USDA United States Department of Agriculture

Natural Resources Conservation Service

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

Soil Survey of Morgan 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.

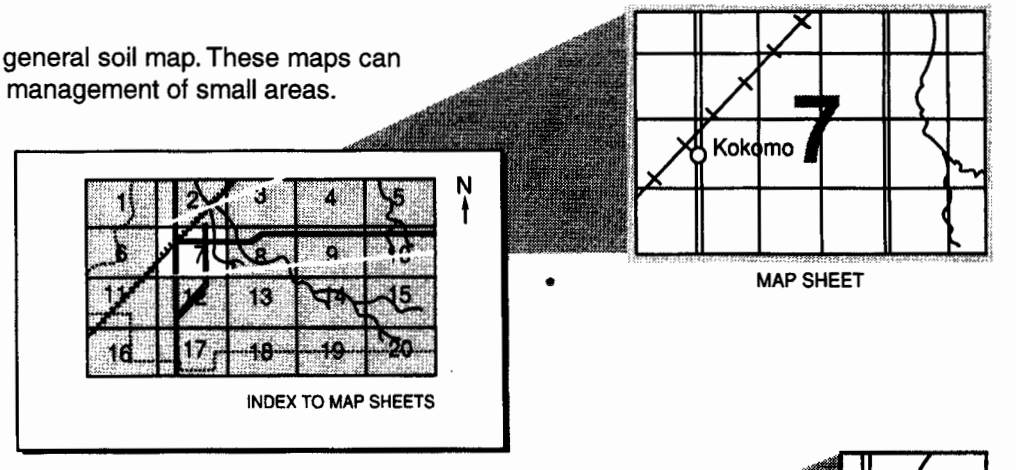
Detailed Soil Maps

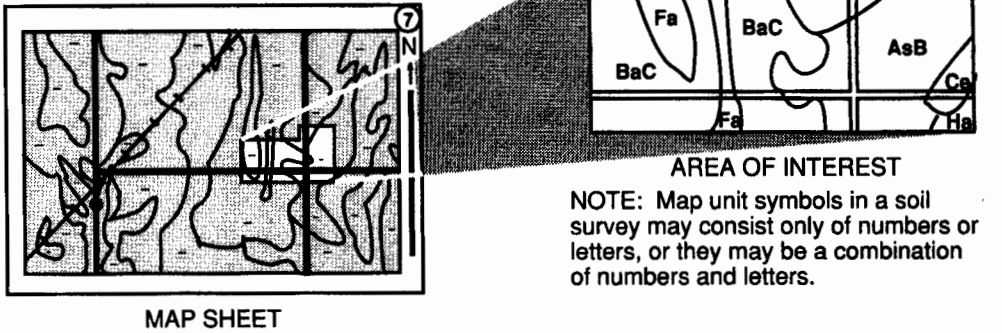
The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

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.

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

The **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.





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

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

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Forest Service; Ohio Department of Natural Resources, Division of Soil and Water Conservation; the Ohio Agricultural Research and Development Center; the Ohio Cooperative Extension Service; and the Morgan County Commissioners. It was funded in part by contributions from the local coal mining industry through local units of government. The survey is part of the technical assistance furnished to the Morgan Soil and Water Conservation District.

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

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Cover: A farmstead, in Morgan County, Ohio, on strongly sloping Westgate soils surrounded by moderately steep Guernsey and Upshur soils. Lowell and Gilpin soils are on the steep hillsides.

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Foreword

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

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

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

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

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

Patrick Wolf
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Morgan County, Ohio

By Paul C. Jenny and Don N. McClure, Natural Resources Conservation Service

Fieldwork by Paul C. Jenny and Don N. McClure, Natural Resources Conservation Service

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

MORGAN COUNTY is in the southeastern part of Ohio (fig. 1). Its area is 269,888 acres, or 422 square miles. Its landscape consists predominantly of hills interrupted by a few broad ridgetops and valleys. In 1980, the population of the county was 14,200 (*15*). The population of McConnelsville, the county seat and largest village, was 2,100, and that of Malta, the next largest village, was 956.

Woodland is the major land use in the county. Most of the woodland is in areas of moderately steep to very steep soils. These soils are poorly suited or generally unsuited to crops but they are suited to trees. The county is in the central hardwood forest region. Lumber is the most important forest product.

Agriculture is also important. Beef cattle, sheep, and general farming are the major types of farm enterprises. Hay, corn, and wheat are grown mainly on ridgetops or in broad valleys. Orchard and truck crops are also grown in the county.

In the north-central and northeastern parts of the county, many farming areas have been taken out of production because of surface mining for coal. The recently mined areas have been reclaimed to grow hay. The older reclaimed areas, which have been reverting to brush and woodland, are used for camping, hunting, and fishing.

General Nature of the County

This section gives general information about the climate; history; physiography, relief, and drainage; mineral resources; geology; farming; and industry and transportation in Morgan County, Ohio.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at McConnelsville in the

Figure 1.—Location of Morgan County in Ohio.

period 1951 to 1988. 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 19 degrees. The lowest temperature on record, which occurred on January 21, 1984, is -22 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred on September 3, 1953, is 104 degrees.

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

The total annual precipitation is about 40 inches. Of this, 23 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 4.68 inches on July 15, 1985. Thunderstorms occur on about 41 days each year, and most occur in summer.

The average seasonal snowfall is about 26 inches. The greatest snow depth at any one time during the period of record was 20 inches. On the average, 11 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 40 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in spring.

History

Morgan County was named in honor of General Daniel Morgan, who fought in the Revolutionary War. The county was formed December 29, 1817, from parts of Guernsey, Washington, and Muskingum Counties (*8*).

The early settlers came from the eastern and middle states and the surrounding counties. They settled the river valleys in Windsor, Union, Bloom, York, Manchester, and Center Townships. In its early days, Morgan County was woodland and was inhabited by several Indian tribes. In 1791, the earliest settlement in Morgan County was destroyed by Indians.

Malta was surveyed and laid out in 1816, and McConnelsville, in 1817. McConnelsville, which became the county seat in 1818, was named for General Robert McConnel, who donated land for churchs, schools, public buildings, and a cemetary.

Morgan County grew with the increase of traffic on the Muskingum River. Livestock and fruit crops were introduced and settlement spread to the uplands.

Physiography, Relief, and Drainage

Morgan County lies in the western part of the Kanawha section of the unglaciated Appalachian Plateaus Province (*5*). Rugged, it consists mostly of steep hillsides and narrow ridgetops throughout. Some broad, gently sloping uplands are in the western part of the county and on the floors of postglacial stream valleys.

Meltwater from ice sheets breached a divide in the northern part of Morgan County and established the southeasterly flow of streams today. The Muskingum River formed when water overtopped the divide and flowed southeasterly through the headwater channel of the old system of Beverly Creek.

The eastern part of the county is drained by Meigs Creek and Olive Green Creek. The topography consists mainly of moderately steep to very steep hillsides and gently sloping or strongly sloping ridgetops. It also includes some fairly broad stream valleys and moderately steep to very steep areas where coal is surface mined.

The western part of the county is drained by Wolf Creek and its tributaries. The topography consists of gently sloping to moderately steep hillsides, ridgetops, and foot slopes and steep and very steep hillsides along major and minor streams.

The central part of the county is drained by the Muskingum River and its tributaries. The topography consists of very gently to strongly sloping terraces of varying width along a narrow flood plain. The tributaries are narrow and are separated by steep side slopes and fairly broad ridgetops.

The southwestern part of the county is drained by branches of Federal and Sunday Creeks. The topography consists of moderately steep to steep hillsides and valleys, broad foot slopes, and narrow ridgetops.

The highest elevation in the county is 540 feet.

Mineral Resources

Morgan County contains a wide range of mineral resources. They consist of coal, sand, and gravel; oil and gas deposits; and sandstone and limestone (*5*).

Coal has been mined from four dominant coal beds: Middle Kittanning No. 6, Upper Freeport No. 7, Pittsburg No. 8, and Meigs Creek No. 9.

In Morgan County, sand and gravel deposits occur along the Muskingum River. Some pits yield large amounts of sand but little gravel. Also, a thick layer of silty

material overlies the sand and gravel. Additional amounts of sand, known as mountain sand, are produced through the weathering of weakly cemented Waynesburg sandstone.

Oil and gas have been produced in Morgan County since 1861. The early wells were associated with Cow Run sandstone. The later wells, which were drilled deeper, yielded greater amounts of oil and gas.

Cow Run sandstone was the only sandstone bed of economic importance in the county. It was used for canal locks, bridge piers, foundations, and retaining walls.

Because of thin layers, limestone was used mainly for road gravel and for agricultural lime on local farms.

