and leaf litter into the surface layer and planting cover crops help to maintain tilth and control erosion. Plant nutrients are rapidly leached from the soil. Applying small amounts of lime and fertilizer in a timely manner minimizes the loss of nutrients by leaching.

This soil is moderately well suited to building site development. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Building local roads and streets on the contour and seeding road cuts also help to control erosion. The bedrock at a depth of 20 to 40 inches is a limitation on sites for dwellings with basements, but it commonly is rippable.

This soil is only moderately well suited to septic tank absorption fields because of the moderate depth to bedrock. Sanitary facilities should be connected to central sewers and treatment facilities because of the depth to bedrock and the high density of houses in this unit.

No land capability classification or pasture and hayland suitability group has been assigned. The woodland ordination symbol is 8F in areas of the Steinsburg soil. Urban land has not been assigned a woodland ordination symbol.

WeB—Wellston silt loam, 1 to 7 percent slopes. This deep, nearly level and gently sloping, well drained soil is on ridgetops in the uplands. Most areas are long and narrow or irregularly shaped. They are 200 to 400 feet wide. They range from 4 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 37 inches thick. It is dark yellowish brown, yellowish brown, and brown, friable silt loam in the upper part; yellowish brown and strong brown, mottled, friable silt loam in the next part; and yellowish brown, friable very channery silt loam in the lower part. Weathered, fine grained sandstone bedrock is at a depth of about 43 inches. Hard, fine grained sandstone is at a depth of about 63 inches. In some places the subsoil has more sand. In a few places, the soil is wetter and the upper part of the subsoil is mottled.

Included with this soil in mapping are small areas of the moderately deep Gilpin soils. These areas are generally less than 2 acres in size. These soils are intermingled with areas of the Wellston soil. They make up 10 to 15 percent of most areas.

Permeability is moderate in the Wellston soil. Available water capacity also is moderate. Runoff is slow or medium. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The potential for frost action is high.

Most areas are used as cropland or pasture. A few areas are wooded.

This soil is well suited to pasture and to corn, small grain, and hay grown in a crop rotation. The hazard of erosion is a major management concern. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, erosion is a hazard. A conservation tillage system that leaves crop residue on the surface, grassed waterways, contour tillage, and cover crops help to maintain tilth and control runoff and erosion. Crusting of the surface layer slows moisture penetration and the movement of air. Shallow cultivation breaks up this crust. Crusting is not so much of a problem in no-till areas. Proper stocking rates and pasture rotation help to prevent overgrazing and soil loss.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Applying gravel or crushed stone on haul roads and log landings improves soil strength.

This soil is well suited to building site development and moderately well suited to septic tank absorption fields. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover reduce the hazard of erosion during construction. The depth to bedrock is a limitation on sites for buildings with basements. The depth to bedrock and the moderate permeability are limitations on sites for septic tank absorption fields. Increasing the size of the absorption area, installing a double absorption field system, and adding suitable fill material improve the effectiveness of septic tank absorption fields. Adding suitable base material to local roads and streets helps to prevent the damage caused by frost action.

This soil is well suited to camp areas and to paths and trails. Water bars, steps, and switchbacks reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard.

The land capability classification is IIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-6.

WkC—Westmoreland silt loam, 8 to 15 percent slopes. This deep, well drained, strongly sloping soil is on ridgetops in the uplands. Most areas are circular or elongated. They range from 5 to 25 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 26 inches thick. It is yellowish brown and friable. The upper part is silt loam, and the lower part is shaly silt loam. The substratum is yellowish brown, friable very shaly silt loam. Bedded shale bedrock is at a depth of about 43 inches. In some areas the soil is 20 to 40 inches deep over bedrock. In other areas, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with this soil in mapping are narrow strips of the moderately well drained Guernsey soils on the sides of ridges, small areas of the moderately deep Berks soils near the edge of ridgetops, and less sloping areas of Wellston soils. Guernsey soils have more clay in the subsoil than the Westmoreland soil. Berks soils have a higher content of coarse fragments in the subsoil than the Westmoreland soil. Wellston soils have fewer fragments and are more silty in the upper part of the subsoil than the Westmoreland soil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Westmoreland soil. Available water capacity also is moderate. Runoff is medium or rapid. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The potential for frost action is moderate.

Many areas are used as cropland or pasture. Some are wooded.

This soil is moderately well suited to corn and small grain. In areas where air drainage is good, the soil can be used for orchard crops. The hazard of erosion is the main management concern. If the soil is cultivated, the hazard of erosion is severe. The soil is well suited to no-till planting. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Crusting of the surface layer slows moisture penetration and the movement of air, especially in tilled areas. Shallow cultivation breaks up this crust.

This soil is well suited to hay and pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss.

This soil is well suited to woodland. Cutting and filling to a more desirable slope improve sites for log landings. Applying gravel or crushed stone on haul roads and log landings improves soil strength. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately well suited to building site development and septic tank absorption fields. The slope and the depth to bedrock are limitations. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Buildings should be designed so that they conform to the natural slope of the land. Because bedrock is at a depth of 40 inches in some areas, the soil is better suited to buildings without basements than to buildings with basements.

This soil is moderately well suited to septic tank absorption fields. The slope, the depth to bedrock, and the moderate permeability are limitations on sites for septic tank absorption fields. Enlarging the absorption area helps to overcome the moderate permeability. Adding suitable fill material helps to overcome the limited depth to bedrock. Laying out the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

Building local roads and streets on the contour and seeding road cuts help to control erosion. Frost action and low strength can cause damage to roads and streets. Adding suitable base material helps to prevent this damage.

This soil is moderately well suited to camp areas and to paths and trails. The slope is a limitation in camp areas. Grading the soil so that it has a more desirable slope helps to overcome this limitation. Water bars, steps, and switchbacks reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-1.

WkD—Westmoreland silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on ridgetops and side slopes in the uplands. Slopes are smooth. Most areas are long and narrow or are oblong. They range from 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 24 inches thick. It is yellowish brown and friable. The upper part is silt loam, and the lower part is silty clay loam. The substratum is yellowish brown, friable very shaly clay loam. Bedded shale bedrock is at a depth of about 43 inches. In some areas the soil is 20 to 40 inches deep over bedrock. In other areas, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with this soil in mapping are small areas of the moderately deep Berks soils on the upper part of slopes and narrow strips of the moderately well drained Guernsey soils on the lower part of slopes. Berks soils have a higher content of coarse fragments in the subsoil than the Westmoreland soil. Guernsey soils have more clay in the subsoil than the Westmoreland soil. The narrow strips of Guernsey soils typically extend as much as 100 feet across the slope and are 30 feet wide. Seeps and springs are in areas of the Guernsey soils. Inclusions make up about 10 percent of most areas.

Permeability is moderate in the Westmoreland soil. Available water capacity also is moderate. Runoff is rapid. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone is deep. The potential for frost action is moderate.

Most areas are used as cropland or pasture. Some are wooded.

This soil is poorly suited to corn and small grain and moderately well suited to hay. Erosion is the main management concern. A commonly used crop rotation includes a cultivated crop about once every 4 years. If the soil is cultivated, the hazard of erosion is very severe. Maintaining a permanent plant cover is the best means of controlling erosion. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and surface crusting. The slope limits the use of some farm machinery.

This soil is moderately well suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss.

This soil is well suited to woodland. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and sun. Cutting and filling to a more desirable slope improve sites for log landings. Applying gravel or crushed stones on haul roads improves soil strength. Special equipment is needed for site preparation and planting. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Mainly because of the slope, this soil is poorly suited to building site development and septic tank absorption fields. Land shaping is needed in some areas. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion during construction. Because bedrock is at a depth of 40 inches in some areas, the soil is better suited to buildings without basements than to buildings with basements. Buildings should be designed so that they conform to the natural slope of the land. Laying out the distribution lines of the absorption field on the contour helps to prevent seepage of the effluent to the surface. Enlarging the absorption area improves the filtering capacity.

Building local roads and streets on the contour and seeding road cuts help to control erosion. Frost action and low strength can cause damage to local roads and streets. Adding suitable base material helps to prevent this damage.

This soil is poorly suited to camp areas because of the slope. It is poorly suited to paths and trails because of the hazard of erosion. Camp areas can be improved by grading the soil so that it has a gentler slope. Water bars, steps, and switchbacks reduce the hazard of erosion. Establishing paths and trails on the contour also reduces this hazard.

The land capability classification is IVe. The woodland ordination symbol is 4R. The pasture and hayland suitability group is A-2.

WtE—Westmoreland-Berks complex, 25 to 40 percent slopes. These steep, well drained soils are on side slopes in the uplands. Most areas are long and narrow. They range from 40 to several hundred acres in size. The deep Westmoreland soil makes up about 50 percent of the map unit, and the moderately deep Berks soil makes up about 40 percent. Many areas are directly above less sloping soils or mined areas. Other areas consist of the valley walls on both sides of narrow drainageways. These two soils occur in alternating bands so intricately mixed that it is not practical to separate them in mapping.

Typically, the Westmoreland soil has a surface layer of dark brown, friable silt loam about 4 inches thick. The subsoil is about 32 inches of yellowish brown, friable silt loam and channery silt loam. The substratum is yellowish brown, firm very channery silt loam. Bedded shale bedrock is at a depth of about 43 inches. In places, the soil is wetter and the lower part of the subsoil has gray mottles.

Typically, the Berks soil has a surface layer of brown, friable shaly silt loam about 3 inches thick. The subsoil is about 19 inches of yellowish brown, friable shaly silt loam and very shaly silt loam. Bedded shale bedrock is at a depth of about 22 inches. In some areas the soil is deep over bedrock. In other areas the subsoil has fewer coarse fragments.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils on benches. These included soils have more clay in the subsoil than the Westmoreland soil. They make up about 10 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderate or moderately rapid in the Berks soil. Available water capacity is moderate in the Westmoreland soil and very low in the Berks soil. Runoff is very rapid on both soils. The organic matter content is moderately low in the surface layer, and tilth is good. The root zone is deep in the Westmoreland soil and moderately deep in the Berks soil. The potential for frost action is moderate in the Westmoreland soil.

A few areas are in permanent pasture. Most are wooded.

These soils are generally unsuited to corn and small grain because of the slope and hazard of erosion. They are poorly suited to pasture and hay. The slope and the hazard of erosion are the major management concerns. Maintaining a permanent plant cover is the best means of controlling erosion. If the soils are plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion. No-till seeding also helps to control erosion. Mowing for weed control and applying lime and fertilizer are difficult because of the slope.

These soils are well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and sun. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Mulching around seedlings reduces the seedling mortality rate on the Berks soil, especially on south- and west-facing slopes. Cutting and filling to a more desirable slope improve sites for log landings. Applying gravel or crushed stone on haul roads improves soil strength in areas of the Westmoreland soil. Special equipment is needed for site preparation and planting. Plant competition on the Westmoreland soil can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope, these soils are generally unsuited to building site development, septic tank absorption fields, and camp areas. They are poorly suited to paths and trails because of the slope and the hazard of erosion on the Westmoreland soil. Establishing paths and trails on the contour reduces the hazard of erosion and the angle of incline. Water bars, steps, and switchbacks also help to control erosion.

The land capability classification is VIe. The woodland ordination symbol is 4R in areas of the Westmoreland soil. It is 4R on north aspects of the Berks soil and 3R on south aspects. The pasture and hayland suitability group is A-3 in areas of the Westmoreland soil and F-2 in areas of the Berks soil.

WtF—Westmoreland-Berks complex, 40 to 70 percent slopes. These very steep, well drained soils are on side slopes in the uplands. Most areas are long and narrow. They range from 40 to several hundred acres in size. The deep Westmoreland soil makes up about 50 percent of the map unit, and the moderately deep Berks soil makes up about 40 percent. Many areas are directly above less sloping soils or mined areas. Other areas consist of the valley walls on both sides of narrow drainageways. These two soils occur in alternating bands so intricately mixed that it is not practical to separate them in mapping.

Typically, the Westmoreland soil has a surface layer of brown, friable silt loam about 3 inches thick. The subsoil is about 30 inches of yellowish brown, friable silt loam and channery silt loam. The substratum is yellowish brown, friable channery silt loam. Bedded shale bedrock is at a depth of about 48 inches. In places, the soil is wetter and the lower part of the subsoil has gray mottles.

Typically, the Berks soil has a surface layer of brown, friable shaly silt loam about 5 inches thick. The subsoil is yellowish brown, friable very shaly silt loam about 17 inches thick. Bedded shale bedrock is at a depth of about 22 inches. In some areas the soil is deep over bedrock. In other areas the subsoil has fewer coarse fragments.

Included with these soils in mapping are small areas of the moderately well drained Guernsey soils on benches. Included soils make up about 10 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderate or moderately rapid in the Berks soil. Available water capacity is moderate in the Westmoreland soil and very low in the Berks soil. Runoff is very rapid on both soils. Tilth is good. The root zone is deep in the Westmoreland soil and moderately deep in the Berks soil. The potential for frost action is moderate in the Westmoreland soil.

Almost all areas are in woodland. These soils are generally unsuited to crops and pasture because of the slope.

These soils are moderately well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and sun. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion. Mulching around seedlings reduces the seedling mortality rate on the Berks soil. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Plant competition on the Westmoreland soil can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope, these soils are generally unsuited to building site development, septic tank absorption fields, and camp areas. They are poorly suited to paths and trails because of the slope and the hazard of erosion on the Westmoreland soil. Establishing paths and trails on the contour reduces the hazard of erosion and the angle of incline. Water bars, steps, and switchbacks also help to control erosion.

The land capability classification is VIIe. The woodland ordination symbol is 4R on the Westmoreland soil. It is 4R on north aspects of the Berks soil and 3R on south aspects. The pasture and hayland suitability group is H-1.

WuF—Westmoreland-Lowell complex, 40 to 70 percent slopes. These very steep, deep, well drained soils are on side slopes in the uplands. Most areas are long and narrow and range from 30 to several hundred acres in size. The Westmoreland soil makes up about 45 percent of the map unit, and the Lowell soil makes up about 35 percent. Most areas are directly below mined areas and include both side slopes of small valleys. The Lowell soil has seep areas and slips. These two soils occur in alternating bands so intricately mixed that it is not practical to separate them in mapping.

Typically, the Westmoreland soil has a surface layer of very dark grayish brown, very friable silt loam about 4 inches thick. The subsurface layer is about 9 inches of dark yellowish brown and yellowish brown, very friable and friable silt loam and channery silt loam. The subsoil is yellowish brown. It is about 21 inches of friable channery silt loam, firm silty clay loam, and firm channery silty clay loam. The substratum is brown, firm very channery clay loam. Bedded shale bedrock is at a depth of about 41 inches. In places, the soil is wetter and the lower part of the subsoil has gray mottles.

Typically, the Lowell soil has a surface layer of dark brown, friable silty clay loam about 3 inches thick. The subsoil is brown, firm silty clay about 39 inches thick. Interbedded shale bedrock and limestone bedrock are at a depth of about 42 inches. In places, the soil is wetter and the lower part of the subsoil has gray mottles.

Included with these soils in mapping are small areas of Berks and Hazleton soils. Berks soils are moderately deep over bedrock. They generally are in scattered areas. Hazleton soils generally are on the upper part of side slopes. Berks and Hazleton soils have a higher content of coarse fragments in the subsoil than the Westmoreland and Lowell soils. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Westmoreland soil and moderately slow in the Lowell soil. Available water capacity is moderate in both soils. Runoff is very rapid. The root zone of both soils is deep, but root growth is restricted somewhat by the clayey subsoil in the Lowell soil. The shrink-swell potential is moderate in the Lowell soil and low in the Westmoreland soil. The potential for frost action is moderate in both soils.

Almost all areas are in woodland. These soils are generally unsuited to cropland and pasture because of the slope and a very severe hazard of erosion.

These soils are moderately well suited to woodland. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because they are not so exposed to the prevailing wind and sun. Establishing haul roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and vegetative cover also help to control erosion.

Applying gravel or crushed stone on haul roads and log landings improves soil strength in areas of the Lowell soil. Haul roads and log landings should not be located on active slips in areas of the Lowell soil. Cutting and filling to a more desirable slope improve sites for log landings. Special equipment is needed for site preparation and planting. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope of both soils and the hazard of hillside slippage in areas of the Lowell soil, these soils generally are unsuited to building site development, septic tank absorption fields, and camp areas. They are poorly suited to paths and trails because of the slope and the hazard of erosion. Establishing paths and trails on the contour reduces the hazard of erosion and the angle of incline. Water bars, steps, and switchbacks also help to control erosion.

The land capability classification is VIIe. The woodland ordination symbol is 4R in areas of the Westmoreland soil and 5R in areas of the Lowell soil. The pasture and hayland suitability group is H-1.

WvA—Wheeling silt loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on flats on stream terraces. Most areas are only slightly higher than the flood plain. They are long and narrow or are oblong and range from 3 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 44 inches thick. The upper part is dark yellowish brown, brown, and yellowish brown, friable silt loam and loam. The next part is yellowish brown, firm loam. The lower part is brown, friable sandy loam. The substratum to a depth of about 80 inches is yellowish brown, light yellowish brown, and strong brown, friable gravelly sandy loam and loose stratified loamy sand and loamy very fine sand. In some places the surface layer is dark brown or dark yellowish brown silty clay loam. In other places, the upper part of the subsoil has a higher content of coarse fragments and the substratum has more clay and less sand.

Included with this soil in mapping are small areas of moderately well drained soils in depressions and small areas of Nolin and Tioga soils on flood plains. Tioga soils have more sand in the subsoil than the Wheeling soil. Nolin soils have less sand in the subsoil than the Wheeling soil. Also included are soils that are not on low terraces and have more gravel in the lower part of the subsoil than the Wheeling soil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Wheeling soil and rapid in the substratum. Available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer, and tilth is good. The root zone is deep. The potential for frost action is moderate.

Most areas are used as cropland. Some are used as pasture or woodland.

This soil is well suited to corn, small grain, hay, pasture, and specialty crops. Row crops can be grown year after year if good management practices are applied. The soil is well suited to planting early in spring and to irrigation. Cover crops and no-till planting or another system of conservation tillage that leaves crop residue on the surface help to maintain tilth and control erosion.

This soil is well suited to woodland. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is well suited to building site development, paths and trails, and camp areas. Low strength and the potential for frost action are limitations on sites for local roads and streets. Adding suitable base material helps to prevent damage caused by low strength and frost action.