Geology

The bedrock of Morgan County is sedimentary in nature. The exposed strata consists of three series of the Pennsylvanian System and one series of the Permian System (*5*). The Allegheny, Conemaugh, and Monongahela Series are part of the Pennsylvanian System. The Washington Series is part of the Dunkard Division of the Permian System. The bedrock in these layers are sandstone, shale, siltstone, limestone, and coal. The bedrock layers are in nearly horizontal beds but dip southeast, on average, 30 feet per mile.

The Allegheny Series crops out only in the stream channels in the extreme northwestern part of the county. The Middle Kittanning No. 6 and the Upper Freeport No. 7 coalbeds are part of this series. It is the least exposed of all the series.

The Conemaugh Series is the most extensively exposed bedrock in the county. Conemaugh rocks crop out in a broad band through the western and northcentral parts of the county, trending in southwest to northeast.

The Monongahela Series crops out in all except the extreme northwestern part of the county. The Pittsburgh No. 8 and the Meigs Creek No. 9 coalbeds are part of this series.

The Washington Series of the Dunkard Division crops out on the higher hills and ridges in the eastern part of the county.

Farming

The Soil and Water Conservation District Resource Inventory for Morgan County shows that 85 percent of the county is used for agricultural production, including 49 percent for woodland, 22 percent for pasture, and 14 percent for cropland (*12*).

Most farm income is generated from the sale of livestock and livestock products, mainly dairy products and beef (*6*). Sheep, hogs, and poultry are also marketed. Corn, wheat, and hay are the leading income producing crops. Smaller amounts of fruits and truck crops are also produced.

Most of the cropland consists of gently sloping and strongly sloping soils on ridgetops and terraces. These soils have good surface drainage, but they are subject to moderate or severe erosion.

Most of the pasture consists of strongly sloping to steep soils on ridgetops, hillsides, and foot slopes. These soils also have good surface drainage and are subject to moderate or severe erosion. Wetness and slippage also occur on foot slopes.

In the northeastern part of the county, areas that had been farmed have been taken out of production by surface mining for coal. In the western part of the county adjoining Perry County, 3,234 acres of the Wayne National Forest is managed by the U.S. Forest Service. In the southwestern part of the county, Wolf Creek Wildlife Area and Burr Oak State Park are managed by the State of Ohio.

Industry and Transportation

The main industries in Morgan County are coal mining, metals fabrication, farming, furniture manufacturing, manufacturing of new and replacement windows, the mining of sand and gravel, timber production, oil and gas production, recreation, and other forms of light manufacturing.

Coal is mined primarily in the northcentral and northeastern parts of the county. Sand and gravel are mined along the entire length of the Muskingum River. Other industrial activity is located near the villages of McConnelsville and Malta.

The transportation network includes State Routes 37, 60, 78, 83, 266, 339, 376, 377, 555, 669, and 792. One railroad, the Muskingum Electric, hauls coal from surface mines in adjoining Muskingum and Noble Counties and the northeastern part of Morgan county to the coal preparation plant in Unionville.

The Muskingum River and its system of locks and dams is used for pleasure boating.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or

horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

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

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

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

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

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

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

Soil Survey Procedures

The general procedures followed in making this survey are described in the National Soil Survey Handbook of the Natural Resources Conservation Service. The soil survey maps made for conservation planning on individual farms prior to the start of the project and the Geology and Mineral Resources of Morgan County *(5)* were among the references used.

Before the actual fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on aerial photographs flown in 1982 at a scale of 1:15,840. U.S. Geological Survey topographic maps at a scale of 1:24,000 helped the soil scientists to relate land and image features.

Traverses were made on foot to examine the soils. In areas such as the Westgate-Upshur-Guernsey association on the general soil map, the soil pattern is very complex and traverses were as close as 200 yards apart (*4*). In areas such as the moderately steep to very steep hillsides of the Lowell-Gilpin-Guernsey association, where land use is less intensive, traverses were about 1/4 mile apart.

As the traverses were made, the soil scientists divided the landscape into segments in which use and management of the soil were different. A hillside would be separated from a terrace, a gently sloping ridgetop, from a strongly sloping side slope. In most areas, soil examinations along the traverses were made 50 to 300 yards apart, depending on the landscape and soil pattern.

Observations of such items as landforms, blown-down trees, vegetation, roadbanks, bedrock highwalls in surface mined areas, and animal burrows were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined with the aid of a 3/4-inch-diameter soil sampling tube, bucket auger, or spade to a depth of about 4 feet or to bedrock if the bedrock was at a depth of less than 4 feet. Examinations of selected areas of deeper soils were made by using a truck-mounted, hydraulic soil coring rig to a depth of 8 feet or more. The pedons described as typical were observed and studied in pits that were dug with shovels, spades, and digging bars.

Soil mapping was recorded on the 1982 photo base maps and transferred to film positive mylars. The drainageways were mapped in the field. Most cultural features were recorded from visual observations, but some were transferred from U.S. Geological Survey 7-1/2 minute topographic maps.

At the beginning of the survey, sample blocks were selected to represent the major landscapes in the county. These areas were mapped at a rate roughly half that used in the remainder of the county. Extensive notes were taken on the composition of map units in these preliminary study areas. As mapping progressed, these notes were modified to reach the final assessment of the composition of the individual map units.

Samples for chemical and physical analyses and those for analyses of engineering properties were taken from representative sites of several soils in the survey area. The chemical and physical analyses were made by the Soil Characterization Laboratory, Department of Agronomy, The Ohio State University, Columbus, Ohio. The results of the analyses are stored in a computerized data file at the laboratory. The analyses of engineering properties were made by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. The laboratory procedures can be obtained by request from these respective laboratories. The results of the laboratory analyses can be obtained from the Department of Agronomy, the Ohio State University, Columbus, Ohio; The Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Natural Resources Conservation Service, Ohio State Office, Columbus, Ohio.

General Soil Map Units

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

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

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

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinement in series concepts and the application of the latest soil classification system.

Soil Descriptions

1. Chavies-Nolin-Conotton association

Very deep, nearly level to strongly sloping, well drained soils formed in alluvium and stratified gravelly outwash on terraces and flood plains

This map unit is on broad multi-level terraces and on narrow to wide flood plains adjacent to the Muskingum River (fig. 2). It is bounded by steep and very steep hillsides on adjacent uplands. Slope ranges from 0 to 12 percent.

This map unit makes up about 2 percent of the county. It is 35 percent Chavies soils, 25 percent Nolin soils, 15 percent Conotton soils, and 25 percent soils of minor extent.

Chavies soils are nearly level and gently sloping and are on low terrace levels. Available water capacity is moderate. Permeability is moderately rapid. The hazard of erosion is moderate.

Nolin soils are nearly level and are on flood plains. Available water capacity is high. Permeability is moderate. These soils are subject to occasional flooding.

Conotton soils are nearly level to strongly sloping and are on high terrace levels. Available water capacity is low. Permeability is rapid. The hazard of erosion is moderate or high.

Of minor extent in this map unit are Brookside, Gilpin, Lowell, Upshur, and Vandalia soils. Brookside soils are moderately well drained and have more clay in the subsoil than have the major soils. They are on moderately steep and steep foot slopes. Gilpin soils are moderately deep. They are on steep and very steep hillsides. Lowell, Upshur, and Vandalia soils have more clay in the subsoil than have the major soils. Lowell soils are on steep and very steep hillsides. Upshur soils are on steep and very steep benches. Vandalia soils are on moderately steep and steep foot slopes.

The acreage consists of some urban land but mostly cropland. The major soils are well suited to poorly suited to cropland and moderately well suited and well suited to pasture. They are well suited to woodland. They are well suited to unsuited to urban use.

The major management concerns for cropland on terraces are droughtiness and erosion. Those for urban uses are flooding on flood plains and possible ground water contamination on high terrace levels.

2. Westmoreland-Guernsey association

Deep and very deep, moderately steep to very steep, well drained and moderately well drained soils formed in residuum and colluvium derived from interbedded sandstone, siltstone, shale, and limestone on uplands.

This map unit is on hillsides and benches. The hillsides are broken by narrow benches and are dissected by deep drains and very narrow flood plains. Slope ranges from 12 to 70 percent.

This map unit makes up about 9 percent of the county. It is about 35 percent Westmoreland soils, 30 percent Guernsey soils, and 35 percent soils of minor extent.

Westmoreland soils are moderately steep to very steep and well drained. They are on hillsides. Available water

capacity is low. Permeability is moderate. The hazard of erosion is high.

Guernsey soils are very deep, moderately steep to very steep, and moderately well drained. They are on narrow benches. Available water capacity is moderate. Permeability is moderately slow or slow. Shrink-swell potential is high. A seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. The hazard of erosion is severe.