This soil is well suited to septic tank absorption fields. Enlarging the field improves the capacity of the field to absorb effluent. The substratum does not adequately filter the effluent from septic tanks. Installing the leach lines as close to the surface as possible reduces the hazard of pollution of ground-water supplies.

The land capability classification is I. The woodland ordination symbol is 4A. The pasture and hayland suitability group is A-1.

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 20,170 acres in the survey area, or about 8 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but they are mainly in associations 1, 2, 3, and 6, which are described under the heading "General Soil Map Units." About 10,000 acres of this prime farmland is used for crops. The crops grown on this land are mainly corn, hay, oats, and wheat.

More than 8,000 acres of the prime farmland consists of well drained and moderately well drained soils on ridgetops and benches on uplands. Nearly 12,000 acres consists of somewhat poorly drained, moderately well drained, and well drained soils on terraces, on flood plains, and on foot slopes, toe slopes, and fans at the base of hillsides. The somewhat poorly drained soils are considered prime farmland only in areas where a drainage system has been installed. Onsite investigation is needed to determine whether or not the wetness has been overcome.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify as prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Figure 9.—An area of Urban land-Omulga complex, 3 to 15 percent slopes, in the Ohio River valley.

the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be minimized by designing walls that have pilasters and that are reinforced with concrete, by supporting the walls with large spread footings, and by backfilling around foundations with material that has a low shrink-swell potential. Grading the soil so that it has a more desirable slope helps to overcome the slope. Buildings should be designed so that they conform to the natural slope of the land. Frost action and low strength can cause damage to local roads and streets. Adding suitable base material helps to prevent this damage.

Because of the wetness and the slow permeability, the Omulga soil is poorly suited to septic tank absorption fields. Installing leach lines on the contour in the more sloping areas helps to prevent seepage of the effluent to the surface. Installing perimeter drains helps to overcome the wetness. Enlarging the size of the absorption area or installing a double absorption field system helps to overcome the slow permeability. Sanitary facilities should be connected to central sewers and treatment facilities, especially in areas that have a high density of houses.

No land capability classification, woodland ordination symbol, or pasture and hayland suitability group has been assigned.

Use and Management of the Soils

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

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

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the 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.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown under the heading "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

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 Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

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

At the end of each map unit description, the soil has been assigned to a pasture and hayland suitability group. These groups are based primarily on the suitability of the soil for certain pasture species, management needs, and potential productivity. Detailed interpretations for each pasture suitability group in the county are provided in the "Technical Guide," which is available in the local office of the Natural Resources Conservation Service.

Crops

Ray Rummell, district conservationist, Natural Resources Conservation Service, helped prepare this section.

In 1984, Jefferson County had 78,000 acres of farmland *(17)*. Approximately 26,100 acres of this farmland was used for the production of crops. Of this cropland, 5,000 acres was used for corn, 1,100 acres for oats, less than 1,000 acres for wheat, 19,000 acres for hay, and a relatively small number of acres for orchards.

The potential of the soils of Jefferson County for increased production of food is excellent. About 51,000 acres of potential cropland is used as woodland and about 23,900 acres as pasture *(26)*. Production can be increased by using the information in this survey and by applying the latest production techniques.

The acreage of farmland used for the production of crops increased by 2,600 acres in 1984 from the preceding year. The major increase was in corn production. Cropping patterns have also changed in recent years. Crop rotations that included 4 years or more of hay were a standard practice in most areas of cropland. This practice has changed somewhat with the major increase in corn production through the use of no-till farming or another system of conservation tillage that leaves crop residue on the surface. The addition of corn to some rotations, however, has caused excessive rates of erosion.

Various soil characteristics such as soil fertility, drainage, and tilth need special attention in Jefferson County. Reducing erosion, improving water quality, and improving forage production are also of concern to landowners and operators.

Soil erosion is the major problem in areas of cropland in the county. It is damaging in two ways. First, productivity is reduced because 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 Elba, Guernsey, and Lowell soils. Erosion also reduces productivity on soils that have a restricted root zone or are droughty. Examples are the Berks, Gilpin, and Steinsburg soils. Second, soil erosion results in sedimentation of lakes and streams and thus reduces water quality. Reducing the hazard of erosion improves the quality of water for municipal and recreational uses and for fish and wildlife.

Erosion-control practices provide a protective surface layer, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil losses to amounts that do not reduce the productive capacity of the soils. A conservation tillage system that leaves crop residue on the surface increases the rate of water infiltration and reduces the hazards of runoff and erosion. No-tillage is the most effective conservation tillage method when planting corn. It can be adapted to most of the soils in the survey area but is more difficult to use successfully on soils that have a silty clay loam surface layer, such as Elba, Guernsey, and Lowell soils, or on soils that drain slowly or moderately slowly, such as Fitchville Variant and Orrville soils.

About 28 percent of the cropland in Jefferson County needs some form of erosion control *(26)*. Contour stripcropping is one of the best methods to control erosion in the county. Cover crops and grassed waterways also help to control erosion. The grassed waterways, which are natural or constructed, help to dispose of surface water. Natural drainageways are the best sites for grassed waterways. They generally require minimal shaping when a good channel is designed. Channels should be wide and flat so that they can be easily crossed by farm machinery.

Soil fertility is naturally low in most of the soils in the county. It is especially low in Berks, Bethesda, Fairpoint, and Morristown soils. Soils that are commonly associated with outcrops of limestone bedrock are relatively high in natural fertility. Examples are the Elba and Guernsey soils. Nolin, Orrville, and Tioga soils, which are on flood plains, have medium or high natural fertility.

Almost all of the soils in the county are naturally acid in the surface layer. If the soils have never been limed, they require applications of ground limestone to raise the pH level sufficiently for alfalfa and other crops to grow well. Elba and Morristown soils commonly have a neutral or mildly alkaline surface layer. Applications of lime and fertilizer on all soils should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields.

Soil moisture is a critical management concern in areas of soils that have a high content of sand in the subsoil, such as Rigley and Steinsburg soils, and in areas of soils that have only a moderately deep root zone, such as Berks and Gilpin soils. Bethesda, Fairpoint, and Morristown soils also have a very low water-holding capacity. Yields of row crops and forages grown on these soils can be improved by applying practices that help to control runoff and reduce the rate of evaporation. These practices include a system of conservation tillage that leaves crop residue on the surface, winter cover crops, contour stripcropping, and crop rotations that include grasses and legumes.

Soil drainage is a major management concern only in the narrow areas along some streams. Some soils are naturally so wet that the production of crops common to the area is generally not possible without installing a drainage system. Examples are the Fitchville Variant and Orrville soils. Some soils on hillsides, such as Coshocton and Guernsey soils, have seepy areas that need random subsurface drains.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water. Soils with good tilth are granular and porous.

Most of the soils in the county have a surface layer of silt loam that has low to moderate organic matter content. Generally, the structure of such soils is weak or moderate, and intense rainfall causes the formation of a crust on the surface. When dry, this crust is hard and nearly impervious to water. It reduces the rate of water infiltration and increases the runoff rate. Conservation practices that add organic matter and help to maintain a protective vegetative cover on the surface improve soil structure and minimize crusting. Such practices include a conservation cropping system, a conservation tillage system, crop residue management, winter cover crops, and contour stripcropping.

Specialty crops grown in the county include nursery plants, produce from orchards, and Christmas trees. Soils that are characterized by good natural drainage and that warm up early in the spring are well suited to specialty crops. Examples are Richland and Wheeling soils along streams and Gilpin and Steinsburg soils on uplands.

Pasture

Ray Rummell, district conservationist, Natural Resources Conservation Service, helped prepare this section.

In 1985, about 35,900 acres in the county was used as pasture or hayland *(26)*. Most of the pasture and hayland is on hillsides adjacent to cultivated areas of less sloping soils. The soils that are used for pasture and hay formed in the underlying shale, siltstone, or sandstone bedrock. They are subject to erosion. The pasture and hayland dominantly support bluegrass and tall grasses. The tall grasses are tall fescue, orchardgrass, and timothy. Many pastures are unimproved and require renovation and brush and weed control.

Some pastures and meadows are overgrazed. Overgrazing has resulted in weedy pastures and in low forage production. The soils are subject to increased erosion because of the sparse, short vegetative cover. Soils in these fields frequently are acid and have low levels of phosphorus and potassium. In time, good management can restore the soils to a much higher level of productivity.

The successful establishment of forage crops requires the selection of quality seed of species and varieties adapted to the climate and the soils. Reseeding requires proper seedbed preparation, proper seeding methods and seeding times, and applications of recommended kinds and amounts of lime and fertilizer. The existing grass and weeds should be killed or suppressed before the desirable species are reseeded. The object is to kill the existing sod and leave it on or near the surface as a dead mulch, which can help to control erosion. Nearly level pastures can be plowed. The vegetation on gently sloping and strongly sloping soils should be killed or suppressed. The pasture should be tilled or seeded on the contour. Application of herbicides in conjunction with conservation tillage reduces the amount of tillage needed to kill the existing vegetation.

No-till seeding is effective on most of the soils in the county, except for the wetter soils. Before this method of seeding is used, the vegetation should be suppressed or killed by grazing and herbicides.

April or August is usually the best time for seeding. The forage species can be seeded with small grain, but in many areas forage production is reduced because of plant competition for light, moisture, and nutrients.

Seeding mixtures should be based on the soil type and the desired pasture management system. Legumes provide nitrogen, which improve the growth of grasses. Alfalfa and red clover should be seeded on soils that are characterized by good drainage. Ladino clover and alsike clover grow best on the wetter soils. Birdsfoot trefoil, bromegrass, lespedeza, warm-season grasses, and vetches are generally not grown as forage in the county.

Applying lime and fertilizer according to the results of soil tests ensures good productivity and lengthens the life of the stand. Weed control by mowing, clipping, and spraying is important for continued high production. Weeds should be mowed before they set seed. Control of insects, such as alfalfa weevil and potato leafhopper, may be necessary. If herbicides are used, all label restrictions should be observed. Harvesting hay, silage, or pasture plants at the proper stage of maturity helps to obtain the maximum quality feed.

Table 6 can be used by farmers, farm managers, conservationists, and extension agents in planning the use of the soil for pasture and hay crops. Soils that have a slope of more than 25 percent are generally not suited to pasture or hay. The soils in the county are assigned to pasture and hayland suitability groups. Soils that are assigned the same pasture and hayland suitability group symbol require the same general management and have about the same potential productivity. The suitability groups are based on soil characteristics and limitations that affect the growth of hay and pasture and are listed at the end of each map unit.

The soils assigned to group A have few limitations affecting the management and growth of climatically adapted plants. Those in group A-1 are deep and are well drained and moderately well drained. They have a surface layer of sandy loam, fine sandy loam, silty clay loam, or silt loam. The available water capacity ranges from moderate to high. Slopes range from 0 to 15 percent. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes in the stand.

The soils in group A-2 are deep and are well drained and moderately well drained. They have a surface layer of silty clay loam, fine sandy loam, sandy loam, or silt loam. The available water capacity is moderate. Slopes range from 15 to 25 percent. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes in the stand. The slope limits the mechanical application of lime and fertilizer. It also limits clipping, mowing, and spraying for weed control. Erosion is a hazard if the pasture is overgrazed or cultivated for reseeding. These soils are suited to no-till reseeding.

The soils in group A-3 are deep and are well drained and moderately well drained. They have a surface layer of silty clay loam or silt loam. The available water capacity is moderate. Slopes range from 25 to 40 percent. As a result, these soils are generally not suitable for pasture or hayland, but some grass pasture is produced.

The soils in group A-5 are deep and are well drained and moderately well drained. They are on flood plains and are frequently or occasionally flooded. The flooding limits these soils for pasture during periods of stream overflow, and the deposition of sediment by floodwater lowers the quality of the forage. These soils have a surface layer of loam or silt loam. The available water capacity is low to very high. Slopes are 0 to 3 percent.

The soils in group A-6 are deep, are well drained and moderately well drained, and are subject to frost action, which can damage legumes. Legume-grass mixtures are less likely to be damaged by frost heaving than pure stands of legumes. These soils have a surface layer of silt loam or silty clay loam. The available water capacity ranges from low to very high. Slopes range from 1 to 15 percent. These soils respond favorably to additions of lime and fertilizer. Frequent applications may be needed to maintain adequate pH and nutrient levels. These soils are suited to no-till reseeding.

The soils in group B are limited by droughtiness. Those in group B-1 are deep and well drained. They have a surface layer of silt loam, silty clay loam, very channery clay loam, very shaly clay loam, or very shaly silty clay loam. The available water capacity is low. Slopes range from 0 to 25 percent. These droughty soils are suited to tall grasses, such as tall fescue, orchardgrass, timothy, and bromegrass. They have a moderately deep root zone. Forage species that do not have a taproot system grow better because the root zone is limited. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes in the stand. The substratum of these soils is sandy or skeletal.

The soils in group B-2 are deep and well drained. They have a surface layer of silty clay loam or channery loam. The available water capacity is low. Slopes range from 25 to 40 percent. These soils generally are not suited to pasture or hay.

The soils in group C have a seasonal high water table. Those in group C-1 are deep and somewhat poorly drained. They have a surface layer of silt loam. The available water capacity ranges from low to high. Slopes range from 1 to 6 percent. Frost action may damage legumes. Including grasses in seeding mixtures minimizes the damage caused by frost heaving. A seasonal high water table limits the rooting depth of forage plants. Shallow-rooted species grow best on these soils. Subsurface drains lower the seasonal high water table. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes in the stand.

The soils in group C-3 are deep and are somewhat poorly drained and poorly drained. They are on flood plains and are frequently or occasionally flooded. The flooding limits these soils for pasture during periods of stream overflow, and the deposition of sediment by floodwater lowers the quality of the forage. These soils have a surface layer of silt loam. The available water capacity ranges from moderate to very high. Slopes range from 0 to 3 percent. Frost action may damage legumes. Including grasses in seeding mixtures minimizes the damage caused by frost heaving. A seasonal high water table limits the rooting depths of forage plants. Shallow-rooted species grow best on these soils. Subsurface drains lower the seasonal high water table. The effectiveness of the drains is limited by the position of the soils on the landscape.

The soils in group F have a root zone that extends to a depth of 20 to 40 inches. They are better suited to forage species that do not have a taproot system because the root zone is limited.

The soils in group F-1 are moderately deep and are well drained and moderately well drained. They have a surface layer of shaly silt loam, fine sandy loam, or silt loam. The available water capacity is very low or low. Slopes range from 3 to 25 percent. These droughty soils are suited to tall grasses, such as tall fescue, orchardgrass, bromegrass, and timothy. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes in the stand.

The soils in group F-2 are moderately deep and are well drained and moderately well drained. They have a surface layer of channery loam or shaly silt loam. The available water capacity is low or very low. Slopes range from 25 to 40 percent. These soils are generally unsuited to pasture and hay.

The soils in group F-3 are deep, are moderately well drained, and have a fragipan. They have a moderately deep root zone. Forage species that do not have a taproot system grow better because the root zone is limited. Plants on these soils respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. A low pH level in the subsoil shortens the life of some deep-rooted legumes in the stand. These soils have a surface layer of silt loam. The available water capacity is moderate or low in the root zone. Slopes range from 3 to 25 percent.

The soils in group H-1 are toxic or are on slopes of more than 40 percent. They are unsuited to pasture and hay.

Yields of orchardgrass-alfalfa hay and Kentucky bluegrass pasture are given in table 6. The yields given are those that can be expected under a high level of management. They may vary in any given year because of seasonal rainfall and other climatic factors. Grass yields are dependent on an adequate supply of nitrogen. The indicated yields cannot be achieved without applications of nitrogen fertilizer. An animal unit month (AUM) is the forage requirement for a mature cow with a calf for 1 month. Thus 6 AUM means that 1 acre can provide 6 months or 180 days of pasture for one mature cow with a calf. An AUM also is equal to 1,200 pounds of hay or the equivalent forage. A pasture calendar guide can provide the relative distribution of animal unit days on a monthly basis since they are not evenly distributed throughout the growing season.

Management of Disturbed Lands

Ray Rummell, district conservationist, Natural Resources Conservation Service, helped prepare this section.

In 1986, about 50,000 acres of land in Jefferson County had been affected by surface mining. About 78 percent of this land was mined prior to the 1972 Ohio reclamation law. It generally consists of graded and ungraded ridges and spoil piles in areas where no soil material has been replaced. The soils in these areas are mapped as Bethesda, Fairpoint, and Morristown soils. Because of the high content of coarse fragments and the low available water capacity, this land is generally unsuited to cropland and is poorly suited to pasture. It is used mostly as woodland and habitat for wildlife.

The legislation enacted in 1972 required the restoration of all land mined in the future. The land must be restored to the approximate original contour and blanketed with topsoil and subsoil from natural soils. Fairpoint silt loam, 3 to 15 percent slopes, and Morristown silty clay loam, 0 to 3 percent slopes, were reclaimed by this technique. Reclaimed soils make up about 10,930 acres in Jefferson County. They are better suited to agricultural production than unreclaimed mined land, but they still have limitations that need to be overcome.

The current law requires that soils identified as prime farmland be replaced in natural sequence to a depth of as much as 48 inches following mining. Most soils in surface-mined areas do not meet the requirements for prime farmland. As a result, most of the mined land is being reclaimed with a minimum of 6 inches of soil material overlying the spoil.

Soil properties must be considered in managing these soils. The organic matter content is considerably lower in formerly mined soils than in natural soils. A high bulk density is common in both the replaced soil material and the underlying graded spoil. The compaction is a result of the use of heavy machinery, especially wheeled reclamation equipment; excessive handling of topsoil material when it is stockpiled and spread; mining and reclamation activities performed under unfavorable moisture conditions; and insufficient time for soil-forming processes to decrease the bulk density. The high bulk density reduces the available water capacity and retards plant growth. As a result, it reduces crop yields.

Typically, the content of rock fragments in mine spoil is 35 to 60 percent, compared to 0 to 15 percent in the surface layer of most soils. Rock fragments reduce the thickness of the effective root zone and the available water capacity in formerly mined soils. Roots tend to concentrate in the profile where soil and rock fragments adjoin. Few roots penetrate the compact, massive spoil material.

Planting suitable forage species increases the organic matter content, improves soil structure, minimizes compaction, and increases the water infiltration rate, pore space, and root growth in formerly mined soils. Forage species are better soil-building crops than row crops. They are also more effective in reducing the susceptibility to runoff and erosion (fig. 10). Thin stands should be reseeded. Companion crops and conservation tillage seeding methods help to control erosion.

Formerly mined soils generally are unsuited to grazing in winter, when they are wet. Winter grazing can result in compaction and damage to the plants and can increase the erosion hazard. Frequent, light applications of fertilizer are better suited to these soils than larger applications because of the loss of plant nutrients through runoff and the concentration of roots in the upper few inches of the soils.

Reclamation practices that improve the suitability of formerly mined soils for agricultural use are as follows:

1. Blanketing the spoil with a thicker layer of natural soil material to increase the available water capacity

Figure 10.—Grasses and legumes help to control erosion and increase the rate of infiltration in a disturbed area of Morristown soils.

and the effective rooting depth. Each foot of replaced soil material increases the available water capacity by about 1 inch. Moisture retention studies show that most unreclaimed surface mine spoil, such as Bethesda very channery clay loam, 3 to 15 percent slopes, retains about one-fourth as much water as a natural soil, such as Wellston silt loam, 1 to 7 percent slopes.

2. Keeping the surface soil and subsoil separate and then replacing them in their natural sequence.

3. Minimizing soil compaction. The degree of soil compaction is influenced largely by soil texture, moisture conditions, organic matter content, and soil structure.

Soil compaction can be minimized by not stockpiling soil material if possible. The land should be reclaimed during the mining process. Spreading freshly scalped soil material on graded, formerly mined soils helps to prevent the compaction caused by stockpiling.

Spoil should not be graded when it is wet, and soil material should not be handled when it is wet. Grading the spoil and handling the soil material under wet conditions destroy soil structure and result in the formation of an impermeable zone with each layer that is replaced.

Final grading should be held to a minimum. The spoil and the soil material that is replaced should be graded only enough to ensure that slopes are smooth and the soil material is of an even thickness.

The proper equipment should be used, and reclamation activities should be carefully planned. Scraper pans generally have the desirable depth control for soil removal. Wheeled equipment, however, causes much more compaction than tracked equipment. The traffic pattern of wheeled equipment should be carefully controlled in order to minimize compaction. In most areas replacing the soil material beginning at the farthest point from the stockpile or soil removal site is necessary.

Nonessential traffic should be kept out of reclaimed areas. Limiting the traffic to designated roadways that have been built across the slope minimizes the extent of the compaction. When these roadways are no longer needed, they can be reclaimed by such special practices as subsoiling.

Deep tillage practices, such as subsoiling and chiseling, loosen up compacted soil. They break up the compacted layers and thus increase the movement of air and water. In reclaimed areas of prime farmland, both the replaced subsoil layer and topsoil layer may need deep tillage in separate operations during reclamation to avoid mixing the two layers.

4. Properly designing and constructing water-control systems that help to control runoff and erosion. Diversions reduce the length of the slope and thus reduce the velocity of runoff and the amount of erosion. They have been used successfully on slopes of as much as 30 percent in reclaimed areas.

A series of small, properly designed sediment-control structures in or immediately adjacent to the surface mined area is generally more practical than large impoundments away from the site. The smaller, onsite sediment-control structures can be removed after reclamation has been completed, and the sediment and the embankment material can be spread over the immediate area.

A mulch of hay or straw that is crimped into the soil by a straight blade disk helps to control erosion on short slopes. About 2 to 3 tons of mulch per acre is generally recommended. The higher rate is needed on steep slopes if erosion control is a primary objective.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit *(24)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

James T. Elze, service forester, Ohio Department of Natural Resources, helped prepare this section.

Approximately 57 percent of Jefferson County is wooded. The wooded acreage is mainly privately owned stands of timber and farm woodlots, but woodland near Jefferson Lake State Park, Fernwood State Forest, and Brush Creek Wildlife Area is state owned. The most extensive wooded areas are in the northern and eastern parts of the county.

The wooded areas mainly support mixed hardwoods. The major forest type is oak-hickory. The dominant woodland species are oak, hickory, ash, yellow-popular, black cherry, and red maple. Most of the wooded areas are on moderately steep to very steep soils that formed in material weathered from sandstone, shale, siltstone, or limestone. Gilpin, Lowell, Berks, and Hazleton soils are common in these areas. Much of the woodland is on slopes along streams and drainageways. Some tracts of land that formerly were used for hay and pasture are reverting to woodland.

Some of the woodland in the county demonstrates the outcome of poor management. Poor harvesting techniques have removed the best timber and left diseased, damaged, and low-value trees on many of the good woodland sites. In many wooded areas grapevines are killing or deforming valuable trees, thus lowering forest productivity. Cattle have been allowed to graze in wooded areas and have damaged some woodland by destroying leaf litter and desirable seedlings, damaging roots, and compacting the soil. Good management can restore these areas to a higher level of production. Additional information on woodland management can be obtained from the local offices of the Natural Resources Conservation Service and the Ohio Department of Natural Resources, Division of Forestry.

Soils differ greatly in their productivity for woodland. The factors that influence tree growth are essentially the same as those that affect annual crops and pasture. The major difference is that tree roots penetrate the soil to a greater depth, especially around rock fragments in the lower part of the profile. The aspect and the position of the soil on the landscape also are important factors.

The aspect is the compass direction in which a slope faces. North aspects are those slopes that have an azimuth of 355 to 95 degrees. South aspects have an azimuth of 96 to 354 degrees *(8)*. Trees grow better on north and east aspects, which are less exposed to the prevailing winds and to direct sunrays and thus have more soil moisture. Some of the factors that make south and west aspects less productive are a higher soil temperature, a higher evaporation rate, earlier snowmelt, and more freezing and thawing.

The position of the soil on the landscape is important in determining the amount of moisture available for tree growth. The supply of soil moisture commonly increases as elevation on a slope decreases, partly because of seepage downslope. The lower part of the slope has deeper soils, more moisture available to plants, less evaporation, and lower soil temperatures.

The slope is another important factor affecting woodland management. Steep and very steep slopes seriously limit the use of equipment. As the percent of slope increases, the rate of water infiltration decreases and the rate of runoff and the hazard of erosion increase.

Erosion reduces the amount of soil available for water storage. Severe erosion removes the surface layer and exposes the less porous subsoil, thus increasing the runoff rate and lowering the rate of water infiltration. Under these conditions, tree growth and natural reseeding are adversely affected.

Soil reaction and fertility influence the growth of different kinds of trees. For example, black walnut trees grow well on Tioga, Nolin, Wheeling, and other soils that have a higher, natural content of lime in the root zone than other soils. Growth is slower on the less fertile soils.

Christmas trees are grown in some areas of the county. They can grow well on many of the soils but are adversely affected by various soil properties. Managing and harvesting the trees are difficult on steep and very steep soils. Strongly sloping or gently sloping soils are the preferred sites for growing Christmas trees. Some spruces and firs are susceptible to frost damage and do not grow well in narrow valleys that are prone to frost late in the spring. The drainage and texture of the soils greatly affect the species that can be successfully grown. For example, blue spruce and Fraser fir do not grow well on poorly drained and somewhat poorly drained soils, such as Fitchville Variant and Orrville soils. Fraser fir also does not grow well on soils that have a fine textured subsoil, such as the Elba soils. Other factors that affect the species that can be successfully grown are the fertility of the soil, available water capacity, the potential for frost action, and the depth to bedrock. Wellston soils are better suited to spruce and fir than the Berks soils because they are naturally more fertile, have a higher available water capacity, and are deeper over bedrock.

Tables 8 and 9 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. Table 8 lists the ordination symbol for each suitable 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 an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excessive water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, high content of coarse fragments in the soil profile; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site 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.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suited to the soils and to commercial wood production.

Table 9 gives the degree and kinds of limitations that affect the operation of equipment used in tree harvesting and in the regeneration of woodland. Ratings are given for haul roads, log landings, skid trails and logging areas, and site preparation and planting. The limitations are considered *slight* if the physical site characteristics impose little or no limitations on kind of equipment or time of operation; *moderate* if physical site characteristics impose some limitations on the kind of equipment or the time of operation, or both; and *severe* if physical site conditions are such that special equipment or special logging techniques are needed or the time of efficient operation is very limited.

Haul roads are access roads leading from log landings to primary or surfaced roads. Generally, these are unpaved roads that are not graveled. The ratings are based on soil properties, site features, and observed performance of the soils. Wetness, rockiness, depth to hard bedrock, stoniness, soil strength, slope, soil texture, and flooding should be considered in selecting routes for haul roads. Wetness and flooding affect the duration of use. Rock outcrops, stones, and boulders, which are difficult to move, hinder the construction when cutting and filling is needed. Soil strength, as inferred from the AASHTO group index and AASHTO group, is a measure of the traffic-supporting capacity of the soil. Slope affects the use of equipment and the cutting and filling requirements of the site.

Log landings are areas where logs are assembled for transportation. The best sites for landings require little or no surface preparation, which consists of cutting and filling. Considerable soil compaction can be expected in these areas. The ratings are based on the soil properties, site features, and the observed performance of the soils. Wetness, flooding, rockiness, stoniness, slope, depth to hard bedrock, soil strength, soil texture, and content of coarse fragments should be considered in selecting sites for log landings. Wetness and flooding affect the duration of use. Rock outcrops, stones, and boulders, which are difficult to move, affect the use of equipment and affect the configuration and location of landings. Depth to hard bedrock is a problem where cutting and filling is required. Slope affects the use of equipment and the cutting and filling requirements of the site. Soil texture affects trafficability. Soil strength, as inferred from the AASHTO group index and AASHTO group, is a measure of the traffic-supporting capacity of the soil.

Skid trails and *logging areas* include the areas from the stumps to the log landings that are partially or completely logged with rubber-tired equipment. Other types of log-moving equipment can sometimes be used to minimize or overcome the site limitations. The ratings are based on soil properties, site features, and the observed performance of the soils. Wetness, flooding, rockiness, stoniness, texture, and slope affect the use of logging equipment. Deferring logging activities during periods when the soil is saturated at or near the surface helps to minimize environmental damage. Special equipment is usually required during these periods. Soils that are subject to flooding of long duration should not be logged because logging activities can damage the equipment or the environment, or both. Surface stones, boulders, and rock outcrops limit the efficient and safe use of equipment. As slope gradients increase, traction problems worsen. Traction is a problem on clayey soils during wet periods and on sandy soils during dry periods. Unless frozen, organic soils are severely damaged by the use of rubber-tired or tracked equipment.

Site preparation and *planting* are mechanized operations. The ratings are based on the limitations affecting the efficient use of equipment and on the hazards that can result to the site when the equipment is used. It is assumed that the operating techniques used do not displace or remove topsoil from the site or create channels in which storm runoff can concentrate. Wetness, flooding, rockiness, stoniness, the content of coarse fragments, depth to hard bedrock, texture, and slope affect the use of site preparation and planting equipment. Deferring site preparation and planting during periods when the soil is saturated at or near the surface helps to minimize environmental damage. Special equipment is usually required during these periods. Equipment should not be used on soils that are subject to flooding of long duration. Operating equipment on these soils can result in equipment damage or environmental damage, or both. Surface stones, boulders, and rock outcrops limit the efficient and safe use of equipment. Coarse fragments and hard bedrock at very shallow depths can interfere with equipment used in site preparation and planting. As slope gradients increase, traction problems worsen. Traction is a problem on clayey soils during wet periods and on sandy soils during dry periods.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly deciduous shrubs and evergreen trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service, the Ohio Department of Natural Resources, Division of Forestry, and the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, 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 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

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

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

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

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

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

Wildlife Habitat

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 12, 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 flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

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

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

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

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

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

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

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

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

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

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

Engineering

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

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 13 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 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 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, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock 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 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 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 resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, 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 should be considered.

The ratings in table 14 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 landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to 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 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration.

The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally perferred 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 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for 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 control 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 soil blowing 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 soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. Some of these results are reported in table 20.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

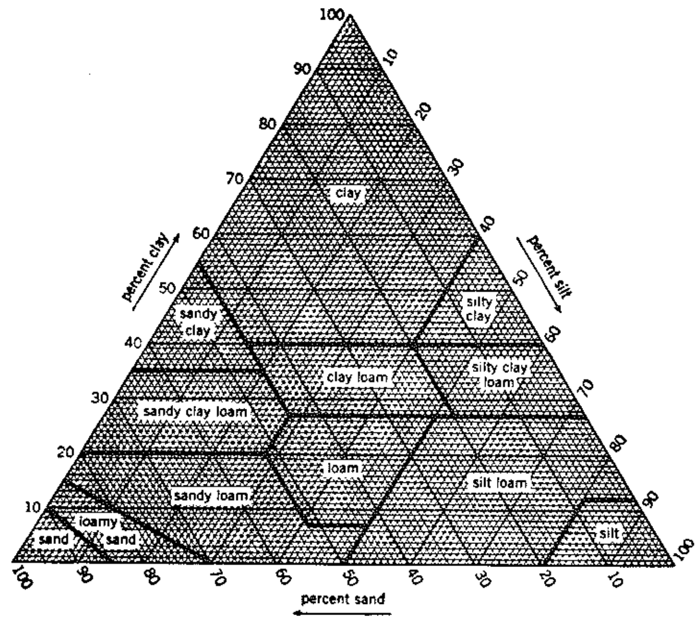

Figure 11.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 11). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(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, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

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 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.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 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 infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the 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 results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Samples of many of the soils in Jefferson County were analyzed by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The data obtained on most samples include those on particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of these soils and in evaluating their behavior under various land uses. Seven of the profiles were selected as representative for the respective series and are described in this survey. These series and their laboratory identification numbers are Berks (JF-20), Brookside (JF-19), Elba (JF-21), Gilpin (JF-16), Guernsey (JF-18), Lowell (JF-22), and Steinsburg (JF-17).

In addition to the Jefferson County data, data are also available from nearby counties in eastern Ohio. All of these data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Natural Resources Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); and Moisture density—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(25)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is 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 has a humid 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. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size 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" *(27)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(25)*. 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."

Berks Series

The Berks series consists of moderately deep, well drained, moderately permeable or moderately rapidly permeable soils on ridgetops and side slopes in the uplands. These soils formed in material weathered from shale, siltstone, and fine grained sandstone. Slopes range from 3 to 70 percent.

Berks soils are similar to Dekalb and Hazleton soils and are commonly adjacent to Coshocton, Gilpin, Guernsey, and Westmoreland soils on ridgetops and side slopes. Dekalb and Hazleton soils have more sand in the subsoil than the Berks soils. Coshocton, Gilpin, Guernsey, and Westmoreland soils have an argillic horizon. Also, they have fewer coarse fragments in the subsoil than the Berks soils. Hazleton, Coshocton, and Westmoreland soils are deep over bedrock. Coshocton and Guernsey soils are moderately well drained and have low-chroma mottles in the subsoil.

Typical pedon of Berks shaly silt loam, in an area of Berks-Guernsey complex, 15 to 25 percent slopes, about 3 miles southeast of Annapolis, in Salem Township, about 590 feet west and 1,340 feet south of the northeast corner of sec. 19, T. 10 N., R. 3 W.

Ap—0 to 5 inches; brown (10YR 4/3) shaly silt loam, light brownish gray (2.5Y 6/2) dry; moderate medium and fine granular structure; very friable; many roots; about 25 percent coarse fragments; neutral; abrupt smooth boundary.

Bw1—5 to 14 inches; brownish yellow (10YR 6/6) very shaly silt loam; weak medium subangular blocky structure; friable; common roots; about 40 percent coarse fragments; medium acid; clear smooth boundary.

Bw2—14 to 23 inches; yellowish brown (10YR 5/4) extremely shaly loam; weak medium subangular blocky structure; friable; few roots; about 65 percent coarse fragments; strongly acid; clear wavy boundary.

R—23 to 25 inches; rippable shale bedrock.

The thickness of the solum ranges from 18 to 36 inches, and the depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments ranges from 15 to 50 percent in the upper part of the Bw horizon, from 35 to 75 percent in the lower part, and from 50 to 90 percent in the C horizon.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly shaly silt loam, but it is silt loam in some pedons. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is the shaly to extremely shaly analogs of loam or silt loam. The content of clay in the Bw horizon ranges from 18 to 27 percent. The C horizon, if it occurs, has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4.

Bethesda Series

The Bethesda series consists of deep, well drained, moderately slowly permeable soils on ridgetops, benches, and side slopes in mine spoil areas. These soils formed in a mixture of partly weathered fine-earth material and fragments of shale, siltstone, and sandstone. Slopes range from 3 to 70 percent.

Bethesda soils are similar to Fairpoint and Morristown soils and are commonly adjacent to Lowell and Westmoreland soils. Fairpoint and Morristown soils are less acid in the substratum than the Bethesda soils. Lowell and Westmoreland soils formed in colluvium and residuum in unmined areas. They have an argillic horizon.

Typical pedon of Bethesda very channery clay loam, 25 to 70 percent slopes, about 3 miles north of New Alexandria in Cross Creek Township, about 50 feet east and 315 feet south of the northwest corner of sec. 9, T. 6 N., R. 2 W.

A—0 to 2 inches; dark grayish brown (10YR 4/2) very channery clay loam, light gray (2.5Y 7/2) dry; weak medium and fine granular structure; friable; common very fine roots; about 35 percent coarse fragments; very strongly acid; abrupt smooth boundary.

C1—2 to 19 inches; variegated 50 percent brown (10YR 5/3), 35 percent dark gray (10YR 4/1), and 15 percent yellowish brown (10YR 5/4) very channery clay loam; massive; friable; common very fine roots; about 50 percent coarse fragments; very strongly acid; gradual smooth boundary.

C2—19 to 36 inches; variegated 50 percent dark olive gray (5Y 3/2), 40 percent brown (10YR 5/3), and 10 percent yellowish brown (10YR 5/6) very channery clay loam; massive; friable; few very fine roots; about 50 percent coarse fragments; very strongly acid; gradual smooth boundary.

C3—36 to 60 inches; variegated 75 percent brown (10YR 5/3), 15 percent dark olive gray (5Y 3/2), and 10 percent gray (10YR 6/1) very channery clay loam; massive; friable; about 60 percent coarse fragments; very strongly acid.

The content of coarse fragments in the C horizon to a depth of 40 inches ranges from 35 to 60 percent. Rock fragments are generally less than 10 inches in diameter, but some are larger in size.