Some soils of minor extent in this map unit are the Berks, Lobdell, Newark, Upshur, and Westgate soils. Berks soils are moderately deep and contain more rock fragments than the major soils. They are on very steep hillsides. Lobdell soils have less clay in the subsoil than Guernsey soils and fewer rock fragments in the underlying material than Westmoreland soils. They are on flood plains. Newark soils are somewhat poorly drained and have more silt and fewer rock fragments than the major soils. They are on flood plains. Upshur soils are redder in the subsoil than the major soils. They are on strongly sloping and moderately steep, wide benches and on moderately steep to very steep narrow benches. Westgate soils have more silt in the upper part of the subsoil than the major soils. They are on gently sloping and strongly sloping ridgetops.

Most of the acreage is woodland. The major soils are well suited and moderately well suited to woodland. They are poorly suited or unsuited to urban uses.

The major management concerns for woodland are slope and the hazard of erosion. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes. Those slopes are characterized by less evapotranspiration and cooler temperatures. The major management concerns for urban use are slope, restricted permeability, shrink-swell potential, erosion potential, slippage, and wetness.

3. Westgate-Upshur-Guernsey association

Deep or very deep, gently sloping to very steep, moderately well drained and well drained soils formed in loess and in residuum and colluvium derived from interbedded shale, limestone, and siltstone on uplands.

This map unit is on broad, undulating ridgetops and benches. The ridgetops and benches are dissected by narrow stream valleys bounded by steep and very steep hillsides and narrow benches. Slope ranges from 2 to 70 percent.

This map unit makes up about 8 percent of the county. It is 25 percent Westgate soils, 20 percent Upshur soils, 15 percent Guernsey soils, and 40 percent soils of minor extent.

Westgate soils are deep or very deep, gently sloping and strongly sloping, and moderately well drained. They are on ridgetops and broad benches. Available water capacity is high. Permeability is moderate in the upper part and slow in the lower part of the subsoil. Shrink-swell potential is moderate in the upper part and high in the lower part of the subsoil. A seasonal high water table is at a depth of 2.0 to 3.5 feet during extended wet periods. The hazard of erosion is moderate or severe.

Upshur soils are deep or very deep, strongly sloping to steep, and well drained. They are on ridgetops and benches. Available water capacity is moderate. Permeability is slow. Shrink-swell potential is high. The hazard of erosion is severe.

Guernsey soils are deep and very deep, moderately steep to very steep, and moderately well drained. They are on benches. Available water capacity is moderate. Permeability is moderately slow or slow. Shrink-swell potential is high. A seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. The hazard of erosion is severe.

Of minor extent in this map unit are Berks, Gilpin, Lobdell, and Westmoreland soils. Berks, Gilpin, Lobdell, and Westmoreland soils have less clay in the subsoil than the major soils. Berks soils are on very steep hillsides. Gilpin soils are on moderately steep and steep hillsides. Lobdell soils are on flood plains. Westmoreland soils are on moderately steep to very steep hillsides.

Most of the acreage is in pasture or cropland. The steeper soils are used as woodland. The steep and very steep soils are unsuited to cropland and most urban uses. They are poorly suited or unsuited to pasture and well suited or moderately well suited to woodland. The less sloping soils are well suited or moderately well suited to cropland and moderately well suited or poorly suited to most urban uses.

The major management concerns for most land uses are seasonal wetness, restricted permeability, shrink-swell potential, slope, slippage, and erosion potential. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes. Those slopes are characterized by less evapotranspiration and cooler temperatures.

4. Lowell-Gilpin-Guernsey association

Moderately deep to very deep, moderately steep to very steep, well drained and moderately well drained soils formed in residuum and colluvium derived from interbedded limestone, siltstone, shale, and sandstone on uplands.

This map unit is on ridgetops, hillsides, and benches. The ridgetops are narrow. Some hillsides are broken by a few narrow benches. The broader benches are undulating and dissected by narrow stream flood plains. Slope ranges from 12 to 70 percent.

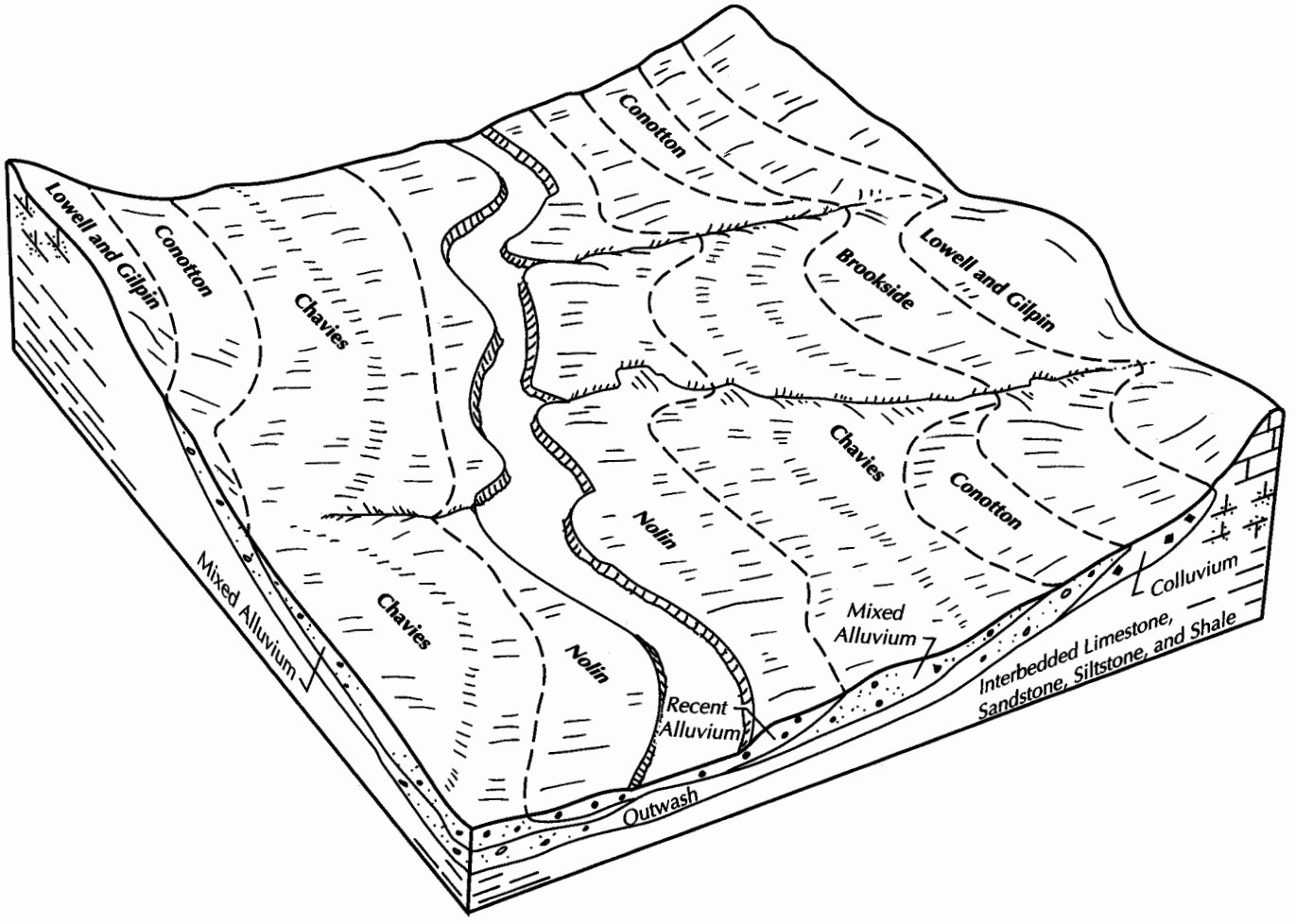

Figure 2.—Typical pattern of soils and parent material in the Chavies-Nolin-Conotton association.

This map unit makes up about 45 percent of the county. It is 40 percent Lowell soils, 15 percent Gilpin soils, 10 percent Guernsey soils, and 35 percent soils of minor extent (fig. 3).

The well drained Lowell soils are on ridgetops and hillsides. Available water capacity is moderate. Permeability is moderately slow. Shrink-swell potential is moderate. The hazard of erosion is high.

Gilpin soils are moderately deep, steep and very steep, and well drained. They are on hillsides. Available water capacity is low. Permeability is moderate. The hazard of erosion is severe.

Guernsey soils are moderately steep and moderately well drained. They are on broad benches. Available water capacity is moderate. Permeability is moderately slow or slow. Shrink-swell potential is high. A seasonal high water table is at a depth of 1.5 to 3.0 feet during extended wet periods. The hazard of erosion is severe. Soil slippage potential is high.