The A horizon has hue of 10YR to 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is dominantly very channery clay loam but is shaly clay loam in some pedons. In reclaimed areas the surface layer is silt loam. The C horizon has hue of 7.5YR or 5Y or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 6. The fine-earth fraction is clay loam, silty clay loam, silt loam, or loam.

Brookside Series

The Brookside series consists of deep, moderately well drained, moderately slowly permeable soils on foot slopes, in coves at the head of drainageways, on fans, and on benches in the uplands. These soils formed in colluvium weathered from interbedded shale, siltstone, limestone, and sandstone. The colluvium has been mixed by downslope movement. Slopes range from 8 to 40 percent.

Brookside soils are similar to Elba, Guernsey, and Lowell soils and are commonly adjacent to Morristown, Nolin, and Lowell soils. Elba and Lowell soils are well drained and are commonly on side slopes above the Brookside soils. Guernsey soils formed in residuum and colluvium and have mottles closer to the surface than those of the Brookside soils. Morristown and Nolin soils do not have an argillic horizon. Nolin soils formed in silty alluvium. They are lower on the landscape than the Brookside soils. Morristown soils formed in calcareous spoil material in mined areas. They are higher on the landscape than the Brookside soils.

Typical pedon of Brookside silty clay loam, 15 to 25 percent slopes, about 1.7 miles northeast of Dillonvale, in Warren Township, 370 feet west and 1,584 feet north of the southeast corner of sec. 31, T. 5 N., R. 2 W.

Ap—0 to 7 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to moderate medium and fine granular; friable; common very fine roots; few coarse fragments; neutral; abrupt smooth boundary.

Bt1—7 to 19 inches; yellowish brown (10YR 5/6) clay; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent randomly oriented coarse fragments; slightly acid; clear smooth boundary.

Bt2—19 to 29 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium angular blocky; firm; few very fine roots; common faint brown (10YR 5/3) clay films on faces of peds; about 5 percent randomly oriented coarse fragments; slight effervescence in places; neutral; clear smooth boundary.

Bt3—29 to 39 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; few faint brown (10YR 5/3) clay films on faces of peds; about 10 percent randomly oriented coarse fragments; slight effervescence; mildly alkaline; gradual smooth boundary.

BC—39 to 48 inches; brown (10YR 5/3) silty clay loam; common fine faint grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few faint brown (10YR 5/3) clay films on faces of peds; common medium white (10YR 8/1) weathered limestone remnants; about 5 percent randomly oriented coarse fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

C—48 to 60 inches; brown (10YR 5/3) silty clay loam; common fine faint grayish brown (10YR 5/2) mottles; massive; firm; common medium white (10YR 8/1) limestone remnants; about 10 percent randomly oriented coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 54 inches, and the depth to bedrock ranges from 60 to more than 120 inches. The content of randomly oriented coarse fragments of sandstone, siltstone, and shale ranges from 5 to 20 percent in the B horizon and from 5 to 30 percent in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly silty clay loam but is silt loam in some pedons. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is silty clay loam, silty clay, clay, or the shaly or channery analogs of those textures. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, silty clay, clay, or the shaly or channery analogs of those textures.

Chavies Series

The Chavies series consists of deep, well drained, moderately rapidly permeable soils on terraces along streams. These soils formed in old alluvium. Slopes range from 0 to 3 percent.

Chavies soils are commonly adjacent to Omulga soils. Omulga soils are slightly higher on the landscape than the Chavies soils. They are moderately well drained and have a fragipan.

Typical pedon of Chavies fine sandy loam, in an area of Urban land-Chavies complex, 0 to 3 percent slopes, about 2.8 miles north of Steubenville, in Island Creek Township, 1,320 feet west and 2,112 feet south of the northeast corner of sec. 32, T. 3 N., R. 1 W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) fine sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; many very fine roots; few coarse fragments; very strongly acid; clear wavy boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/6) fine sandy loam; weak coarse subangular blocky structure; friable; few very fine roots; few faint yellowish brown (10YR 5/6) clay films bridging sand grains and few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; common medium dark yellowish brown (10YR 4/4) krotovinas; very strongly acid; clear smooth boundary.

Bt1—12 to 22 inches; brown (7.5YR 5/4) fine sandy loam; moderate medium and coarse subangular blocky structure; friable; few very fine roots; many faint brown (7.5YR 5/4) clay films bridging sand grains; common distinct dark yellowish brown (10YR 4/4) coatings in root channels; common medium faint strong brown (7.5YR 5/6) and common medium distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt2—22 to 36 inches; brown (7.5YR 5/4) fine sandy loam; weak medium and coarse subangular blocky structure; friable; many faint brown (7.5YR 5/4) clay films bridging sand grains; common medium distinct strong brown (7.5YR 5/8) and common medium distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt3—36 to 46 inches; dark brown (7.5YR 4/4) fine sandy loam; weak coarse subangular blocky structure; friable; common faint brown (7.5YR 5/4) clay films bridging sand grains; common medium distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

C1—46 to 52 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; strongly acid; clear smooth boundary.

C2—52 to 55 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grain; loose; about 30 percent coarse fragments; strongly acid; clear smooth boundary.

C3—55 to 60 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; about 5 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 30 to 50 inches. The content of coarse fragments ranges from 0 to 10 percent in the solum and from 0 to 30 percent in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. It is dominantly fine sandy loam but is loam or silt loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is typically fine sandy loam, but in some pedons it has subhorizons of loam or silt loam. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand or the gravelly or very gravelly analogs of loamy sand.

Clarksburg Series

The Clarksburg series consists of deep, moderately well drained soils on foot slopes and on benches in the uplands. These soils formed in colluvium. They have a fragipan. Permeability is moderate above the fragipan and moderately slow or slow in and below the fragipan. Slopes range from 15 to 25 percent.

Clarksburg soils are commonly adjacent to Lowell, Richland, and Westmoreland soils. The well drained Lowell and Westmoreland soils are commonly on very steep side slopes above the Clarksburg soils. They do not have a fragipan. Lowell soils have more clay in the subsoil than the Clarksburg soils. The well drained Richland soils are commonly on fans below the Clarksburg soils.

Typical pedon of Clarksburg silt loam, 15 to 25 percent slopes, about 3.1 miles north of Steubenville, in Island Creek Township, 360 feet south and 1,630 feet west of the northeast corner of sec. 32, T. 3 N., R. 1 W.

Ap—0 to 5 inches; dark brown (10YR 3/3) silt loam, gray (10YR 6/1) dry; moderate medium and fine granular structure; very friable; common very fine and few fine roots; about 10 percent coarse fragments; very strongly acid; abrupt wavy boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common very fine and few fine roots; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—10 to 22 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium subangular blocky structure; firm; few very fine roots; few faint yellowish brown clay films in pores; few faint brownish yellow (10YR 6/6) silt coatings on faces of peds; about 20 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—22 to 30 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium subangular blocky structure; firm; few very fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; few faint brownish yellow (10YR 6/6) silt coatings on vertical faces of peds; about 25 percent coarse fragments; few fine very dark gray (10YR 3/1) iron and manganese concretions; strongly acid; clear smooth boundary.

Bt3—30 to 38 inches; strong brown (7.5YR 5/6) channery silt loam; common fine prominent light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few very fine roots; common faint brown (10YR 5/4) clay films on faces of peds; many faint brownish yellow (10YR 6/6) silt coatings on vertical faces of peds; about 20 percent coarse fragments; common fine very dark gray (10YR 3/1) iron and manganese concretions; very strongly acid; clear smooth boundary.

Btx—38 to 48 inches; strong brown (7.5YR 5/6) channery loam; common fine prominent grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure; very firm, brittle; few roots in vertical seams; few faint brown (7.5YR 5/4) clay films on faces of peds; many faint light yellowish brown (10YR 6/4) silt coatings on yellowish brown (10YR 5/8) borders along vertical seams; about 25 percent coarse fragments; common fine very dark gray (10YR 3/1) iron and manganese stains; very strongly acid; abrupt smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/6) channery loam; massive; friable; about 20 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. Depth to the fragipan ranges from 20 to 40 inches. The depth to bedrock is more than 60 inches. The content of coarse fragments of shale, siltstone, or sandstone ranges from 2 to 25 percent in horizons above the fragipan and from 5 to 30 percent in the fragipan and in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly silt loam but is channery silt loam in some pedons. The Bt horizon has chroma of 4 to 6. It is silt loam, loam, silty clay loam, or the channery analogs of those textures. The Btx horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam, loam, or the channery analogs of those textures. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. It is silt loam, loam, clay loam, silty clay loam, or the channery analogs of those textures.

Coshocton Series

The Coshocton series consists of deep, moderately well drained, slowly permeable or moderately slowly permeable soils on ridgetops, foot slopes, and hillsides in the uplands. These soils formed in colluvium and in material weathered from shale and siltstone. Slopes range from 1 to 25 percent.

Coshocton soils are similar to Westmoreland soils and are commonly adjacent to Gilpin and Westmoreland soils. Gilpin and Westmoreland soils are well drained and do not have low-chroma mottles in the subsoil. Gilpin soils are in gently sloping to moderately steep areas on uplands and are moderately deep over bedrock. Westmoreland soils are on steep and very steep side slopes.

Typical pedon of Coshocton silt loam, in an area of Gilpin-Coshocton silt loams, 8 to 15 percent slopes, about 1.6 miles west of Emerson, in Mt. Pleasant Township, 870 feet north and 1,880 feet east of the southwest corner of sec. 29, T. 7 N., R. 3 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many very fine roots; about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt1—9 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common very fine roots; few faint brown (10YR 5/3) clay films on faces of peds; about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—16 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; friable; few very fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; strongly acid; clear smooth boundary.

Bt3—20 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; many fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure; firm; few very fine roots; many distinct grayish brown (10YR 5/2) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt4—27 to 36 inches; yellowish brown (10YR 5/6) shaly silty clay loam; many medium prominent gray (10YR 6/1) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; many distinct gray (10YR 6/1) clay films on faces of peds; about 20 percent coarse fragments; very strongly acid; clear smooth boundary.

BC—36 to 42 inches; yellowish brown (10YR 5/4) shaly clay loam; common fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; about 30 percent coarse fragments; strongly acid; gradual smooth boundary.

C1—42 to 54 inches; yellowish brown (10YR 5/4) very shaly clay loam; common fine distinct grayish brown

(10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 40 percent coarse fragments; strongly acid; gradual smooth boundary.

C2—54 to 60 inches; yellowish brown (10YR 5/6) shaly silty clay loam; common medium prominent gray (10YR 5/1) mottles; massive; firm; about 30 percent coarse fragments; streaks of very dark gray (10YR 3/1) coal; strongly acid.

The thickness of the solum ranges from 30 to 50 inches, and the depth to bedrock ranges from 40 to more than 72 inches. The content of coarse fragments of shale, siltstone, or sandstone ranges from 2 to 15 percent in the upper part of the solum, from 15 to 35 percent in the lower part of the solum, and from 20 to 50 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. It is dominantly silt loam but is loam in some pedons. The Bt horizon generally has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. In some pedons it has hue of 2.5Y and chroma of 2 or 3 in the lower part. The upper part of the Bt horizon is silty clay loam, silt loam, or clay loam, and the lower part is silty clay, silty clay loam, clay loam, or the shaly or channery analogs of those textures. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, silty clay, clay loam, or the shaly, very shaly, channery, or the very channery analogs of those textures.

Dekalb Series

The Dekalb series consists of moderately deep, well drained, rapidly permeable soils on side slopes in the uplands. These soils formed in material weathered from sandstone. Slopes range from 25 to 70 percent.

Dekalb soils are similar to Berks and Hazleton soils and commonly are adjacent to Gilpin and Westmoreland soils. Berks soils have less sand in the solum than the Dekalb soils. Hazleton and Westmoreland soils are deep over bedrock. Gilpin and Westmoreland soils have fewer coarse fragments in the subsoil than the Dekalb soils. They have an argillic horizon and are on ridgetops and side slopes.

Typical pedon of Dekalb channery loam, 40 to 70 percent slopes, about 1.9 miles southeast of Mt. Pleasant, in Mt. Pleasant Township, 79 feet north and 2,218 feet west of the southeast corner of sec. 4, T. 7 N., R. 3 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) channery loam, light brownish gray (10YR 6/2) dry; weak medium and fine granular structure; very friable; common fine and very fine roots; about 25 percent coarse fragments; very strongly acid; abrupt irregular boundary.

Bw1—5 to 11 inches; strong brown (7.5YR 5/6) very channery sandy loam; weak medium and fine subangular blocky structure; very friable; common very fine roots; about 35 percent coarse fragments; very strongly acid; clear smooth boundary.

Bw2—11 to 21 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak fine subangular blocky structure; very friable; few very fine roots; about 50 percent coarse fragments; very strongly acid; clear wavy boundary.

R—21 to 23 inches; sandstone bedrock that is fractured in the upper few inches.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of coarse fragments ranges from 15 to 60 percent in individual horizons of the solum. Some pedons have a C horizon. The content of coarse fragments in that horizon ranges from 50 to 90 percent.

The Ap horizon has value of 3 or 4 and chroma of 1 to 4. The Bw horizon has value of 5 or 6 and chroma of 4 to 8. It is the channery or very channery analogs of loam or sandy loam. The content of clay in the Bw horizon ranges from 7 to 18 percent. The C horizon, if it occurs, has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. It is the very channery or extremely channery analogs of sandy loam or loamy sand.

Elba Series

The Elba series consists of deep, well drained, slowly permeable soils on side slopes and ridgetops in the uplands. These soils formed in material weathered from limestone and gray, calcareous shale. Slopes range from 8 to 25 percent.

Elba soils are similar to Brookside, Guernsey, and Lowell soils and are commonly adjacent to Gilpin, Morristown, and Lowell soils. Brookside and Guernsey soils are moderately well drained and have low-chroma mottles in the subsoil. Guernsey and Lowell soils are deeper to carbonates. Lowell soils are in landscape positions similar to those of the Elba soils. Morristown soils formed in partly weathered fine-earth material and rock fragments in areas that have been surface mined for coal. The moderately deep Gilpin soils have less clay and are more acid in the subsoil than the Elba soils. They are in gently sloping to moderately steep areas on uplands.

Typical pedon of Elba silty clay loam, 15 to 25 percent slopes, eroded, about 1.9 miles west of Smithfield, in Smithfield Township, 343 feet east and 1,953 feet south of the northwest corner of sec. 17, T. 8 N., R. 3 W.

Ap—0 to 7 inches; brown (10YR 5/3) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; friable; many very fine roots; specks of light olive brown (2.5Y 5/4) Bt material; neutral; abrupt smooth boundary.

Bt1—7 to 14 inches; yellowish brown (10YR 5/4) silty clay; moderate fine angular blocky structure; firm; few very fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few fine dark brown (7.5YR 4/4) nodules of iron and manganese oxide; few coarse fragments; slightly acid; clear smooth boundary.

Bt2—14 to 19 inches; yellowish brown (10YR 5/4) and brown (7.5YR 4/4) silty clay; moderate medium and fine angular blocky structure; firm; few very fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few fine dark brown (7.5YR 4/4) nodules of iron and manganese oxide; few coarse fragments; neutral; clear smooth boundary.

Bt3—19 to 28 inches; brown (7.5YR 4/4) and yellowish brown (10YR 5/6) silty clay; weak medium subangular blocky structure; firm; few very fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent grayish brown (10YR 5/2) soft shale fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C1—28 to 41 inches; olive brown (2.5Y 4/4) and brown (7.5YR 4/4) silty clay; massive; friable; about 5 percent grayish brown (10YR 5/2) soft shale fragments; strong effervescence; moderately alkaline; clear smooth boundary.

C2—41 to 72 inches; light olive brown (2.5Y 5/4) silty clay; massive; friable; about 10 percent coarse fragments; strong effervescence; moderately alkaline; clear smooth boundary.

Cr—72 to 74 inches; light olive brown (2.5Y 5/4) shale bedrock.

The thickness of the solum ranges from 24 to 48 inches. The depth to bedrock ranges from 40 to 80 inches, and the depth to carbonates ranges from 10 to 30 inches. The content of limestone and shale fragments ranges from 0 to 15 percent, by volume, in the A horizon, from 0 to 35 percent in the Bt horizon, and from 5 to 45 percent in the C horizon.

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 is silty clay in some severely eroded pedons. The B horizon has hue of 7.5YR to 2.5Y and chroma of 3 to 6. It is clay, silty clay, silty clay loam, or the shaly or channery analogs of those textures. The C horizon has hue of 7.5YR to 2.5Y and chroma of 1 to 4. It is clay, silty clay, silty clay loam, or the shaly, very shaly, or very channery analogs of those textures.

Fairpoint Series

The Fairpoint series consists of deep, well drained, moderately slowly permeable soils on ridgetops, benches, and side slopes in mine spoil areas. These soils formed in a mixture of partly weathered fine-earth material and fragments of shale, siltstone, and sandstone. Slopes range from 3 to 70 percent.

Fairpoint soils are similar to Bethesda and Morristown soils and are commonly adjacent to Berks and Westmoreland soils. Bethesda soils are more acid in the C horizon than the Fairpoint soils, and Morristown soils are mildly alkaline or moderately alkaline in the C horizon. Berks soils formed in residuum, and Westmoreland soils formed in colluvium and material weathered from shale, siltstone, and sandstone. Berks and Westmoreland soils are on ridgetops and side slopes in unmined areas. Berks soils are moderately deep over bedrock and have a cambic horizon. Westmoreland soils have an argillic horizon.

Typical pedon of Fairpoint very shaly clay loam, 25 to 70 percent slopes, about 1.7 miles east of Bergholz, in Ross Township, 115 feet north and 2,700 feet west of the southeast corner of sec. 34, T. 11 N., R. 3 W.

A—0 to 2 inches; dark yellowish brown (10YR 4/4) very shaly clay loam, light yellowish brown (2.5Y 6/4) dry; weak medium and fine granular structure; very friable; many fine roots; about 35 percent coarse fragments; medium acid; abrupt smooth boundary.

C1—2 to 11 inches; variegated 80 percent yellowish brown (10YR 5/4) and 20 percent strong brown (7.5YR 5/6) very shaly clay loam; massive; friable; common fine roots; about 40 percent coarse fragments; medium acid; clear smooth boundary.

C2—11 to 31 inches; variegated 70 percent yellowish brown (10YR 5/4) and 30 percent strong brown (7.5YR 5/6) very shaly loam; massive; friable; few very fine roots; about 50 percent coarse fragments; medium acid; clear smooth boundary.

C3—31 to 44 inches; variegated 85 percent yellowish brown (10YR 5/6) and 15 percent brown (7.5YR 5/4) very shaly clay loam; massive; friable; few very fine roots; about 35 percent coarse fragments; medium acid; clear smooth boundary.

C4—44 to 60 inches; variegated 70 percent yellowish brown (10YR 5/4) and 30 percent yellowish brown (10YR 5/8) very shaly loam; massive; friable; about 45 percent coarse fragments; slightly acid.

The content of coarse fragments in the C horizon to a depth of 40 inches ranges from 35 to 60 percent.

Rock fragments generally are less than 10 inches in diameter, but some are larger in size.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is dominantly very shaly clay loam, but it is shaly clay loam or channery clay loam in some pedons. In reclaimed areas the surface layer is silt loam. The C horizon has hue of 7.5YR to 2.5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 8. It is the very channery or very shaly analogs of loam, clay loam, or silty clay loam.

Fitchville Variant

The Fitchville Variant consists of deep, somewhat poorly drained, moderately slowly permeable soils on alluvial fans and low terraces along streams. These soils formed in stratified old alluvium. Slopes range from 1 to 6 percent.

Fitchville Variant soils commonly are adjacent to Berks, Gilpin, Richland, Tioga, and Westmoreland soils, all of which are well drained and do not have low-chroma mottles in the upper part of the subsoil. Berks, Gilpin, and Westmoreland soils are on the side slopes of stream terraces in the uplands. Richland soils are on alluvial fans and on low terraces. Tioga soils are on flood plains. They have more sand and less clay in the subsoil than the Fitchville Variant soils, and they have a cambic horizon.

Typical pedon of Fitchville Variant silt loam, 1 to 6 percent slopes, about 1.6 miles north of Richmond, in Salem Township, 1,230 feet north and 1,360 feet west of the southeast corner of sec. 12, T. 10 N., R. 3 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; moderate medium and fine granular structure; friable; common very fine roots; about 2 percent coarse fragments; very strongly acid; abrupt smooth boundary.

BE—9 to 13 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct brown (10YR 5/3) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few very fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds; common medium very dark gray (10YR 3/1) iron and manganese concretions; strongly acid; clear smooth boundary.

Bt1—13 to 18 inches; yellowish brown (10YR 5/6) silt loam; common fine prominent grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few very fine roots; few faint yellowish brown (10YR 5/4) clay films and many distinct grayish brown (10YR 5/2) coatings on faces of peds; common medium very dark gray (10YR 3/1) iron and manganese concretions; strongly acid; clear smooth boundary.

Bt2—18 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; common fine prominent grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure; firm; few very fine roots; few faint brown (10YR 5/3) clay films and many distinct grayish brown (10YR 5/2) coatings on faces of peds; common medium very dark gray (10YR 3/1) iron and manganese concretions; strongly acid; clear smooth boundary.

Bt3—23 to 31 inches; yellowish brown (10YR 5/6) and brown (7.5YR 4/4) clay loam; common fine prominent grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure; firm; few very fine roots; few distinct brown (7.5YR 5/2) clay films and many distinct grayish brown (10YR 5/2) coatings on faces of peds; few coarse fragments; common medium very dark gray (10YR 3/1) iron and manganese concretions; strongly acid; abrupt wavy boundary.

Bt4—31 to 37 inches; brown (7.5YR 4/4) and strong brown (7.5YR 5/6) very gravelly clay loam; common fine prominent grayish brown (10YR 5/2) mottles; moderate medium prismatic structure; firm; few distinct brown (7.5YR 5/2) clay films and common distinct grayish brown (10YR 5/2) coatings on faces of peds; about 45 percent gravel; few fine and medium very dark gray (10YR 3/1) concretions; medium acid; abrupt wavy boundary.

BC—37 to 53 inches; brown (7.5YR 4/4) clay loam; common fine prominent gray (N 5/0) and common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; very few faint brown (7.5YR 4/4) clay films and few distinct brown (7.5YR 5/2) coatings on faces of peds; few coarse fragments; few fine and medium very dark gray (10YR 3/1) concretions; medium acid; clear smooth boundary.

C1—53 to 74 inches; brown (7.5YR 4/2) very gravelly loam; common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; about 40 percent gravel; medium acid; abrupt smooth boundary.

C2—74 to 80 inches; yellowish brown (10YR 5/4) silty clay loam; common fine prominent strong brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; massive; firm; brown (7.5YR 5/2) vertical seams; medium acid.

The thickness of the solum ranges from 30 to 60 inches. The content of coarse fragments ranges from 0 to 5 percent in the upper part of the solum and from 0 to 50 percent in the lower part of the solum and in the C horizon.

The Ap horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly silt loam but is silty clay loam in some pedons. The Bt horizon has chroma of 2 to 8. The upper part of the Bt horizon is silty clay loam or silt loam. The lower part is dominantly silty clay loam, clay loam, or the gravelly or very gravelly analogs of those textures, but in some pedons it has subhorizons of loam, gravelly loam, or very gravelly loam. The C horizon has hue of 7.5YR to 2.5Y and chroma of 2 to 6. It is dominantly very gravelly loam or very gravelly clay loam that has strata of silt loam or silty clay loam.

Gilpin Series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils on ridgetops, side slopes, and foot slopes in the uplands. These soils formed in material weathered from interbedded, acid siltstone, shale, and sandstone. Slopes range from 3 to 25 percent.

Gilpin soils are similar to Westmoreland soils and are commonly adjacent to Coshocton, Hazleton, Lowell, and Westmoreland soils. Hazleton soils have more sand and less clay in the subsoil than the Gilpin soils. They also have a cambic horizon and a higher content of coarse fragments in the subsoil than the Gilpin soils. Coshocton, Hazleton, Lowell, and Westmoreland soils are deep over bedrock. Coshocton soils are moderately well drained and have low-chroma mottles in the subsoil. Lowell soils have more clay in the subsoil than the Gilpin soils. Coshocton and Lowell soils are on ridgetops and side slopes. Hazleton and Westmoreland soils are on steep or very steep side slopes below the Gilpin soils.

Typical pedon of Gilpin silt loam, 8 to 15 percent slopes, about 4.7 miles east of Bergholz, in Ross Township, 1,240 feet south and 1,720 feet east of the northwest corner of sec. 15, T. 11 N., R. 3 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale yellow (2.5Y 7/4) dry; weak medium and fine granular structure; friable; common very fine roots; about 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—8 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few very fine roots; few faint yellowish brown (10YR 5/4) silt coatings and few faint yellowish brown (10YR 5/4) clay films on faces of peds; common fine dark brown (7.5YR 4/2) segregations of iron and manganese oxide; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—14 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; few distinct brown (7.5YR 5/4) clay films on faces of peds; common fine dark brown (7.5YR 3/2) segregations of iron and manganese oxide; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—20 to 27 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common distinct brown (7.5YR 5/4) clay films on faces of peds; many fine dark brown (7.5YR 3/2) segregations of iron and manganese oxide; about 10 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—27 to 29 inches; layered sandstone bedrock.

The thickness of the solum ranges from 20 to 36 inches, and the depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments of shale, siltstone, or sandstone ranges from 5 to 35 percent in the B horizon. Some pedons have a C horizon. The content of coarse fragments in that horizon ranges from 30 to 60 percent.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. It is dominantly silt loam but is loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam, loam, silty clay loam, or the shaly or channery analogs of those textures. The C horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is the channery, very channery, shaly, or very shaly analogs of loam or silt loam.

Glenford Series

The Glenford series consists of deep, moderately well drained, moderately slowly permeable soils on stream terraces. These soils formed in stratified silty material. Slopes range from 1 to 15 percent.

Glenford soils are commonly adjacent to Coshocton, Gilpin, and Tioga soils. Coshocton and Gilpin soils are in the higher positions on uplands. Gilpin soils are well drained and moderately deep over bedrock. Coshocton soils have more sand and coarse fragments in the solum than the Glenford soils. Tioga soils have a cambic horizon. They are on flood plains and are lower on the landscape than the Glenford soils.

Typical pedon of Glenford silt loam, 1 to 7 percent slopes, in a hay field about 2 miles west of Bergholz, in Springfield Township, 132 feet east and 2,112 feet south of the northwest corner of sec. 16, T. 12 N., R. 4 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium and fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 18 inches; yellowish brown (10YR 5/4) silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—18 to 30 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Bt3—30 to 36 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt4—36 to 42 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common faint brown (10YR 5/3) clay films on faces of peds; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; strongly acid; clear wavy boundary.

Bt5—42 to 50 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; firm; common distinct brown (7.5YR 5/2) and common faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; few distinct light brownish gray (10YR 6/2) clay films on vertical partings; strongly acid.

The thickness of the solum ranges from 35 to 60 inches. These soils generally do not contain coarse fragments, but some pedons contain a few fragments.

The Ap horizon has chroma of 2 or 3. The Bt and BC horizons, if they occur, have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. A thin layer of slightly brittle material is in the lower part of the Bt horizon in some pedons. The C horizon has chroma of 3 to 6. It is dominantly silt loam or silty clay loam but in some pedons has strata of loam, fine sandy loam, and silty clay.

Guernsey Series

The Guernsey series consists of deep, moderately well drained, slowly permeable or moderately slowly permeable soils on ridgetops, benches, and hillsides in the uplands. These soils formed in colluvium and in material weathered from interbedded shale, siltstone, and limestone. In places they have a thin mantle of loess. Slopes range from 1 to 40 percent.

Guernsey soils are similar to Brookside, Elba, and Lowell soils and are commonly adjacent to Berks and Gilpin soils. Berks and Gilpin soils are on ridgetops and side slopes, are well drained, are moderately deep over bedrock, and have less clay in the subsoil than the Guernsey soils. Berks soils have a cambic horizon. Brookside soils formed entirely in colluvium on foot slopes and on benches. Elba and Lowell soils are well drained and are in landscape positions similar to those of the Guernsey soils.

Typical pedon of Guernsey silt loam, 1 to 7 percent slopes, about 1.5 miles northeast of Unionport, in Wayne Township, 1,110 feet west and 1,350 feet south of the northeast corner of sec. 30, T. 9 N., R. 3 W.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; common very fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 12 inches; yellowish brown (10YR 5/6) silty clay loam; few fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few very fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt2—12 to 18 inches; yellowish brown (10YR 5/6) silty clay; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm, plastic and sticky; few very fine roots; many distinct brown (7.5YR 5/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

2Bt3—18 to 28 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) clay; common fine distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure; firm, plastic and sticky; few very fine roots; many distinct brown (7.5YR 5/4) clay films on faces of peds; few coarse fragments; strongly acid; clear wavy boundary.

2BC—28 to 36 inches; light olive brown (2.5Y 5/4) silty clay; bands of common fine prominent light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm, plastic and sticky; few very fine roots; common distinct light brownish gray (2.5Y 6/2) clay films on vertical faces of peds; common fine dark brown (7.5YR 3/2) segregations of iron and manganese oxide; few soft coarse fragments; slightly acid; clear wavy boundary.

2C—36 to 59 inches; light olive brown (2.5Y 5/4) silty clay; few medium prominent yellowish brown (10YR 5/8) and few fine prominent gray (N 6/0) mottles; massive; firm; common fine dark brown (7.5YR 3/2) segregations of iron and manganese oxide; about 5 percent soft coarse fragments; slight effervescence; mildly alkaline; abrupt wavy boundary.

R—59 to 61 inches; hard limestone bedrock.

The thickness of the solum ranges from 32 to 48 inches, and the depth to bedrock ranges from 50 to 80 inches. Carbonates, if they occur, are at a depth of more than 30 inches. The content of shale or siltstone fragments ranges from 0 to 15 percent in the Bt horizon, from 0 to 20 percent in the 2Bt horizon, and from 2 to 35 percent in the 2BC and 2C horizons.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly silt loam but is silty clay loam in some pedons. The Bt and 2Bt horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. The upper part of the Bt horizon is silt loam, silty clay loam, or the shaly or channery analogs of those textures. The 2Bt horizon is clay, silty clay, silty clay loam, or the shaly analogs of those textures. The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is silty clay, silty clay loam, or the shaly or channery analogs of those textures.

Hazleton Series

The Hazleton series consists of deep, well drained, rapidly permeable or moderately rapidly permeable soils on side slopes in the uplands. These soils formed in colluvium and material weathered from sandstone. Slopes range from 25 to 70 percent.

Hazleton soils are similar to Berks and Dekalb soils and are commonly adjacent to Gilpin, Steinsburg, Summitville, and Westmoreland soils. Berks, Dekalb, Gilpin, and Steinsburg soils are moderately deep over bedrock. Berks and Dekalb soils are in landscape positions similar to those of the Hazleton soils. Berks, Gilpin, Steinsburg, Summitville, and Westmoreland soils have more silt and clay and less sand in the subsoil than the Hazleton soils. Gilpin, Steinsburg, Summitville, and Westmoreland soils have an argillic horizon. They have fewer coarse fragments in the subsoil than the Hazleton soils. Summitville soils are moderately well drained and have low-chroma mottles in the subsoil. Summitville soils are commonly on benches below the Hazleton soils. Westmoreland soils are commonly associated with Hazleton soils on steep and very steep side slopes. Gilpin and Steinsburg soils are commonly on ridgetops above the Hazleton soils.

Typical pedon of Hazleton channery loam, in an area of Hazleton-Summitville complex, 15 to 40 percent slopes, about 3.3 miles northeast of Bergholz, in Brush Creek Township, 845 feet west and 1,188 feet north of the southeast corner of sec. 31, T. 12 N., R. 3 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) channery loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; very friable; many very fine and common fine roots; about 25 percent coarse fragments; very strongly acid; clear smooth boundary.

E—5 to 8 inches; dark yellowish brown (10YR 4/4) channery loam; weak medium and fine granular structure; very friable; many very fine and common fine roots; about 20 percent coarse fragments; very strongly acid; abrupt smooth boundary.

Bw1—8 to 14 inches; yellowish brown (10YR 5/6) sandy loam; moderate medium and coarse subangular blocky structure; very friable; common very fine roots; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bw2—14 to 23 inches; brownish yellow (10YR 6/6) channery sandy loam; weak coarse subangular blocky structure; very friable; few fine roots; about 30 percent coarse fragments; strongly acid; gradual smooth boundary.

Bw3—23 to 32 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak coarse subangular blocky structure; very friable; few fine roots; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

BC—32 to 46 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak coarse subangular blocky structure; very friable; few fine roots; about 55 percent coarse fragments; strongly acid; gradual smooth boundary.

C—46 to 53 inches; yellowish brown (10YR 5/6) very channery loamy sand; massive; loose; about 40 percent coarse fragments; strongly acid; clear wavy boundary.

R—53 to 55 inches; sandstone bedrock.

The thickness of the solum ranges from 25 to 50 inches, and the depth to bedrock ranges from 40 to more than 72 inches. The content of sandstone fragments ranges from 5 to 40 percent in the upper part of the B horizon, from 35 to 70 percent in the lower part of the B horizon, and from 35 to 80 percent in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly channery loam, but in some pedons it is loam. The B horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sandy loam, loam, or the channery or very channery analogs of those textures in the upper part and the very channery or extremely channery analogs of sandy loam or loam in the lower part. The C horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 4 to 6. It is the very channery or extremely channery analogs of sandy loam or loamy sand.

Keene Series

The Keene series consists of deep, moderately well drained, slowly permeable or moderately slowly permeable soils on ridgetops in the uplands. These soils formed in a silty mantle and the underlying residuum of shale and siltstone. Slopes range from 1 to 7 percent.

Keene soils are similar to Wellston soils and commonly are adjacent to Coshocton, Gilpin, Lowell, and Morristown soils. Coshocton, Gilpin, and Lowell soils are commonly on convex slopes on ridgetops. Morristown soils are commonly in surface mined areas that are higher on the landscape than the Keene soils. Gilpin, Lowell, Morristown, and Wellston soils are well drained and do not have low-chroma mottles in the upper part of the subsoil. Gilpin soils are moderately deep over bedrock. Coshocton, Gilpin, and Morristown soils have a higher content of sand and coarse fragments in the upper part of the subsoil than the Keene soils. Lowell soils have a higher content of clay in the upper part of the subsoil than the Keene soils.

Typical pedon of Keene silt loam, 1 to 7 percent slopes, about 4.3 miles northwest of Richmond, in Ross Township, 220 feet north and 2,130 feet east of the southwest corner of sec. 20, T. 11 N., R. 3 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate and weak medium granular structure; very friable; many very fine roots; very strongly acid; clear smooth boundary.

BE—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few very fine roots; few faint yellowish brown (10YR 5/6) silt coatings on faces of peds; few fine very dark gray (N 3/0) segregations of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt1—12 to 21 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; few very fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; few fine very dark gray (N 3/0) segregations of iron and manganese oxide; strongly acid; abrupt smooth boundary.

2Bt2—21 to 28 inches; strong brown (7.5YR 5/6) silty clay loam; many fine distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to weak medium platy; firm; few very fine roots; few faint brown (7.5YR 5/4) clay films on faces of peds; common distinct brown (10YR 5/3) silt coatings along vertical seams and in pores; few fine very dark gray (N 3/0) segregations of iron and manganese oxide; strongly acid; clear smooth boundary.

2Bt3—28 to 38 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate coarse prismatic structure parting to weak medium and thick platy; firm; few very fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) silt coatings along vertical seams; few fine very dark gray (N 3/0) segregations of iron and manganese oxide; strongly acid; clear smooth boundary.

2Bt4—38 to 54 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak thick prismatic structure; firm; few faint yellowish brown (10YR 5/4) clay films on vertical seams; common medium very dark gray (N 3/0) stains of iron and manganese oxide on horizontal faces of peds; strongly acid; clear smooth boundary.

2C1—54 to 62 inches; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; massive; firm; medium acid; clear smooth boundary.

2C2—62 to 84 inches; yellowish brown (10YR 5/4) silty clay; common fine prominent yellowish brown (10YR 5/8) and few fine distinct light brownish gray (10YR 6/2) mottles; massive; firm; slightly acid; clear smooth boundary.

2Cr—84 to 86 inches; yellowish brown (10YR 5/6) and olive brown (2.5Y 5/4), bedded shale bedrock.