Of minor extent in this map unit are Licking, Nolin, Upshur, and Westgate soils. Licking soils have fewer rock fragments than the major soils. They are on terraces. Nolin soils have more silt in the subsoil than the major soils. They are on flood plains. Upshur soils are redder in the subsoil than the major soils. Upshur soils are on moderately steep, broad benches. Westgate soils have more silt in the upper part of the subsoil than the major soils. Westgate soils are on gently sloping and strongly sloping ridgetops and broad benches.

Most acreage on ridgetops and broad benches is cropland and pasture. The hillsides are pasture or woodland. The major soils are well suited or moderately well suited to woodland. The steep and very steep soils are poorly suited or unsuited to cropland and most urban uses. They are poorly suited or unsuited to pasture. The less sloping soils are poorly suited to cropland, moderately well suited to pasture, and poorly suited to most urban uses.

The major management concerns for most land uses on ridgetops are slope, restricted permeability, shrink-

swell potential, and the hazard of erosion. The major management concerns on broad benches are slope, restricted permeability, shrink-swell potential, the hazard of erosion, seasonal wetness, and slippage. The major management concerns on hillsides are slope, restricted permeability, slippage, shrink-swell potential, the hazard of erosion, depth to bedrock, and droughtiness. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes. Those slopes are characterized by less evapotranspiration and cooler temperatures.

5. Gilpin-Upshur association

Moderately deep to very deep, moderately steep to very steep, well drained soils formed in residuum derived from interbedded sandstone, siltstone, and shale on uplands.

This map unit is on ridgetops, hillsides, and benches. The ridgetops are narrow. The hillsides are broken by narrow benches and are dissected by drains and very narrow flood plains of streams. Slope ranges from 12 to 70 percent.

This map unit makes up about 27 percent of the county. It is 35 percent Gilpin soils, 30 percent Upshur soils, and 35 percent soils of minor extent (fig. 4).

Gilpin soils are moderately deep and are on ridgetops and hillsides. Available water capacity is low. Permeability is moderate. The hazard of erosion is severe.

Upshur soils are deep and very deep and are on ridgetops and narrow benches. Available water capacity is moderate. Permeability is slow. Shrink-swell potential is high. The hazard of erosion is severe.

Of minor extent in this map unit are Aaron, Elba, Lobdell, Nolin, Vandalia, and Westgate soils. Aaron soils are moderately well drained. They are on ridgetops. Elba soils are calcareous in the subsoil. They are on steep hillsides. Lobdell soils are moderately well drained. They are on flood plains. Nolin soils have more silt in the subsoil than the major soils. They are on flood plains. Vandalia soils have more sandstone fragments than the Upshur soils, and more clay in the subsoil than the Gilpin soils. They are on foot slopes. Westgate soils are moderately well drained and have more silt in the upper part of the subsoil than the major soils. They are on gently sloping and strongly sloping ridgetops.

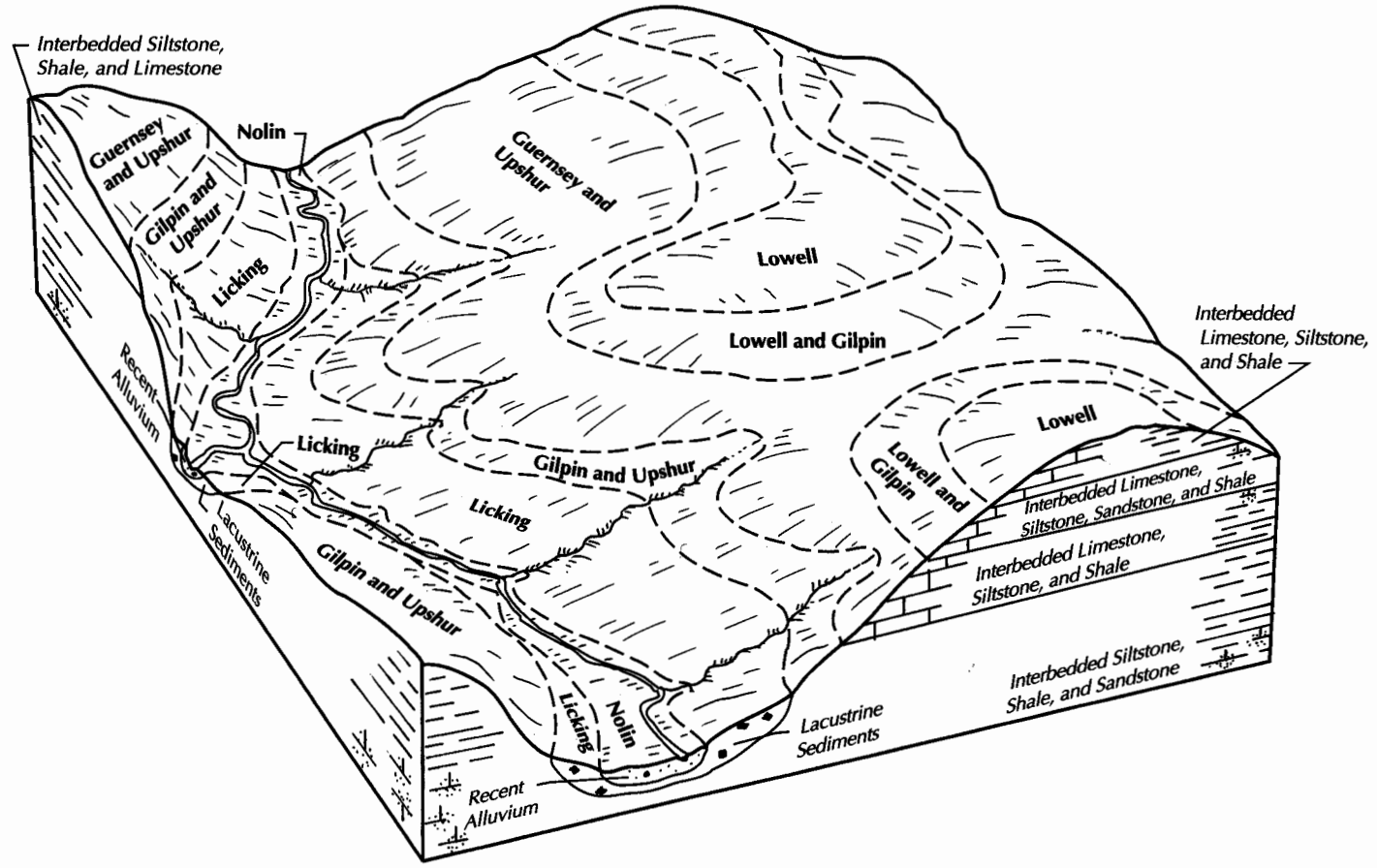

Figure 3.—Typical pattern of soils and parent material in the Lowell-Gilpin-Guernsey association.

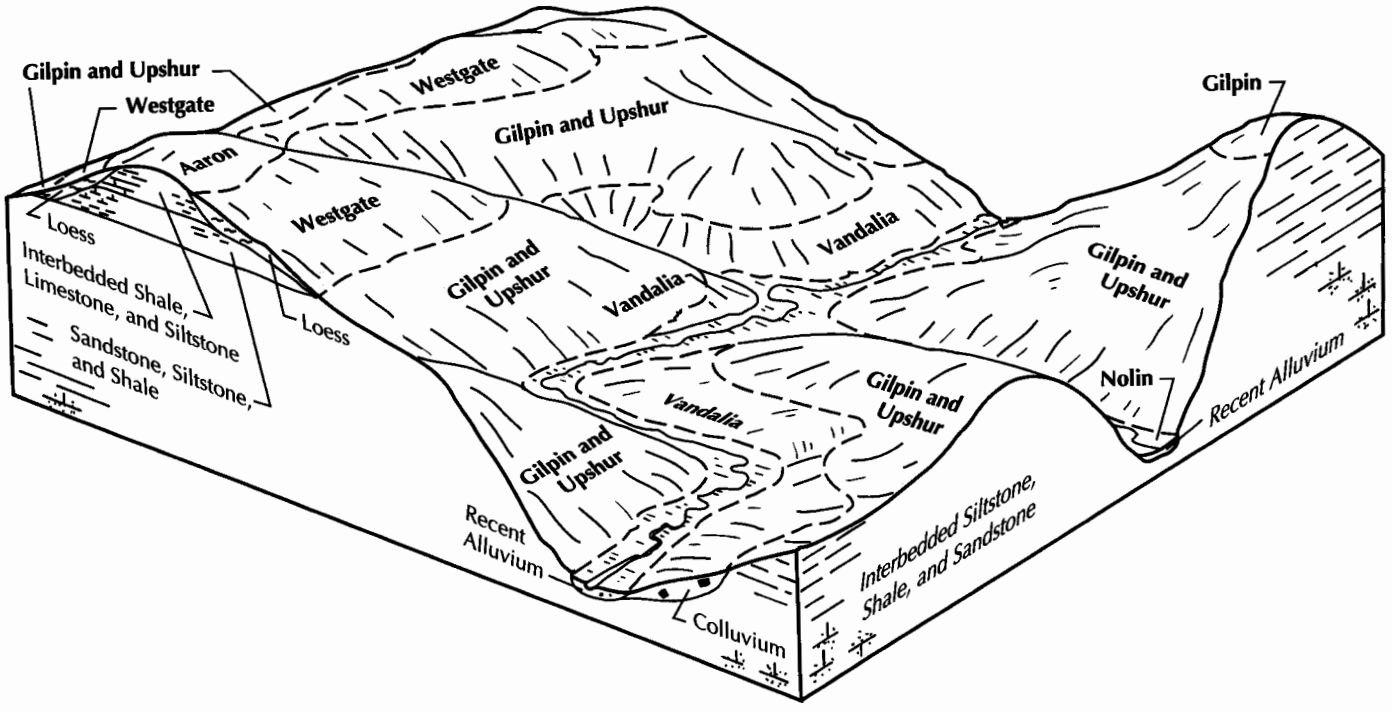

Figure 4.—Typical pattern of soils and parent material in the Gilpin-Upshur association.

Most acreage on ridgetops is cropland and pasture. The hillsides and narrow benches are pasture or woodland. The major soils are poorly suited to unsuited to cropland and most urban uses. They are moderately well suited to unsuited to pasture. They are well suited and moderately well suited to woodland.

The major management concerns for most land uses are slope, moderate depth to rock, droughtiness, restricted permeability, shrink-swell potential, slippage, and the hazard of erosion. The north- and east-facing slopes are better suited to woodland than the south-and west-facing slopes. These slopes are characterized by less evapotranspiration and cooler temperatures.

6. Morristown-Gilpin-Lowell association

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

This map unit is on ridgetops and hillsides in places affected by surface coal mining. Ridgetops are broad to narrow. Hillsides are uniform to broken by narrow to wide benches and are dissected by narrow to wide stream flood plains. Slope ranges from 0 to 70 percent.

This map unit makes up about 9 percent of the county. It is 50 percent Morristown soils, 15 percent Gilpin soils, 10 percent Lowell soils, and 25 percent soils of minor extent.

Morristown soils are very deep. They are on surface mined ridgetops and hillsides. Available water capacity is low. Permeability is moderately slow. Shrink-swell potential is moderate. The hazard of erosion is severe.

Gilpin soils are moderately deep and strongly sloping to very steep. They are on ridgetops and hillsides. Available water capacity is low. Permeability is moderate. The hazard of erosion is severe.

Lowell soils are deep or very deep and moderately steep to very steep. They are on ridgetops and hillsides. Available water capacity is moderate. Permeability is moderately slow. Shrink-swell potential is moderate. The hazard of erosion is severe.

Of minor extent in this map unit are Guernsey, Melvin, Nolin, Upshur, and Westgate soils. Guernsey soils are moderately well drained and are on moderately steep, broad benches. Melvin soils are on ponded flood plains, are poorly drained, and have more silt in the substratum than the major soils. They are on flood plains of streams that have been blocked by sediment from surface coal mining. Nolin soils have more silt in the subsoil and substratum than the major soils. They are on flood plains. Upshur soils are redder in the subsoil than the major

soils. Upshur soils are on moderately steep, broad benches and steep, narrow benches. Westgate soils are moderately well drained and have more silt in the upper part of the subsoil than the major soils. Westgate soils are on gently sloping and strongly sloping ridgetops and broad benches.

Some acreage on ridgetops is cropland and pasture; the rest is woodland. Hillsides are woodland. The steep and very steep soils are unsuited to cropland and most urban uses. They are poorly suited or unsuited to pasture. They are moderately well suited or well suited to woodland. The less sloping Gilpin and Lowell soils are poorly suited to cropland and moderately well suited to pasture. They are well suited to woodland and poorly suited or unsuited to most urban uses.

The major management concerns for most uses on ridgetops are depth to rock, droughtiness, compaction, crusting, surface ponding, restricted permeability, the hazard of erosion, slippage, slope, and shrink-swell potential. Those on hillsides are depth to rock, slope, droughtiness, the hazard of erosion, stoniness, restricted permeability, slippage, and shrink-swell potential. The north- and east-facing slopes are better sites for woodland than the south- and west-facing slopes. Those slopes are characterized by less evapotranspiration and cooler temperatures.

Detailed Soil Map Units

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

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

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

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

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

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

Soils of one series can differ in texture of the surface layer, slope, stoniness, 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, 12 to 20 percent slopes, eroded, is a phase of the Lowell series.

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

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Lowell-Gilpin complex, 20 to 35 percent slopes, eroded, is an example.

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

of strongly contrasting soils are identified by a special symbol on the soil maps.

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

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Most differences are the result of a better knowledge of soils or of modification and refinement of the concept of soil series. Some differences result from a predominance of different soils in map units consisting of soils of two or more series and from variations in the range in slope allowed within the map units in different surveys.

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 or miscellaneous areas.

Soil Descriptions

AaC2—Aaron silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges
Distinctive landscape features: Seep areas
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 9 inches—brown, friable silt loam

Subsoil:
9 to 16 inches—yellowish brown, firm silty clay loam
16 to 45 inches—yellowish brown, light olive brown, and olive brown, mottled, firm silty clay loam

Bedrock:
45 to 50 inches—calcareous, olive brown shale

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 1.5 to 3.0 feet
Depth class: Deep
Root zone: Deep
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Aaron soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of the moderately well drained Westgate soils on the flatter part of the slope
- Areas of the well drained, moderately deep Gilpin soils near slope breaks to lower elevations

Similar inclusions:
- Areas of severely eroded soils

Use and Management

Land use: Dominant use—cropland; other uses—pasture or woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Wetness, erosion, frost heaving
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Draining seeps and springs allows timely equipment operations and prevents excessive surface compaction, clodding, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heaving.

Pasture

Suitability: Well suited
Major management concerns: Erosion and surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited

Major management concerns: Equipment limitation, plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Applying gravel or crushed stone on haul roads and log landings improves soil strength.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness, shrinking and swelling; dwellings without basements—shrinking and swelling
Suitable management practices:
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases basement floor wetness caused by a seasonal high water table.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
• Installing the distribution lines in suitable fill material helps to improve the ability of the field to absorb effluent.
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.
• Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, shrinking and swelling, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the surface of roads.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 5C
Pasture and hayland suitability group: A-6

AgC2—Aaron-Gilpin complex, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Aaron—knolls on ridges; Gilpin—ridgetops
Shape of areas: Long and narrow
Size of areas: 5 to 20 acres

Typical Profile

Aaron

Surface layer:
0 to 9 inches—brown, friable silt loam

Subsoil:
9 to 16 inches—yellowish brown, firm silty clay loam
16 to 45 inches—yellowish brown, light olive brown and olive brown, mottled, firm silty clay loam

Bedrock:
45 to 50 inches—olive brown shale

Gilpin

Surface layer:
0 to 5 inches—brown, friable silt loam

Subsoil:
5 to 27 inches—strong brown and yellowish brown, firm loam and channery loam
27 to 30 inches—yellowish brown, firm very channery loam

Substratum:
30 to 33 inches—olive brown, firm extremely channery loam

Bedrock:
33 to 35 inches—fractured, olive brown, fine grained sandstone

Soil Properties and Qualities

Drainage class: Aaron—moderately well drained; Gilpin—well drained
Seasonal high water table: Aaron—at a depth of 1.5 to 3.0 feet; Gilpin—at a depth of more than 6 feet
Depth class: Aaron—deep; Gilpin—moderately deep
Root zone: Aaron—deep; Gilpin—moderately deep
Permeability: Aaron—slow; Gilpin—moderate
Available water capacity: Aaron—moderate; Gilpin—low
Surface runoff: Rapid
Shrink-swell potential: Aaron—high; Gilpin—low

Composition

Aaron soil and similar inclusions: 45 percent

Gilpin soil and similar inclusions: 35 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
- Areas of moderately deep soils on slope breaks
- Areas of very deep Westgate soils, in less sloping areas, that have more silt and less clay in the upper part of the subsoil

Use and Management

Land use: Dominant use—Cropland; other uses—pasture and woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion, wetness, frost heaving, surface compaction
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when its not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Draining seeps and springs allows timely equipment operations.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Construction equipment is needed to rip through the bedrock.
- Applying gravel or crushed stone on haul roads and log landings improves soil strength on the Aaron soil.