The thickness of the solum ranges from 30 to 60 inches, and the depth to bedrock ranges from 40 to 84 inches. The content of coarse fragments is from 0 to 1 percent in the upper part of the solum and ranges from 5 to 25 percent in the lower part and in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The BE and Bt horizons have value of 5 or 6 and chroma of 4 to 6. The C horizon has hue of 10YR or

2.5Y and value of 4 or 5. It is silty clay loam, silty clay, or the shaly analogs of those textures.

Lowell Series

The Lowell series consists of deep, well drained, moderately slowly permeable soils on foot slopes, ridgetops, and side slopes in the uplands. These soils formed in colluvium and material weathered from limestone and interbedded limestone, shale, and siltstone. Slopes range from 1 to 70 percent.

Lowell soils are similar to Brookside, Elba, and Guernsey soils and are commonly adjacent to Gilpin, Elba, and Westmoreland soils. Brookside and Guernsey soils are moderately well drained. Elba soils have carbonates closer to the soil surface than those of the Lowell soils. They are in landscape positions similar to those of the Lowell soils. Gilpin and Westmoreland soils have less clay in the subsoil than the Lowell soils. Gilpin soils are moderately deep over bedrock and are on ridgetops and side slopes. Westmoreland soils are on very steep side slopes.

Typical pedon of Lowell silt loam, 7 to 15 percent slopes, about 0.9 mile northwest of Smithfield, in Smithfield Township, 1,610 feet east and 2,534 feet north of the southwest corner of sec. 12, T. 8 N., R. 3 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium and fine granular structure; friable; common very fine roots; few coarse fragments; medium acid; abrupt smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/6) silty clay; strong medium and fine subangular blocky structure; firm; few very fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few coarse fragments; very strongly acid; clear smooth boundary.

Bt2—14 to 19 inches; light olive brown (2.5Y 5/4) silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; firm; few very fine roots; common faint light olive brown (2.5Y 5/4) clay films on faces of peds; common thin platelike gray (N 5/0) remnants of weathered shale; few coarse fragments; very strongly acid; clear smooth boundary.

Bt3—19 to 26 inches; light olive brown (2.5Y 5/4) silty clay; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; few faint light olive brown (2.5YR 5/4) clay films on faces of peds; common thin platelike gray (N 5/0) remnants of weathered shale; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt4—26 to 42 inches; light olive brown (2.5Y 5/4) silty clay; common fine prominent brownish yellow (10YR 6/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few very fine roots; few faint light olive brown (2.5Y 5/4) clay films on faces of peds; common medium platelike gray (N 5/0) remnants of weathered shale; few fine very dark gray (N 3/0) segregations of iron and manganese oxide; about 15 percent coarse fragments; medium acid; abrupt smooth boundary.

BC—42 to 48 inches; brownish yellow (10YR 6/8) and brown (7.5YR 4/2) silty clay; weak medium prismatic structure; firm; few very fine roots; few distinct yellowish brown (10YR 5/4) clay films on vertical seams; few coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C—48 to 59 inches; light yellowish brown (2.5Y 6/4) silty clay; common fine prominent brownish yellow (10YR 6/8) and common fine prominent light gray (10YR 7/2) mottles; massive; firm; few coarse fragments; strong effervescence; mildly alkaline; abrupt smooth boundary.

R—59 to 61 inches; hard limestone bedrock.

The thickness of the solum ranges from 30 to 54 inches, and the depth to bedrock ranges from 40 to more than 80 inches. Carbonates, if they occur, are at a depth of more than 30 inches.

The Ap horizon has chroma of 2 or 3. It is silty clay loam or silt loam. The Bt horizon typically has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 4 to 6. In some pedons it has low-chroma mottles in the lower part. It is silty clay loam, silty clay, or clay in the upper part and silty clay or clay in the lower part. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam, silty clay, clay, or the shaly or channery analogs of those textures.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils on flood plains. These soils formed in medium textured alluvium. Slopes range from 0 to 2 percent.

Melvin soils commonly are adjacent to Coshocton, Hazleton, Morristown, and Westmoreland soils on upland side slopes and to Omulga soils on the slightly higher terraces. Some of the side slopes have been surface mined. All of the adjacent soils in the upland areas have more sand and coarse fragments in the subsoil than the Melvin soils. Hazleton, Morristown, and Westmoreland soils are well drained and do not have low-chroma mottles in the subsoil. Coshocton and Omulga soils are moderately well drained and have fewer low-chroma colors in the subsoil than the Melvin soils. Coshocton, Omulga, and Westmoreland soils have an argillic horizon. Hazleton soils have a cambic horizon.

Typical pedon of Melvin silt loam, ponded, about 3.3 miles southeast of Bloomingdale, in Wayne Township, 1,056 feet west and 1,600 feet north of the southeast corner of sec. 3, T. 9 N., R. 3 W.

Oi—4 to 0 inches; dark reddish brown (2.5YR 3/4) undecomposed mat of cattails and sedges; mildly alkaline; clear smooth boundary.

A—0 to 6 inches; olive gray (5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; few medium prominent yellowish brown (10YR 5/4) mottles; weak medium granular structure; friable; slightly sticky, slightly plastic; common fine roots; few faint very dark gray coatings on peds; mildly alkaline; clear smooth boundary.

Cg1—6 to 17 inches; dark gray (5Y 4/1) silt loam; few medium prominent yellowish brown (10YR 5/4) mottles; massive; friable; slightly sticky, slightly plastic; common very fine roots; mildly alkaline; gradual smooth boundary.

Cg2—17 to 32 inches; dark gray (5Y 4/1) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles along roots; massive; friable; few fine roots; mildly alkaline; gradual smooth boundary.

Cg3—32 to 60 inches; dark grayish brown (2.5Y 4/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; few prominent strong brown (7.5YR 5/6) and few distinct gray (N 5/0) areas along pores and root channels; thin layer of channery silt loam in the lower part of this horizon; common fine black (10YR 2/1) segregations of iron and manganese oxide; mildly alkaline.

The content of coarse fragments ranges from 0 to 5 percent to a depth of 30 inches and from 0 to 15 percent in individual subhorizons below that depth.

The A horizon has value of 4 or 5 and chroma of 1 or 2. The C horizon has hue of 2.5Y or 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is dominantly silt loam or silty clay loam, but in some pedons it has a thin layer that is the channery analog of those textures.

Morristown Series

The Morristown series consists of deep, well drained, moderately slowly permeable soils on side slopes, ridgetops, and benches in mine spoil areas. These soils formed in calcareous, partly weathered fine-earth material and fragments of limestone and shale. Slopes range from 0 to 70 percent.

Morristown soils are similar to Bethesda and Fairpoint soils and are commonly adjacent to Gilpin, Lowell, and Westmoreland soils. Bethesda and Fairpoint soils do not have carbonates in the substratum. Gilpin, Lowell, and Westmoreland soils have an argillic horizon and are in unmined areas. The moderately deep Gilpin and the deep Lowell soils are above and below the mined areas. Westmoreland soils are commonly below the mined areas.

Typical pedon of Morristown shaly silty clay loam, 25 to 70 percent slopes, bouldery, about 2.5 miles southeast of Reeds Mills, in Cross Creek Township, 505 feet west and 1,770 feet south of the northeast corner of sec. 27, T. 6 N., R. 2 W.

A—0 to 2 inches; dark grayish brown (10YR 4/2) shaly silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; friable; common very fine roots; about 25 percent coarse fragments; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—2 to 23 inches; variegated 50 percent brown (10YR 5/3), 30 percent yellowish brown (10YR 5/6), and 20 percent grayish brown (10YR 5/2) very shaly silty clay loam; massive; friable; few fine and few very fine roots; about 45 percent coarse fragments; strong effervescence; mildly alkaline; gradual smooth boundary.

C2—23 to 40 inches; variegated 90 percent brown (10YR 5/3) and 10 percent yellowish brown (10YR 5/6) very shaly silty clay loam; massive; friable; few fine and few very fine roots; about 55 percent coarse fragments; strong effervescence; mildly alkaline; gradual smooth boundary.

C3—40 to 60 inches; variegated 90 percent brown (10YR 5/3) and 10 percent brownish yellow (10YR 6/6) very shaly silty clay loam; massive; friable; about 55 percent coarse fragments; strong effervescence; mildly alkaline.

The content of coarse fragments in the substratum to a depth of 40 inches ranges from 35 to 60 percent. Rock fragments are generally less than 10 inches in diameter, but some are larger in size.

The A horizon has hue of 10YR or 2.5Y and chroma of 1 to 4. It is dominantly shaly silty clay loam, but it is channery clay loam in some pedons. Reclaimed areas have an Ap horizon of silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is the very shaly or very channery analogs of silty clay loam or clay loam.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium derived from limestone, sandstone, siltstone, shale, and loess. Slopes range from 0 to 3 percent.

Nolin soils are commonly adjacent to Brookside and Westmoreland soils on valley walls. Brookside and Westmoreland soils have an argillic horizon.

Typical pedon of Nolin silt loam, occasionally flooded, about 1.6 miles west of Connorville, in Warren Township, 396 feet east and 1,056 feet north of the southwest corner of sec. 30, T. 4 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; common very fine roots; neutral; clear smooth boundary.

Bw1—9 to 16 inches; brown (10YR 4/3) silt loam; weak medium prismatic structure; friable; few very fine roots; many faint dark grayish brown (10YR 4/2) organic coatings on faces of peds and lining root channels; few coarse fragments; neutral; clear smooth boundary.

Bw2—16 to 29 inches; brown (10YR 4/3) silt loam; moderate medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; many faint dark grayish brown (10YR 4/2) organic coatings on faces of peds and lining root channels; few coarse fragments; neutral; gradual smooth boundary.

Bw3—29 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure; friable; few very fine roots; many faint brown (10YR 4/3) organic coatings on faces of peds and lining root channels; few coarse fragments; neutral; gradual smooth boundary.

Bw4—40 to 54 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse and medium prismatic structure; friable; few very fine roots; common faint brown (10YR 4/3) organic coatings on faces of peds and lining root channels; neutral; gradual smooth boundary.

C—54 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; common faint brown (10YR 5/3) coatings lining old root channels; few coarse fragments; neutral.

The thickness of the solum ranges from 40 to 60 inches. The content of coarse fragments ranges from 0 to 5 percent, by volume, in the solum and from 0 to 35 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. The Bw horizon has value of 4 or 5. It is silt loam or silty clay loam. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam, silty clay loam, loam, sandy loam, fine sandy loam, stratified layers of these textures, or the gravelly analogs of these textures.

Omulga Series

The Omulga series consists of deep, moderately well drained soils that are typically on high stream terraces. Some areas of these soils are on the lower terraces along streams. The soils formed in loess and old alluvium. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 1 to 15 percent.

Omulga soils are similar to Pekin soils and are commonly adjacent to Berks, Pekin, Tioga, and Westmoreland soils. Pekin soils have low-chroma mottles closer to the surface than those of the Omulga soils. They are in landscape positions similar to those of the Omulga soils. Berks and Westmoreland soils are on uplands. Tioga soils are on flood plains. Berks, Tioga, and Westmoreland soils are well drained.

Typical pedon of Omulga silt loam, 1 to 7 percent slopes, about 0.9 mile west of Brilliant, in Wells Township, 500 feet south and 2,650 feet west of the northeast corner of sec. 35, T. 1 N., R. 1 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium and fine granular structure; friable; many very fine roots; very strongly acid; abrupt smooth boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common very fine roots; few distinct dark yellowish brown (10YR 4/4) silt coatings in pores; very strongly acid; clear smooth boundary.

Bt1—14 to 25 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—25 to 32 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; many faint brownish yellow (10YR 6/6) clay films on faces of peds; very strongly acid; clear smooth boundary.

Btx1—32 to 38 inches; yellowish brown (10YR 5/6) silt loam; common fine prominent light brownish gray (10YR 6/2) mottles; weak very coarse prismatic structure parting to moderate thick platy; very firm; brittle; common faint yellowish brown (10YR 5/4) clay films; many prominent gray (10YR 6/1) silt coatings on yellowish brown (10YR 5/8) borders along faces of prisms; few fine very dark gray (10YR 3/1) iron and manganese stains; very strongly acid; gradual smooth boundary.

Btx2—38 to 47 inches; yellowish brown (10YR 5/6) silt loam; common fine prominent light gray (10YR 6/1) mottles; weak very coarse prismatic structure parting to moderate very thick platy; very firm; brittle; few faint yellowish brown (10YR 5/4) clay films; many prominent light gray (10YR 6/1) silt coatings on yellowish brown (10YR 5/8) borders along faces of prisms; few fine very dark gray (10YR 3/1) iron and manganese stains; very strongly acid; gradual smooth boundary.

C1—47 to 60 inches; yellowish brown (10YR 5/6) silt loam; common fine prominent light brownish gray (10YR 6/2) mottles; massive; firm; many prominent light gray (10YR 6/1) silt coatings on vertical seams; very strongly acid; clear smooth boundary.

2C2—60 to 70 inches; yellowish brown (10YR 5/6) stratified silty clay loam and loam; massive; firm; very strongly acid.

The thickness of the solum ranges from 40 to 60 inches. Depth to the fragipan ranges from 18 to 36 inches. These soils generally do not contain coarse fragments, but the solum contains a few fragments in some pedons.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is silt loam or silty clay loam. The C and 2C horizons have hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. They are dominantly silt loam or silty clay loam. Some pedons have thin strata of loam, sandy loam, or silty clay in the 2C horizon.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 3 percent.

Orrville soils are commonly adjacent to Gilpin, Hazleton, Tioga, and Westmoreland soils. The well drained Tioga soils are on flood plains. The well drained Gilpin, Hazleton, and Westmoreland soils are on side slopes. Gilpin and Westmoreland soils have an argillic horizon. Gilpin soils are moderately deep over bedrock. Hazleton soils have a higher content of coarse fragments than the Orrville soils.

Typical pedon of Orrville silt loam, occasionally flooded, about 1.25 miles west of Bergholz, in Springfield Township, 1,320 feet south and 1,636 feet west of the northeast corner of sec. 16, T. 12 N., R. 4 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium and fine granular structure; friable; common very fine roots; many fine brown (7.5YR 4/4) stains along root channels; strongly acid; abrupt smooth boundary.

Bw—6 to 11 inches; brown (10YR 4/3) silt loam; common fine faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; common very fine roots; dark grayish brown (10YR 4/2) coatings on faces of peds; few coarse fragments; common fine brown (7.5YR 4/4) stains along root channels; strongly acid; abrupt smooth boundary.

Bg—11 to 25 inches; grayish brown (2.5Y 5/2) silt loam; many medium prominent yellowish brown (10YR 5/4) and few fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine roots; strongly acid; clear smooth boundary.

B'w—25 to 37 inches; dark yellowish brown (10YR 4/4) loam; many medium distinct gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse prismatic structure; friable; few very fine roots; gray coatings in pores and on channels; few pebbles; few fine very dark gray (10YR 3/1) nodules of iron and manganese oxide; medium acid; clear smooth boundary.

C1—37 to 46 inches; gray (10YR 5/1) and strong brown (7.5YR 4/4) loam; massive; friable; about 5 percent gravel; medium acid; abrupt wavy boundary.

C2—46 to 60 inches; brown (10YR 4/3) gravelly sandy loam; common fine distinct grayish brown (10YR 5/2) mottles; friable; about 25 percent gravel; medium acid.

The thickness of the solum ranges from 24 to 40 inches. The content of coarse fragments ranges from 0 to 15 percent in the B horizon and from 0 to 25 percent in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y. The B horizon has chroma of 1 to 4. It is dominantly silt loam or loam, but in some pedons it has subhorizons of clay loam or silty clay loam or it has thin subhorizons of sandy loam or loamy sand in the lower part. The C horizon has hue of 10YR to 5Y and chroma of 1 to 6. It is dominantly loam, sandy loam, or the gravelly analogs of those textures, but in some pedons it has strata of loamy sand or gravelly loamy sand below a depth of 40 inches.

Pekin Series

The Pekin series consists of deep, moderately well drained soils that are typically on the lower terraces along streams. Some areas of these soils are on high terraces. The soils formed in old alluvium. Permeability is moderate above and below the fragipan and very slow in the fragipan. Slopes range from 1 to 7 percent.

Pekin soils are similar to Clarksburg and Omulga soils and are commonly adjacent to Omulga, Tioga, and Westmoreland soils. Omulga soils do not have low-chroma mottles in the upper part of the subsoil. They are in landscape positions similar to those of the Pekin soils. Tioga soils have a cambic horizon. They are on flood plains. Westmoreland soils are well drained. They are on valley walls and are higher on the landscape than the Pekin soils. Tioga and Westmoreland soils do not have a fragipan.

Typical pedon of Pekin silt loam, 1 to 7 percent slopes, 1.6 miles southwest of Bergholz, in Springfield Township, 880 feet north and 2,050 feet east of the southwest corner of sec. 9, T. 12 N., R. 4 W.

Ap—0 to 10 inches; brown (10YR 5/3) silt loam, pale yellow (2.5Y 7/4) dry; moderate medium and fine granular structure; friable; many very fine roots; strongly acid; abrupt smooth boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common very fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

B/E—15 to 19 inches; about 65 percent yellowish brown (10YR 5/6) silt loam (Bt); few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few very fine roots; about 35 percent light brownish gray (10YR 6/2) silt loam (E); weak medium platy structure; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; very strongly acid; clear wavy boundary.

Btx1—19 to 25 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak very thick platy; very firm; brittle; few very fine roots between prisms; few distinct brown (7.5YR 5/4) clay films on faces of prisms; many prominent light gray (10YR 7/2) silt coatings on vertical faces of peds; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; very strongly acid; clear smooth boundary.

Btx2—25 to 34 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak very thick platy; very firm; brittle; few very fine roots between prisms; few distinct brown (7.5YR 5/4) clay films on faces of peds; many prominent light gray (10YR 7/2) silt coatings on yellowish brown (10YR 5/8) borders along faces of prisms; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; very strongly acid; gradual smooth boundary.

Btx3—34 to 47 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure; very firm; brittle; few faint brown (7.5YR 5/4) clay films on faces of peds; many prominent light gray (10YR 7/2) silt coatings on yellowish brown (10YR 5/8) borders along faces of prisms; few fine very dark grayish brown (10YR 3/2) segregations of iron and manganese oxide; very strongly acid; clear smooth boundary.