Buildings

Suitability: Moderately well suited
Major management concerns in areas of the Aaron soil: Dwellings with basements—wetness, shrinking and swelling; dwellings without basements—shrinking and swelling
Major management concerns in areas of the Gilpin soil: Dwellings with basements—depth to rock, slope; dwellings without basements—slope
Suitable management practices:
- Blasting or ripping hard rock is needed to excavate for basements.
- Building designs are needed that conform to the natural shape of the land.
- Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
- Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
- Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Aaron—wetness, restricted permeability; Gilpin—depth to rock
Suitable management practices:
- Installing the distribution lines in suitable fill material helps to improve the ability of the field to absorb effluent and to decrease possible ground water contamination.
- Enlarging the distribution area increases absorption of effluent.
- Installing distribution lines on the contour decreases seepage of effluent to the surface.
- Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Aaron—shrinking and swelling, low strength; Gilpin—frost action, slope
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Installing surface and subsurface drains decreases damage to the road surface.

• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: Aaron soil—5C; Gilpin soil—4A
Pasture and hayland suitability group: Aaron—A-6; Gilpin—F-1

BaF—Barkcamp channery sandy loam, 20 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Surface mined hillsides
Distinctive landscape features: Sandstone highwalls, gullies, piles of ultra acid roof shales, and pools of ultra acid water
Shape of areas: Long and narrow
Size of areas: 5 to 10 acres

Typical Profile

Surface layer:
0 to 1 inch—light yellowish brown, friable channery sandy loam

Substratum:
1 to 14 inches—light olive brown and light gray, friable very channery sandy loam
14 to 80 inches—yellowish brown and light brownish gray, firm very channery loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Very shallow because of ultra acid reaction
Permeability: Moderately rapid or rapid
Available water capacity: Very low
Surface runoff: Very rapid

Composition

Barkcamp soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of sandstone highwalls adjacent to pits filled with ultra acid water
• Areas of the less acid Bethesda soils in positions similar to those of the Barkcamp soil

Use and Management

Land use: Dominant use—barren land (fig. 5)

Cropland, pasture, and woodland

Suitability: Generally unsuited
Major hazards or limitations: Slope, gullies, ultra acid reaction, very low available water capacity

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major hazards or limitations: Slope
Local roads and streets *Suitability:* Poorly suited
Major management concerns: Slope
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIIs
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: H-1

BdF—Berks channery silt loam, 35 to 70 percent slopes

Setting

Landform: Uplands
Positions on the landform: Back slopes
Distinctive landscape features: Bedrock escarpments
Shape of areas: Long and narrow
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 3 inches—brown, friable channery silt loam

Subsoil:
3 to 7 inches—yellowish brown, friable very channery silt loam
7 to 19 inches—yellowish brown, friable extremely channery silt loam

Substratum:
19 to 23 inches—yellowish brown, friable extremely channery silt loam

Bedrock:
23 to 25 inches—fractured, light olive brown siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Moderately deep

Root zone: Moderately deep
Permeability: Moderate to moderately rapid
Available water capacity: Very low
Surface runoff: Very rapid

Composition

Berks soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of soils that are shallow to bedrock on the upper part of the slope
- Areas of deep Westmoreland soils on the lower part of back slopes

Similar inclusions:
- Areas of soils that have more rock fragments in the surface layer

Use and Management

Land use: Dominant use—woodland

Cropland and pasture

Suitability: Generally unsuited
Major hazards or limitations: Slope

Woodland

Suitability: Moderately well suited
Major management concerns: Seedling mortality, equipment limitation, erosion hazard
Suitable management practices:
- Mulching around seedlings reduces the seedling mortality rate.
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major hazards or limitations: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R on north aspects, 3R on south aspects
Pasture and hayland suitability group: H-1

BeF—Berks-Westmoreland complex, 35 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Back slopes
Distinctive landscape features: Bedrock escarpments
Shape of areas: Long and narrow
Size of areas: 10 to 100 acres

Typical Profile

Berks

Surface layer:
0 to 3 inches—brown, friable channery silt loam

Subsoil:
3 to 7 inches—yellowish brown, friable very channery silt loam
7 to 19 inches—yellowish brown, friable extremely channery silt loam

Substratum:
19 to 23 inches—yellowish brown, friable extremely channery silt loam

Bedrock:
23 to 25 inches—fractured, light olive brown siltstone

Westmoreland

Surface layer:
0 to 3 inches—dark grayish brown, friable silt loam

Subsoil:
3 to 6 inches—yellowish brown, friable silt loam
6 to 19 inches—strong brown, firm silty clay loam
19 to 35 inches—yellowish brown, firm channery silty clay loam

Substratum:
35 to 43 inches—yellowish brown, firm very channery silty clay loam

Bedrock:
43 to 45 inches—olive siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Berks—moderately deep; Westmoreland—deep
Root zone: Berks—moderately deep; Westmoreland—deep
Permeability: Berks—moderate to moderately rapid; Westmoreland—moderate

Figure 5.—Sparse vegetation on ultra acidic Barkcamp channery sandy loam, 20 to 70 percent slopes.

Available water capacity: Berks—very low;
Westmoreland—low
Surface runoff: Very rapid

Composition

Berks soil and similar inclusions: 50 percent
Westmoreland soil and similar inclusions: 30 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
- Areas of soils that are shallow to bedrock on the upper part of the slope
- Areas of soils, on the lower part of the slope, that have more clay in the subsoil

Similar inclusions:
- Areas of soils that have more rock fragments in the surface layer

Use and Management

Land use: Dominant use—woodland

Cropland and Pasture

Suitability: Generally unsuited
Major hazards or limitations: Slope

Woodland

Suitability: Moderately well suited
Major management concerns: Seedling mortality, equipment limitation, erosion hazard, plant competition
Suitable management practices:

• Mulching around seedlings reduces the seedling mortality rate.
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Removing vines and the less desirable trees and shrubs helps to control plant competition on the Westmoreland soil.
• Constructing water bars and planting cover crops help to control erosion.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major management hazards or limitations: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Berks soil—4R on north aspects, 3R on south aspects; Westmoreland soil—4R
Pasture and hayland suitability group: H-1

BkF—Bethesda channery loam, 20 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Surface mined hillsides
Distinctive landscape features: Highwalls and landslips
Shape of areas: Long and narrow
Size of areas: 10 to 50 acres

Typical Profile

Forest litter:
1 inch to 0—mixed, deciduous leaf litter
Surface layer:
0 to 2 inches—brown and yellowish brown, friable channery loam

Substratum:
2 to 9 inches—variegated yellowish brown, gray and pale olive, firm very channery clay loam
9 to 20 inches—variegated yellowish brown and gray, firm very channery clay loam
20 to 80 inches—variegated yellowish brown, dark grayish brown and gray, firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Very rapid

Composition

Bethesda soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of highwalls adjacent to pits filled with acid water
• Areas of barren soils that are ultra acid
• Seep areas on the lower part of some slopes

Use and Management

Land use: Dominant use—woodland; other use—idle land

Cropland and pasture

Suitability: Generally unsuited
Major hazards or limitations: Slope

Woodland

Suitability: Moderately well suited
Major management concerns: Erosion hazard, equipment limitation, seedling mortality, plant competition
Suitable management practices:
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Mulching around seedlings reduces the seedling mortality rate.
• Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major hazards or limitations: Slope, unstable fill, moderately slow permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, unstable fill
• If fill is determined to be stable, constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Pasture and hayland suitability group: H-1

BrD—Brookside silty clay loam, 12 to 20 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Foot slopes
Distinctive landscape features: Landslips
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 9 inches—dark grayish brown, friable silty clay loam

Subsoil:
9 to 14 inches—brown and dark yellowish brown, firm channery silty clay loam
14 to 25 inches—dark yellowish brown, firm channery silty clay loam
25 to 67 inches—yellowish brown, mottled, firm channery silty clay loam

Substratum:
67 to 80 inches—yellowish brown, mottled, firm channery silty clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.5 to 4.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderately slow
Available water capacity: High
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Brookside soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of somewhat poorly drained Claysville soils near seep areas
• Areas of well drained Lowell soils on the upper foot slopes and back slopes
Similar inclusions:
• Areas of soils that have more rock fragments in the upper part of the subsoil

Use and Management

Land use: Dominant use—pasture; other uses—cropland and woodland

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when its not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Draining seeps and springs allows timely equipment operations.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Erosion hazard, equipment limitation, plant competition
Suitable management practices:
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Applying gravel or crushed stone on haul roads and log landings improves soil strength.
• Avoiding active slips as a location for haul roads and log landings helps to prevent soil failure during log removal.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major hazards or limitations: Slope, shrinking and swelling, slippage, restricted permeability, wetness

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, low strength, shrinking and swelling, slippage
Suitable management practices:

• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: North aspect—5R; south aspect—4R
Pasture and hayland suitability group: A-1

BrE—Brookside silty clay loam, 20 to 35 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Foot slopes
Distinctive landscape features: Landslips, seep spots, occasional large stones or boulders
Shape of areas: Long and narrow
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 10 inches—very dark grayish brown, friable silty clay loam

Subsoil:
10 to 15 inches—dark grayish brown and dark yellowish brown, firm silty clay loam
15 to 25 inches—dark yellowish brown, firm channery silty clay loam
25 to 66 inches—yellowish brown, mottled, firm channery silty clay loam

Substratum:
66 to 80 inches—yellowish brown, mottled, firm channery silty clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.5 to 4.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderately slow
Available water capacity: High
Surface runoff: Very rapid
Shrink-swell potential: High

Composition

Brookside soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of somewhat poorly drained Claysville soils in seep areas
• Areas of well drained Lowell soils on upper foot slopes and back slopes

Use and Management

Land use: Dominant uses—pasture and woodland

Cropland

Suitability: Generally unsuited
Major hazards or limitations: Slope

Pasture

Suitability: Poorly suited
Major management concerns: Erosion, wetness, surface compaction in overgrazed areas
Suitable management practices:
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Erosion, equipment limitation, seedling mortality, plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Spreading roots of seedlings increases soil-root contact.
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Constructing water bars and planting cover crops helps to control erosion.
• Applying gravel or crushed stone on haul roads and log landings improves soil strength.
• Avoiding active slips as a location for haul roads and log landings helps to prevent soil failure during log removal.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major hazards or limitations: Slope, shrinking and swelling, slippage, restricted permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, low strength, slippage
Suitable management practices:

• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: North aspect—5R; south aspect—4R
Pasture and hayland suitability group: A-3

Ca—Chagrin silt loam, frequently flooded

Setting

Landform: Flood plains
Position on the landform: Flats
Slope: 0 to 3 percent
Distinctive landscape features: Long, narrow, sandy natural levees
Shape of areas: Long and narrow
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 36 inches—brown and dark yellowish brown, friable silt loam and loam

Substratum:
36 to 80 inches—dark yellowish brown and brown, friable loam and fine sandy loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of 4.0 to 6.0 feet
Depth class: Very deep
Root zone: Very deep
Permeability: Moderate
Available water capacity: High
Surface runoff: Slow
Flooding: Frequent

Composition

Chagrin soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of sandy soils on slight rises adjacent to the streambank
• Areas of somewhat poorly drained soils adjacent to higher elevations

Use and Management

Land use: Dominant uses—pasture, cropland; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Flooding
Suitable management practices:
• A review of flooding history is needed before growing winter wheat, hay for sale, or high value specialty crops.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Flooding
Suitable management practices:
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Woodland harvesting and planting is feasible when the soil is not flooded.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Flooding

Local roads and streets

Suitability: Poorly suited
Major management concerns: Flooding, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Elevating roads above the known high water level is needed.

Interpretive Groups

Land capability classification: IIw

Woodland ordination symbol: 5A
Pasture and hayland suitability group: A-5

CeB—Chavies loam, 0 to 6 percent slopes

Setting

Landform: Terraces
Position on the landform: Flats and gently sloping areas
Shape of areas: Long and wide
Size of areas: 10 to 80 acres

Typical Profile

Surface layer:
0 to 10 inches—brown, friable loam

Subsoil:
10 to 48 inches—yellowish brown, friable loam and fine sandy loam

Substratum:
48 to 80 inches—yellowish brown, friable loam and fine sandy loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Very deep
Permeability: Moderately rapid
Available water capacity: Moderate
Surface runoff: Medium

Composition

Chavies soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of soils on long, very narrow, steep slopes between terrace levels
- Areas of soils on long, discontinuous rises that contain more sand in the topsoil and subsoil

Use and Management

Land use: Dominant use—cropland; other uses—residential and industrial development

Cropland

Suitability: Well suited
Major management concerns: Erosion
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when its not soft and sticky prevents excessive clodding, surface compaction, and crusting.

Pasture

Suitability: Well suited
Major management concerns: Erosion
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings and septic tank absorption fields

Suitability: Well suited
Major management concerns: None

Local roads and streets

Suitability: Well suited
Major management concerns: Frost action
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4A
Pasture and hayland suitability group: A-1

CgC—Claysville-Guernsey complex, 8 to 15 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Claysville—concave part of benches; Guernsey—convex part of benches
Distinctive landscape features: Seep spots, springs, landslips
Shape of areas: Irregular

Size of areas: 5 to 20 acres

Typical Profile

Claysville

Surface layer:
0 to 9 inches—very dark gray, friable silty clay loam

Subsurface layer:
9 to 17 inches—very dark grayish brown, firm silty clay

Subsoil:
17 to 25 inches—dark grayish brown, mottled, firm clay
25 to 42 inches—olive brown, mottled, firm silty clay loam
42 to 60 inches—light olive brown, mottled, firm silty clay

Substratum:
60 to 80 inches—variegated grayish brown and dusky red, mottled, firm silty clay and silty clay loam

Guernsey

Surface layer:
0 to 7 inches—dark grayish brown, friable silt loam

Subsoil:
7 to 14 inches—light olive brown, firm silty clay loam
14 to 37 inches—dark yellowish brown, mottled, firm silty clay loam and silty clay

Substratum:
37 to 80 inches—yellowish brown and gray, mottled, firm silty clay loam

Soil Properties and Qualities

Drainage class: Claysville—somewhat poorly drained; Guernsey—moderately well drained
Seasonal high water table: Claysville—at a depth of 1.0 to 2.0 feet; Guernsey—at a depth of 1.5 to 3.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Claysville—slow; Guernsey—moderately slow or slow
Available water capacity: Claysville—high; Guernsey—moderate
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Claysville soil and similar inclusions: 45 percent
Guernsey soil and similar inclusions: 40 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of the well drained Upshur soils on the lower edge of the slope
- Areas of stony or bouldery areas below sandstone bedrock escarpments

Use and Management

Land use: Dominant use—pasture; other use—woodland

Cropland

Suitability: Poorly suited
Major management concerns: Wetness
Suitable management practices:
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Surface and subsurface drainage is needed to remove excess water.
- Seeding legumes and grasses that tolerate some periods of standing water is needed.

Pasture

Suitability: Well suited
Major management concerns: Erosion, wetness
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion.
- Fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.
- Seeding grasses and legumes that tolerate some periods of standing water is needed.

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, erosion, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
- Harvesting can be done when the surface layer is frozen or during dry periods on the Claysville soil.
- Site preparation and planting can be done during dry periods on the Claysville soil.
- Applying gravel or crushed stone on haul roads and log landings improves soil strength.

Buildings

Suitability: Poorly suited
Major management concerns in areas of the Claysville soil: Wetness, shrinking and swelling, slippage
Major management concerns in areas of the Guernsey

soil: Dwellings with basements—wetness, shrinking and swelling; dwellings without basements—shrinking and swelling

Suitable management practices:

- Designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
- Avoiding landslips, seeps, springs, and gullies decreases damage to the foundation caused by slippage and wetness.
- Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
- Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
- Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Claysville—wetness, restricted permeability, slippage; Guernsey—wetness, restricted permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Claysville—shrinking and swelling, low strength, slippage; Guernsey—shrinking and swelling, low strength

Suitable management practices:

- Installing surface and subsurface drains decreases damage to the road surface.
- Constructing roads on the contour helps to control erosion.
- Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIw
Woodland ordination symbol: Claysville soil—not assigned; Guernsey soil—4A
Pasture and hayland suitability group: Claysville—C2; Guernsey—A-6

CoB—Conotton gravelly loam, 0 to 6 percent slopes

Setting

Landform: Terraces
Position on the landform: Flats and gently sloping areas
Distinctive landscape features: Gravelly surface layer
Shape of areas: Long and narrow
Size of areas: 5 to 30 acres

Typical Profile

Surface layer:
0 to 8 inches—brown, friable gravelly loam

Subsoil:
8 to 14 inches—yellowish brown, friable very gravelly loam
14 to 70 inches—dark yellowish brown and brown, friable very gravelly loam

Substratum:
70 to 80 inches—brown, loose extremely gravelly coarse sand

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Deep
Permeability: Rapid
Available water capacity: Low
Surface runoff: Slow

Composition

Conotton soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:

- Some areas of soils that have a very gravelly or cobbly surface layer
- Areas of soils that have less gravel in the subsoil

Similar inclusions:

- Small areas of soils that have a surface layer that has more sand and less gravel

Use and Management

Land use: Dominant use—cropland

Cropland

Suitability: Moderately well suited
Major management concerns: Droughtiness
Suitable management practices:

- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.

Pasture

Suitability: Moderately well suited
Major management concerns: Droughtiness

Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Splitting lime and fertilizer applications, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Planting drought-resistant species is needed.