C—47 to 60 inches; yellowish brown (10YR 5/6) loam; few fine distinct light brownish gray (10YR 6/2) mottles; massive; firm; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. Depth to the fragipan ranges from 18 to 32 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has value of 5 or 6 and chroma of 4 to 6. It is silt loam or silty clay loam. The Btx horizon has value of 5 or 6 and chroma of 4 to 6. It is silt loam or silty clay loam. The C horizon has value of 5 or 6 and chroma of 4 to 6. It is silt loam, silty clay loam, or loam.

Richland Series

The Richland series consists of deep, well drained, moderately permeable soils on colluvial foot slopes, fans, and toe slopes at the base of hillsides. These soils formed in colluvium weathered from sandstone, siltstone, and shale. Slopes range from 1 to 15 percent.

Richland soils are similar to Westmoreland soils and are commonly adjacent to Nolin and Tioga soils on flood plains and to Brookside and Westmoreland soils on mostly steep or very steep foot slopes. Westmoreland soils formed in colluvium and residuum. They have lower base saturation in the lower part of the soil than the Richland soils. Nolin and Tioga soils have a cambic horizon. Nolin soils have less sand and fewer coarse fragments in the subsoil than the Richland soils. Tioga soils have less clay in the subsoil than the Richland soils. Brookside soils have more clay in the subsoil than the Richland soils and are moderately well drained.

Typical pedon of Richland silt loam, 1 to 7 percent slopes, about 2.6 miles northwest of Irondale, in Brush Creek Township, 900 feet west and 1,558 feet north of the southeast corner of sec. 9, T. 12 N., R. 3 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; very friable; common very fine roots; about 5 percent flat or rounded coarse fragments; very strongly acid; abrupt smooth boundary.

BE—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few very fine roots; common faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 10 percent flat or rounded coarse fragments; strongly acid; clear smooth boundary.

Bt1—12 to 21 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; friable; few very fine roots; few faint brown (10YR 5/3) clay films on faces of peds; about 25 percent flat or rounded coarse fragments; strongly acid; clear smooth boundary.

Bt2—21 to 36 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; firm; few very fine roots; few faint brown (10YR 4/3) clay films on faces of peds; about 20 percent flat or rounded coarse fragments; strongly acid; clear smooth boundary.

BC—36 to 46 inches; yellowish brown (10YR 5/4) loam; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few very fine roots; about 5 percent flat or rounded coarse fragments; strongly acid; clear smooth boundary.

C—46 to 60 inches; dark yellowish brown (10YR 4/4) very channery loam; massive; firm; about 40 percent flat or rounded coarse fragments; strongly acid.

The thickness of the solum ranges from 44 to 54 inches, and the depth to bedrock ranges from 5 to 10 feet. The content of coarse fragments of sandstone, siltstone, and shale ranges from 5 to 15 percent, by volume, in the Ap horizon and from 5 to 25 percent in the upper part of the Bt horizon. The content of coarse fragments generally ranges from 20 to 35 percent in the lower part of the Bt horizon and from 20 to 50 percent in the C horizon. The content of coarse fragments in the thin subhorizons of the lower part of the Bt horizon and in the C horizon ranges from 5 to 20 percent.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. In areas where it has value of 3 and chroma of 2 or 3, this horizon is less than 7 inches thick. It is dominantly silt loam but is loam in some pedons. The Bt 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, sandy clay loam, or the gravelly or channery analogs of those textures. The C horizon has value of 4 or 5. It dominantly is the gravelly, very gravelly, channery, or very channery analogs of loam, clay loam, or silty clay loam. In some pedons it has subhorizons of loam, clay loam, or silty clay loam.

Rigley Series

The Rigley series consists of deep, well drained, moderately rapidly permeable soils on ridgetops and side slopes in the uplands. These soils formed in colluvium and material weathered from weakly cemented sandstone. Slopes range from 8 to 25 percent.

Rigley soils are similar to Rigley Variant soils and are commonly adjacent to Berks, Coshocton, Gilpin, Rigley Variant, Steinsburg, and Hazleton soils. Steinsburg soils are moderately deep over bedrock. Rigley Variant soils have hard bedrock at a depth of 40 to 60 inches. Steinsburg and Rigley Variant soils are in landscape positions similar to those of the Rigley soils. Berks, Coshocton, and Gilpin soils have more clay and less sand in the subsoil than the Rigley soils. Hazleton soils have a cambic horizon. They have more sandstone fragments in the subsoil than the Rigley soils. Coshocton and Hazleton soils are commonly lower on the landscape than the Rigley soils. They are on side slopes. Berks and Gilpin soils are on side slopes and ridgetops. Coshocton soils are moderately well drained and have low-chroma mottles in the subsoil. Berks and Gilpin soils are moderately deep over bedrock.

Typical pedon of Rigley sandy loam, 15 to 25 percent slopes, in a hay field about 2 miles northwest of Bergholz, in Springfield Township, about 792 feet east and 686 feet south of the northwest corner of sec. 17, T. 12 N., R. 4 W.

Ap—0 to 10 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; many fine roots; about 5 percent coarse fragments; medium acid; abrupt smooth boundary.

Bt1—10 to 19 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; common fine roots; few faint strong brown (7.5YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—19 to 30 inches; yellowish brown (10YR 5/6) channery sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—30 to 42 inches; yellowish brown (10YR 5/6) channery sandy loam; weak medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/4) clay films on faces of peds; about 30 percent coarse fragments; very strongly acid; gradual smooth boundary.

C1—42 to 49 inches; yellowish brown (10YR 5/6) channery loamy sand; massive; friable; about 20 percent coarse fragments; very strongly acid; gradual smooth boundary.

C2—49 to 64 inches; light yellowish brown (10YR 6/4) channery loamy sand; massive; friable; about 25 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—64 to 66 inches; yellowish brown (10YR 5/4), hard sandstone bedrock.

The thickness of the solum ranges from 40 to 54 inches, and the depth to bedrock ranges from 60 to more than 100 inches. The content of sandstone fragments ranges from 5 to 35 percent in the B horizon and from 20 to 70 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. It is dominantly sandy loam but is fine sandy loam and loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is loam, sandy loam, fine sandy loam, or the channery analogs of those textures. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is the channery, very channery, or extremely channery analogs of sandy loam, fine sandy loam, or loamy sand.

Rigley Variant

The Rigley Variant consists of deep, well drained, moderately rapidly permeable soils on ridgetops and side slopes in the uplands. These soils formed in colluvium and material weathered from weakly cemented sandstone. Slopes range from 3 to 25 percent.

Rigley Variant soils are similar to Rigley soils and are commonly adjacent to Berks, Coshocton, Gilpin, Steinsburg, Rigley, and Hazleton soils. Rigley soils are deeper over bedrock than the Rigley Variant soils. Steinsburg soils are moderately deep over bedrock. Rigley and Steinsburg soils are in landscape positions similar to those of the Rigley Variant soils. Berks, Coshocton, and Gilpin soils have more clay and less sand in the subsoil than the Rigley Variant soils. Coshocton and Hazleton soils are commonly on side slopes below the Rigley Variant soils. Berks and Gilpin soils are on ridgetops. Coshocton soils are moderately well drained and have low-chroma mottles in the subsoil. Hazleton soils have a cambic horizon. They have more sandstone fragments in the subsoil than the Rigley Variant soils. Berks and Gilpin soils are moderately deep over bedrock.

Typical pedon of Rigley Variant fine sandy loam, in an area of Steinsburg-Rigley Variant fine sandy loams, 8 to 15 percent slopes, in a wooded area about 1.5 miles northwest of Bergholz, in Springfield Township, about 2,772 feet east and 924 feet south of the northwest corner of sec. 17, T. 12 N., R. 4 W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) fine sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; many fine roots; few coarse fragments; very strongly acid; abrupt smooth boundary.

Bt1—7 to 11 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—11 to 23 inches; yellowish brown (10YR 5/4) fine sandy loam; moderate medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—23 to 29 inches; yellowish brown (10YR 5/4) channery fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; very strongly acid; gradual smooth boundary.

BC—29 to 45 inches; yellowish brown (10YR 5/6) channery fine sandy loam; massive; friable; few fine roots; few faint strong brown (7.5YR 5/4) clay films on faces of peds; about 30 percent coarse fragments; strongly acid; gradual smooth boundary.

Cr—45 to 52 inches; yellowish brown (10YR 5/6), layered, weathered sandstone bedrock; strongly acid; abrupt smooth boundary.

R—52 to 54 inches; yellowish brown (10YR 5/4), hard sandstone bedrock.

The thickness of the solum ranges from 40 to 54 inches, and the depth to bedrock ranges from 40 to 60 inches. The content of sandstone fragments ranges from 5 to 35 percent in the B horizon and from 20 to 60 percent in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The B horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is loam, fine sandy loam, sandy loam, or the channery analogs of those textures. Some pedons have a C horizon, which has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. This horizon is the channery or very channery analogs of sandy loam, fine sandy loam, loamy sand, or sand.

Steinsburg Series

The Steinsburg series consists of moderately deep, well drained, moderately rapidly permeable soils on ridgetops and side slopes in the uplands. These soils formed in material weathered from weakly cemented sandstone. Slopes range from 3 to 25 percent.

Steinsburg soils have a thicker B horizon and an increase in clay content that are not definitive for the series. These differences, however, do not affect the use and management of the soils.

Steinsburg soils are commonly adjacent to Berks, Coshocton, Gilpin, Rigley, Rigley Variant, and Hazleton soils. Berks, Coshocton, and Gilpin soils have more clay and less sand in the subsoil than the Steinsburg soils. Coshocton and Hazleton soils are commonly in the lower landscape positions. Berks and Gilpin soils are on ridgetops. Rigley and Rigley Variant soils are in landscape positions similar to those of the Steinsburg soils. Coshocton soils are moderately well drained and have low-chroma mottles in the subsoil. Coshocton, Rigley Variant, Rigley, and Hazleton soils are deep over bedrock. Hazleton soils have more sandstone fragments in the lower part of the subsoil than the Steinsburg soils.

Typical pedon of Steinsburg fine sandy loam, in an area of Steinsburg-Rigley Variant fine sandy loams, 8 to 15 percent slopes, 1.4 miles south of Bergholz, in Springfield Township, 317 feet west and 1,082 feet north of the southeast corner of sec. 9, T. 12 N., R. 4 W.

Ap—0 to 4 inches; dark yellowish brown (10YR 4/4) fine sandy loam, pale yellow (2.5Y 7/4) dry; weak medium and fine granular structure; very friable; many very fine roots; about 8 percent coarse fragments; very strongly acid; clear smooth boundary.

BE—4 to 8 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; friable; common medium roots; few faint light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—8 to 17 inches; yellowish brown (10YR 5/6) sandy loam; moderate medium subangular blocky structure; friable; few medium roots; few faint brown (7.5YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—17 to 25 inches; yellowish brown (10YR 5/6) channery sandy loam; weak medium subangular blocky structure; friable; few very fine roots; few faint brown (7.5YR 5/4) clay films on faces of peds; about 25 percent coarse fragments; very strongly acid; clear wavy boundary.

Cr—25 to 27 inches; brown (7.5YR 5/4), layered, weathered sandstone bedrock; common faint brown (7.5YR 5/4) clay films on horizontal faces.

The thickness of the solum and the depth to bedrock range from 24 to 40 inches. The content of sandstone fragments ranges from 5 to 35 percent in the B horizon and from 20 to 70 percent in the C horizon.

The Ap horizon has chroma of 2 to 4. It is dominantly fine sandy loam, but it is loam or sandy loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is loam, sandy loam, fine sandy loam, or the channery analogs of those textures. The content of clay in the upper part of the Bt horizon ranges from 10 to 18 percent. The C horizon, if it occurs, has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is the channery or very channery analogs of loamy sand, loamy fine sand, sand, or fine sand.

Summitville Series

The Summitville series consists of deep, moderately well drained, moderately slowly permeable soils on side slopes and benches in the uplands. These soils formed in colluvium and in material weathered from shale and siltstone. Slopes range from 15 to 25 percent.

Summitville soils are commonly adjacent to Berks, Hazleton, and Westmoreland soils. Westmoreland soils have browner hues in the subsoil than the Summitville soils. Berks, Hazleton, and Westmoreland soils are well drained and do not have low-chroma mottles in the subsoil. Berks soils are moderately deep over bedrock. Hazleton soils have a cambic horizon. They have a higher content of coarse fragments in the subsoil than the Summitville soils. Berks and Westmoreland soils are commonly on side slopes and are lower on the landscape than the Summitville soils. Hazleton soils are commonly on side slopes and are higher on the landscape than the Summitville soils.

Typical pedon on Summitville silt loam, in an area of Hazleton-Summitville complex, 15 to 40 percent slopes, about 1.8 miles north of Amsterdam, in Springfield

Township, 800 feet north and 1,730 feet east of the southwest corner of sec. 15, T. 12 N., R. 4 W.

A—0 to 2 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; weak medium and fine granular structure; very friable; many very fine roots; few coarse fragments; very strongly acid; abrupt smooth boundary.

BE—2 to 7 inches; yellowish red (5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common very fine roots; few coarse fragments; very strongly acid; clear smooth boundary.

Bt1—7 to 11 inches; yellowish red (5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; few faint reddish brown (5YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—11 to 17 inches; reddish brown (5YR 5/4) silty clay loam; moderate medium and fine subangular blocky structure; firm; few very fine roots; common faint reddish brown (5YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt3—17 to 22 inches; yellowish red (5YR 5/6) silty clay; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; common faint reddish brown (5YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

2Bt4—22 to 32 inches; reddish brown (2.5YR 4/4) and yellowish red (5YR 4/6) silty clay; moderate medium prismatic structure; very firm; few very fine roots; common faint reddish brown (2.5YR 4/4) clay films on faces of peds; few coarse fragments; very strongly acid; clear smooth boundary.

2Bt5—32 to 39 inches; reddish brown (5YR 4/3) and weak red (10R 4/4) silty clay; few fine prominent light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; very firm; few very fine roots; common distinct weak red (2.5YR 5/2) clay films on faces of peds; few coarse fragments; very strongly acid; clear smooth boundary.

2BC—39 to 49 inches; weak red (10R 4/4) and strong brown (7.5YR 5/6) silty clay; few fine prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very firm; few very fine roots; few faint reddish brown (2.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

2Cr—49 to 60 inches; light reddish brown (2.5YR 6/4), light brownish gray (10YR 6/2), and weak red (10R 4/4) clay shale bedrock.

The thickness of the solum ranges from 36 to 54 inches, and the depth to bedrock ranges from 40 to 80 inches. The content of coarse fragments of shale, siltstone, or sandstone ranges from 2 to 20 percent in the Bt horizon and from 2 to 35 percent in the 2Bt and 2BC horizons.

The A horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 3 or 4. It is dominantly silt loam but is loam or channery loam in some pedons. The Bt horizon has hue of 2.5YR, 5YR, or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam, clay loam, silty clay loam, or the channery analogs of those textures. The 2Bt horizon has hue of 10R, 2.5YR, or 5YR and chroma of 3 to 6. The 2Bt and 2BC horizons are silty clay loam, silty clay, or the shaly or channery analogs of those textures.

Tioga Series

The Tioga series consists of deep, well drained, moderately permeable or moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 3 percent.

Tioga soils are commonly adjacent to Berks, Lowell, and Westmoreland soils on valley walls. Berks soils are moderately deep over bedrock. They have a higher content of coarse fragments in the subsoil than the Tioga soils. Lowell and Westmoreland soils have an argillic horizon. They have more clay in the subsoil than the Tioga soils.

Typical pedon of Tioga silt loam, occasionally flooded, about 4.1 miles east of Bergholz, in Ross Township, 190 feet south and 475 feet west of the northeast corner of sec. 22, T. 11 N., R. 3 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; very friable; many very fine roots; slightly acid; abrupt smooth boundary.

Bw1—8 to 14 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common very fine roots; slightly acid; clear smooth boundary.

Bw2—14 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure; friable; common very fine roots; common faint brown (10YR 4/3) coatings on channels and pores; slightly acid; abrupt smooth boundary.

Bw3—28 to 36 inches; yellowish brown (10YR 5/4) fine sandy loam that has thin lenses of silt loam and loamy fine sand; weak medium subangular blocky structure; very friable; few very fine roots; common faint brown (10YR 4/3) coatings on channels and pores; slightly acid; abrupt smooth boundary.

C1—36 to 42 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; few coarse fragments; medium acid; abrupt smooth boundary.

C2—42 to 60 inches; brown (10YR 4/3) very gravelly loamy sand; single grain; loose; about 50 percent coarse fragments; neutral.

The thickness of the solum ranges from 20 to 40 inches. The content of coarse fragments ranges from 0 to 35 percent, by volume, in individual layers in the solum and from 0 to 60 percent in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is silt loam or loam. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam, loam, fine sandy loam, sandy loam, gravelly fine sandy loam, or gravelly sandy loam, but in some pedons it has thin layers of loamy fine sand, loamy sand, or gravelly loamy sand. The C horizon has hue of 7.5YR or 10YR and chroma of 2 to 4. It is sandy loam, fine sandy loam, loamy sand, or the gravelly or very gravelly analogs of those textures.

Upshur Series

The Upshur series consists of deep, well drained, slowly permeable soils on ridges and benches on side slopes in the uplands. These soils formed in residuum derived from shale and mudstone. Slopes range from 8 to 15 percent.

Upshur soils are commonly adjacent to Berks, Guernsey, Lowell, and Westmoreland soils. All of the adjacent soils typically are on slopes below the Upshur soils, but Berks and Guernsey soils also are in higher landscape positions on knobs and on top of ridges. All of the adjacent soils have a yellower hue in the subsoil than the Upshur soils. Berks and Westmoreland soils have less clay in the subsoil than the Upshur soils. The moderately deep Berks soils have a cambic horizon. They have a higher content of coarse fragments in the subsoil than the Upshur soils. Guernsey soils are moderately well drained and have low-chroma mottles in the subsoil.

Typical pedon of Upshur silty clay loam, 8 to 15 percent slopes, eroded, about 1.4 miles south of Annapolis, in Salem Township, 1,080 feet south and 2,000 feet west of the northeast corner of sec. 31, T. 10 N., R. 3 W.

Ap—0 to 3 inches; dark reddish brown (5YR 3/4 and 2.5YR 3/4) silty clay loam, light reddish brown (5YR 6/4) dry; moderate very fine subangular blocky structure; firm; few very fine roots; medium acid; abrupt wavy boundary.

Bt1—3 to 7 inches; yellowish red (5YR 4/6) clay; strong medium and fine angular blocky structure; firm; few very fine roots; common distinct reddish brown (2.5YR 4/4) clay films on faces of peds; very strongly acid; abrupt smooth boundary.

Bt2—7 to 12 inches; dark red (2.5YR 3/6) clay; strong medium and fine angular blocky structure; very firm; few very fine roots; common distinct reddish brown (2.5YR 4/4) clay films on faces of peds; few slickensides; very strongly acid; clear smooth boundary.

Bt3—12 to 29 inches; dark red (2.5YR 3/6) clay; weak medium subangular blocky structure; very plastic; few very fine roots; few distinct reddish brown (2.5YR 4/4) clay films on faces of peds; few slickensides; very strongly acid; clear smooth boundary.

BC—29 to 43 inches; dark red (2.5YR 3/6) silty clay; few fine prominent brownish yellow (10YR 6/6) mottles inherited from the parent material; weak medium prismatic structure parting to weak fine subangular blocky; firm; few very fine roots; few fine gray (5YR 5/1) weathered limestone remnants; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

C1—43 to 58 inches; dark red (2.5YR 3/6) silty clay; massive; firm; common fine gray (5YR 5/1) and brownish yellow (10YR 6/6) weathered limestone remnants; about 10 percent coarse fragments; neutral; clear smooth boundary.

C2—58 to 82 inches; dark red (2.5YR 3/6), yellowish red (5YR 4/6), and dusky red (10R 3/3) silty clay; massive; firm; few fine light gray (10YR 7/2) weathered limestone remnants; about 10 percent coarse fragments; moderately alkaline; calcareous; clear smooth boundary.

Cr—82 to 84 inches; dusky red (10R 3/3) and light gray (10YR 7/2), bedded shale bedrock.

The thickness of the solum ranges from 26 to 50 inches, and the depth to bedrock ranges from 40 to more than 72 inches. The content of coarse fragments ranges from 0 to 5 percent in the upper part of the solum, from 0 to 15 percent in the lower part, and from 5 to 35 percent in the C horizon.

The Ap horizon has hue of 2.5YR to 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly silty clay loam but is silty clay in some pedons. The B horizon has hue of 10R to 5YR and chroma of 4 to 6. It is silty clay or clay. The C horizon dominantly has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 4 to 6, but some pedons have variegations of olive, olive brown, or yellow. This horizon is silty clay, silty clay loam, or the shaly analogs of those textures.

Wellston Series

The Wellston series consists of deep, well drained, moderately permeable soils on ridgetops in the uplands. These soils formed in a thin layer of loess and in the underlying material weathered from siltstone, sandstone, and shale. Slopes range from 1 to 7 percent.

Wellston soils are similar to Keene soils and are commonly adjacent to Coshocton and Gilpin soils. Coshocton and Gilpin soils have more sand and coarse fragments in the subsoil than the Wellston soils. They commonly are on the gently sloping and strongly sloping, broad ridgetops. Gilpin soils are moderately deep over bedrock. Coshocton and Keene soils are moderately well drained and have low-chroma mottles in the lower part of the subsoil.

Typical pedon of Wellston silt loam, 1 to 7 percent slopes, 1.7 miles west of East Springfield, in Springfield Township, 1,040 feet south and 2,540 feet east of the northwest corner of sec. 11, T. 11 N., R. 4 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak medium and fine granular structure; friable; many very fine roots; very strongly acid; abrupt smooth boundary.

BE—6 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and thick platy structure; friable; common very fine roots; common faint yellowish brown (10YR 5/4) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common very fine roots; few distinct brown (7.5YR 5/4) and few faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—15 to 25 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; few faint brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—25 to 33 inches; brown (7.5YR 5/4) silt loam; weak medium subangular blocky structure; friable; few very fine roots; few faint brown (7.5YR 5/4) clay films on faces of peds; common fine dark brown (7.5YR 3/2) segregations of iron and manganese oxide; few coarse fragments; very strongly acid; clear smooth boundary.

2Bt4—33 to 38 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few very fine roots; few faint brown (7.5YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

2BC—38 to 43 inches; yellowish brown (10YR 5/6) very channery silt loam; weak medium subangular blocky structure; friable; very few faint brown (7.5YR 5/4) clay films on faces of peds; about 40 percent weathered coarse fragments; very strongly acid; clear smooth boundary.

2Cr—43 to 63 inches; thin-bedded, soft, fine grained sandstone bedrock; clear smooth boundary.

2R—63 to 65 inches; hard, fine grained sandstone bedrock.

The thickness of the solum ranges from 32 to 50 inches, and the depth to bedrock ranges from 40 to 72 inches. The content of coarse fragments is from 0 to 2 percent, by volume, in the upper part of the solum, from 0 to 40 percent in the lower part of the solum, and from 2 to 60 percent in the 2C horizon, if it occurs.

The Ap horizon has chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is silt loam or silty clay loam. The 2BC horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, or the channery or very channery analogs of those textures.

Westmoreland Series

The Westmoreland series consists of deep, well drained, moderately permeable soils on side slopes and ridgetops in the uplands. These soils formed in colluvium and material weathered from shale, siltstone, and sandstone. Slopes range from 8 to 70 percent.

Westmoreland soils are similar to Coshocton, Gilpin, and Richland soils and are commonly adjacent to Berks, Hazleton, and Lowell soils on steep and very steep side slopes. Gilpin soils are moderately deep over bedrock. Richland soils formed entirely in colluvium. They have a higher base saturation in the lower part of the soil than the Westmoreland soils. Berks soils have a cambic horizon and are moderately deep over bedrock. Berks and Hazleton soils have a higher content of coarse fragments in the subsoil than the Westmoreland soils. Hazleton soils also have more sand and less clay in the subsoil than the Westmoreland soils. Lowell soils have more clay in the subsoil than the Westmoreland soils. Coshocton soils are moderately well drained and have low-chroma mottles in the subsoil.

Typical pedon of Westmoreland silt loam, in an area of Westmoreland-Lowell complex, 40 to 70 percent slopes, in the City of Steubenville, in Cross Creek Township, 2,032 feet north and 2,191 feet west of the southeast corner of sec. 12, T. 6 N., R. 2 W.

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; very friable; common very fine roots; about 4 percent coarse fragments; strongly acid; abrupt smooth boundary.

A—4 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium granular structure; very friable; common very fine roots; few distinct dark grayish brown (10YR 4/2) organic coatings in pores; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

E—9 to 13 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium platy structure; friable; few very fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; few distinct dark brown (10YR 4/3) organic coatings in pores; about 20 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt1—13 to 19 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium subangular blocky structure; friable; few very fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt2—19 to 27 inches; yellowish brown (10YR 5/8) silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; few distinct brown (7.5YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—27 to 34 inches; yellowish brown (10YR 5/8) channery silty clay loam; moderate medium subangular blocky structure; firm; few very fine roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; about 15 percent coarse fragments; very strongly acid; clear smooth boundary.

C—34 to 41 inches; brown (7.5YR 5/4) very channery clay loam; massive; firm; few faint brown (7.5YR 5/4) clay films in pores and on horizontal faces; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

R—41 to 43 inches; olive (5Y 4/3), thin-bedded shale and siltstone bedrock.

The thickness of the solum ranges from 24 to 40 inches, and the depth to bedrock ranges from 40 to more than 72 inches. The content of coarse fragments of shale, siltstone, or sandstone ranges from 2 to 30 percent in the solum and from 45 to 90 percent in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly silt loam but is loam or channery loam in some pedons. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam, silty clay loam, clay loam, loam, or the shaly or channery analogs of those textures. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is the very channery, extremely channery, or very shaly analogs of silt loam, silty clay loam, clay loam, or loam.

Wheeling Series

The Wheeling series consists of deep, well drained, moderately permeable soils on terraces along streams. These soils formed in old alluvium. Slopes range from 0 to 3 percent.

Wheeling soils are commonly adjacent to Tioga, Nolin, Omulga, and Richland soils. Tioga and Nolin soils are in the slightly lower landscape positions. Omulga and Richland soils are in the slightly higher, more sloping landscape positions. Tioga and Nolin soils are on flood plains and do not have an argillic horizon. Also, Tioga soils have less clay and more sand in the subsoil than the Wheeling soils. Omulga soils are moderately well drained and have a fragipan. Richland soils are on colluvial foot slopes and have less sand in the substratum than the Wheeling soils.

Typical pedon of Wheeling silt loam, 0 to 3 percent slopes, about 3.8 miles southwest of Hammondsville, in Knox Township, 130 feet north and 130 feet east of the southwest corner of sec. 34, T. 8 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; few very fine roots; few rounded pebbles; medium acid; clear smooth boundary.

BA—9 to 12 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few very fine roots; few faint dark brown (10YR 4/3) coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—12 to 22 inches; brown (7.5YR 4/4) loam; moderate coarse subangular blocky structure; friable; few very fine roots; common distinct dark brown (10YR 4/3) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—22 to 31 inches; yellowish brown (10YR 5/6) loam; moderate coarse subangular blocky structure; friable; few very fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and common distinct dark brown (7.5YR 3/2) organic coatings in channels; strongly acid; gradual smooth boundary.

Bt3—31 to 40 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; firm; few very fine roots; few distinct dark brown (7.5YR

4/2) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt4—40 to 46 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; firm; few very fine roots; few distinct dark brown (7.5YR 4/2) clay films on vertical seams; few fine black (N 2/0) pieces of coal; few coarse fragments; strongly acid; clear smooth boundary.

2BC—46 to 53 inches; brown (7.5YR 5/4) sandy loam; weak coarse subangular blocky structure; friable; few fine roots; few faint dark brown (7.5YR 4/2) clay films on vertical seams and in pores; few fine black (N 2/0) pieces of coal; few rounded pebbles; strongly acid; gradual smooth boundary.

2C1—53 to 65 inches; yellowish brown (10YR 5/6) gravelly sandy loam; massive; friable; about 15 percent gravel; strongly acid; abrupt smooth boundary.

2C2—65 to 80 inches; stratified light yellowish brown (10YR 6/4) loamy sand and strong brown (7.5YR 5/6) loamy very fine sand; single grain; loose; few rounded pebbles; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The content of gravel ranges from 0 to 5 percent in the upper part of the solum and from 0 to 15 percent in the lower part of the solum. The content of gravel in the C horizon ranges from 0 to 60 percent.

The Ap horizon has chroma of 2 or 3. The Bt horizon has chroma of 4 to 6. The Ap and Bt horizons are dominantly silt loam, loam, or silty clay loam in the upper part and loam or silt loam in the lower part. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6. It is stratified loamy sand, loamy very fine sand, sandy loam, or the gravelly or very gravelly analogs of those textures.

Formation of the Soils

This section describes how the major factors of soil formation have affected the soils in Jefferson County and explains some of the processes in soil formation.

Factors of Soil Formation

Soils form through processes that act on deposited or accumulated geologic material. The major factors in soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on the parent material is modified by relief and by the length of time that the parent material has been acted upon. The relative importance of each factor differs from place to place. In some areas one factor determines most of the soil properties. Normally, however, the interaction of all five factors determines what kind of soil forms in any given place.

Parent Material

The soils in Jefferson County formed in several kinds of parent material. These are residuum, colluvium, loess, glacial outwash, surface mine spoil, lacustrine material, and alluvium.

Bedrock residuum is the most extensive kind of parent material in the county. It includes material weathered from shale, sandstone, siltstone, and limestone. The Berks soils formed in bedrock residuum. Some soils in small areas on ridges and side slopes in the county formed in as much as 36 inches of loess and in the underlying residuum. The Keene soils formed in loess and in the underlying siltstone and shale residuum.

Most of the soils on side slopes formed in residuum and colluvium. Colluvium is soil material or rock fragments, or both, that have been moved downhill by gravity. Soils that formed in residuum and colluvium derived from sandstone bedrock are coarse textured in the subsoil. The Hazleton soils are an example. Residuum and colluvium derived from clayey shale or limestone are fine textured or moderately fine textured. The soils that formed in these parent materials dominantly are fine textured or moderately fine textured in the subsoil. The Upshur soils formed in shale residuum. Residuum and colluvium derived from siltstone, shale, and sandstone are medium textured or moderately fine textured. The soils that formed in this combination of parent materials generally are medium textured or moderately fine textured in the subsoil. The Coshocton soils are an example.

Sandy and gravelly outwash was deposited by meltwater along glacial streams. Much of this fairly well sorted coarse material was covered by finer textured loamy deposits. The Wheeling soils formed in these materials.

Surface mine spoil is a mixture of partly weathered fine-earth material and fragments of shale, sandstone, siltstone, and limestone. It was piled up or graded during surface mining for coal or clay shale. The Bethesda, Fairpoint, and Morristown soils formed in spoil from strip mines. The spoil is dominated by fragments of rock and some sand, silt, and clay.

Areas of lacustrine material, or lake bottom sediments, are moderately extensive in the county. The layered characteristics of the parent material in these areas are reflected in the subsoil of the Omulga and Pekin soils.

Alluvium, which is deposited by floodwater, is the youngest parent material in the county. It is still accumulating as fresh sediment deposited during periods of stream overflow. The sediment is derived from the surface layer of the higher lying soils. The Nolin and Tioga soils formed in alluvium.

Climate

The climate in Jefferson County is uniform. As a result, it has not greatly contributed to differences among the soils. It has favored both physical changes and chemical weathering of the parent material and the activity of living organisms.

Rainfall has leached the solum of the carbonates in the parent material of some soils. This leaching has occurred in the Pekin and Wheeling soils. The frequency of rainfall resulted in wetting and drying cycles that favored the translocation of clay minerals and the formation of soil structure in Lowell, Gilpin, and other soils in the county.

The range of temperature variations has favored both physical changes and chemical weathering of the parent material. Freezing and thawing aided the formation of soil structure. Warm summer temperatures favored chemical reactions in the weathering of primary minerals.

Both rainfall and temperature have favored plant growth and the accumulation of organic matter in all the soils in the county.

Relief

Relief affects the natural drainage of soils. It influences the amount of runoff and the depth to the seasonal high water table. Water that runs off sloping soils collects in depressions or is removed through a drainage system. Therefore, from an equal amount of rainfall, the sloping soils receive less total water and the depressional soils more total water than the nearly level soils. Gently sloping soils generally show the most development because they are neither saturated nor droughty. Soil formation on steep slopes tends to be inhibited by erosion and the limited amount of water that penetrates the surface.

Living Organisms

Plants, animals, bacteria, fungi, and other living organisms affect soil formation. At the time that the county was settled, the vegetation was dominantly a hardwood forest of oak, hickory, maple, yellow-poplar, and ash. The soils that formed in these forested areas are subject to acid leaching. As a result, the subsoil generally is lower in exchangeable bases than the substratum.

Small animals, insects, earthworms, and burrowing animals leave channels in the soil, making it more permeable. Animals also mix the soil material and contribute organic matter to the soil. Worm channels and wormcasts are common in the surface layer of well drained soils, such as the Gilpin and Lowell soils. Crawfish channels are evident in poorly drained soils, such as the Melvin soils.

Human activities also affect soil formation. Examples of these activities are cultivation, seeding, drainage systems, irrigation, cutting and filling, and surface mining. Another example is the application of lime and fertilizer, which affect soil chemistry.

Time

Time is needed for the other factors of soil formation 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 soil forms slowly. In many areas factors other than time have been responsible for most of the differences in the kind and distinctness of horizons in the different soils.

Most of the soils in the county are old and have a strongly expressed profile. The youngest soils are those that formed in spoil from strip mines. Examples are the Bethesda, Fairpoint, and Morristown soils. Periodic depositions of fresh sediment interrupt soil formation on flood plains. As a result, the Melvin and Orrville soils do not have a strongly expressed profile.

Processes of Soil Formation

Most of the soils in Jefferson County have strongly expressed profiles. The processes of soil formation have resulted in distinct changes in the soils. The strongest development is evident in the soils on ridgetops and side slopes in the uplands and the soils on terraces along the major streams. In contrast, the soils on flood plains and in surface mined areas have been only slightly modified by the processes of soil formation.

The soil-forming processes are additions, removals, transfers, and transformations *(21)*. Some of these processes result in differences among the surface layer, subsoil, and substratum.

The most important addition to the soils in this county is that of organic matter to the surface layer. A thin layer of organic matter accumulates under forest vegetation. If the soils are cleared and cultivated, this organic matter is mixed with underlying mineral material.

Leaching of carbonates from calcareous parent material is one of the most significant losses preceding many other chemical changes in the soils. The limestone and calcareous shale underlying undisturbed soils and combinations of these materials underlying surface mined soils have a high content of carbonates when first exposed to leaching. The soils that formed in residuum of limestone and calcareous shale bedrock, such as Elba soils, still have carbonates at a depth of 10 to 30 inches. Most of the soils on uplands and terraces do not have carbonates within 5 feet of the surface and are very strongly acid or medium acid in the subsoil. Other minerals in the soils are subject to the chemical weathering that results from leaching, but their resistance is higher and their removal is slower.

Seasonal cycles of wetting and drying in the soil are largely responsible for the transfer of clay from the surface layer to the faces of peds in the subsoil. The fine clay is suspended in water percolating through the surface layer and then is deposited in the subsoil. This transfer accounts for the patchy or nearly continuous clay films on faces of peds in the subsoil of most soils on uplands and terraces. Lowell and Omulga soils are examples of soils that have clay films in the subsoil.

The transformation of mineral compounds occurs in most soils. The results of this process are most apparent if the formation of layers is not affected by rapid erosion or by the accumulation of material at the surface. When the silicate minerals are weathered chemically, other minerals, mainly layer lattice silicate clays, are produced. Most of the layer lattice clays remain in the subsoil.

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Glossary

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

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.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

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. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil 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.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

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 resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The depth to bedrock. Deep soils are more than 40 inches to bedrock, moderately deep soils are 20 to 40 inches to bedrock, and shallow soils are 10 to 20 inches to bedrock.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

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, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of 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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Highwalls. The vertical surfaces exposed by mining operations.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

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.

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.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the 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 area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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.

Perimeter drain. An artificial drain placed around the perimeter of a septic tank absorption field to lower the water table; also called a curtain drain.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	below 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

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-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slip. The downhill movement of a mass of soil under wet or saturated conditions.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded 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.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and help to control erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.