Woodland

Suitability: Well suited
Major management concerns: Seedling mortality, plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Mulching around seedlings reduces the seedling mortality rate.

Buildings

Suitability: Well suited
Major management concerns: None

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Possible contamination of ground water
Suitable management practices:
• Installing the distribution lines in suitable fill material decreases possible ground water contamination.

Local roads and streets

Suitability: Well suited
Major management concerns: Frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: 4F
Pasture and hayland suitability group: B-1

CoC2—Conotton gravelly loam, 6 to 12 percent slopes, eroded

Setting

Landform: Terraces
Position on the landform: Terrace riser
Distinctive landscape features: Gravelly surface layer
Shape of areas: Long and narrow
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 5 inches—brown, friable gravelly loam

Subsoil:
5 to 18 inches—yellowish brown and brown, friable very gravelly loam
18 to 54 inches—brown, friable very gravelly loam and very friable very gravelly sandy loam

Substratum:
54 to 80 inches—brown, loose, stratified extremely gravelly coarse sand and very gravelly loamy coarse sand

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Deep
Permeability: Rapid
Available water capacity: Low
Surface runoff: Medium

Composition

Conotton soil and similar inclusions: 80 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
• Areas of soils that have slopes of more than 12 percent
• Some areas of soils that have a very gravelly or cobbly surface layer
Similar inclusions:
• Small areas of soils that have more sand and less gravel in the surface layer

Use and Management

Land use: Dominant use—cropland

Cropland

Suitability: Poorly suited
Major management concerns: Erosion, droughtiness
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.

Pasture

Suitability: Moderately well suited
Major management concerns: Erosion, droughtiness
Suitable management practices:
• Maintaining surface residue with conservation tillage

and companion crops helps to control erosion and to conserve water.
• Splitting lime and fertilizer applications, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Planting drought-resistant species is needed.

Woodland

Suitability: Well suited
Major management concerns: Seedling mortality, plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Mulching around seedlings reduces the seedling mortality rate.

Buildings

Suitability: Moderately well suited
Major management concerns: Slope
Suitable management practices:
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Contamination of ground water
Suitable management practices:
• Installing distribution lines in suitable fill material decreases possible ground water contamination.

Local roads and streets

Suitability: Well suited
Major management concerns: Slope, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4F
Pasture and hayland suitability group: B-1

Ds—Dumps, mine

Setting

Landform: Terraces and hill slopes on uplands
Slope: 0 to 70 percent
Distinctive landscape features: Black, barren, gullied coal waste
Shape of areas: Circular to long and narrow
Size of areas: 5 to 30 acres

Composition

Dumps that consist of roof shales, coal mine waste, and extremely acid or ultra acid mine spoil (locally called "gob," and "red dog"); gullied areas

Inclusions

• Areas of Bethesda and Morristown soils at higher elevations near the upper edge of some areas
• Areas of reclaimed soils with added soil material
• Swampy areas and acid mine seeps near the base of steep hills
Suitable management practices:
• Onsite investigation is needed to determine the suitability for specific uses.
• Reclamation helps control erosion, sedimentation, and acid drainage.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Pasture and hayland suitability group: None

EbE2—Elba silty clay loam, 20 to 35 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Back slopes
Distinctive landscape features: Limestone and siltstone rock outcrops
Shape of areas: Circular to long and narrow
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 5 inches—brown, friable silty clay loam

Subsoil:
5 to 11 inches—dark yellowish brown, firm silty clay
11 to 20 inches—light olive brown, firm silty clay loam
20 to 28 inches—variegated yellowish brown, dark yellowish brown and olive, firm very channery silty clay loam

Substratum:
28 to 41 inches—yellowish brown and olive gray firm channery silty clay loam

Bedrock:
41 to 50 inches—fractured, calcareous, light gray and brownish yellow siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep
Root zone: Deep
Permeability: Slow
Available water capacity: Low
Surface runoff: Very rapid
Shrink-swell potential: High

Composition

Elba soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of soils that are moderately deep to hard limestone bedrock
- Areas of moderately deep Gilpin soils on shoulder slopes and upper back slopes

Similar inclusions:
- Some areas of soils that are redder below the surface layer

Use and Management

Land use: Dominant use—pasture; other uses—cropland and woodland

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Slope, erosion

Pasture

Suitability: Poorly suited
Major management concerns: Erosion, slope, surface compaction in overgrazed areas
Suitable management practices:
- Fertilizing, controlling weeds, rotating pastures, and avoiding overstocked pastures help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.
- Seeding a cover or companion crop, mulching, and no-till help to control erosion.

Woodland

Suitability: Moderately well suited
Major management concerns: Erosion, equipment limitations, windthrow hazard, seedling mortality
Suitable management practices:
- Spreading roots of seedlings increases soil-root contact.
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
- Constructing water bars and planting cover crops helps to control erosion.
- Harvesting to leave the remaining trees closely spaced will reduce the windthrow hazard.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Generally unsuited
Major limitations or hazards: Slope, shrinking and swelling

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, restricted permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Low strength, slope, shrink-swell
- Adding a suitable base material decreases damage to the road surface.
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: 3R
Pasture and hayland suitability group: F-6

EuA—Euclid silt loam, rarely flooded

Setting

Landform: Low terraces
Position on the landform: Flats
Slope: 0 to 3 percent
Distinctive landscape features: Depressions
Shape of areas: Long and narrow
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 10 inches—dark grayish brown, friable silt loam

Subsoil:
10 to 43 inches—brown and yellowish brown, mottled, friable silty clay loam and silt loam

Substratum:

43 to 80 inches—light brownish gray and brown, mottled, friable loam

Soil Properties and Qualities

Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 1.0 to 2.5 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderately slow
Available water capacity: High
Surface runoff: Slow
Flooding: Rare

Composition

Euclid soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of poorly drained soils in depressions
- Areas of soils that have more clay in the subsoil near uplands
- Areas of soils, near uplands, that are not subject to flooding

Use and Management

Land use: Dominant use—cropland; other use—pasture

Cropland

Suitability: Moderately well suited
Major management concerns: Wetness, flooding
Suitable management practices:
- Surface drainage and subsurface drainage are needed to remove excess water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding legumes and grasses that tolerate some standing water increases seedling survival.

Pasture

Suitability: Well suited
Major management concerns: Wetness
Suitable management practices:
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.
- Seeding grasses and legumes that tolerate some periods of standing water is needed.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Flooding, wetness

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Flooding, wetness
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Installing surface and subsurface drains decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 5A
Pasture and hayland suitability group: C-3

GdC2—Gilpin silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges
Shape of areas: Long and narrow
Size of areas: 2 to 20 acres

Typical Profile

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 16 inches—strong brown, friable silt loam
16 to 30 inches—yellowish brown, firm channery loam and very channery loam

Substratum:
30 to 33 inches—olive brown, firm extremely channery loam

Bedrock:
33 to 35 inches—fractured, olive brown siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Moderately deep
Root zone: Moderately deep

Permeability: Moderate
Available water capacity: Low
Surface runoff: Rapid

Composition

Gilpin soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of moderately well drained soils, in saddles, that have more clay in the subsoil
• Areas of deep Wellston soils in less sloping areas
Similar inclusions:
• Areas of soils, on slope breaks to lower elevations, that contain more sand and fewer coarse fragments in the lower part of the subsoil and that overlie sandstone bedrock

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion, droughtiness
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when its not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases the damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Erosion, droughtiness, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—slope, depth to bedrock; dwellings without basements—slope
Suitable management practices:
• Ripping through rock is needed in excavating for basements.
• Building designs are needed that conform to the natural slope of the land.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Slope, depth to rock
Suitable management practices:
• Installing distribution lines in suitable fill material decreases possible ground water contamination.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Slope, potential frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Pasture and hayland suitability group: F-1

GhD2—Gilpin-Upshur complex, 12 to 20 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Gilpin—back slopes; Upshur—benches
Distinctive landscape features: Landslips
Shape of areas: Long and narrow

Size of areas: 10 to 40 acres

Typical Profile

Gilpin

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 27 inches—yellowish brown, friable silt loam and firm silty clay loam

Substratum:
27 to 30 inches—yellowish brown, firm extremely channery silt loam

Bedrock:
30 to 32 inches—fractured, olive brown siltstone

Upshur

Surface layer:
0 to 5 inches—brown, friable silty clay loam

Subsoil:
5 to 50 inches—Strong brown and reddish brown, firm silty clay

Substratum:
50 to 65 inches—reddish brown, firm silty clay

Bedrock:
65 to 67 inches—light yellowish brown and light gray shale

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Gilpin—moderately deep; Upshur—deep and very deep
Root zone: Gilpin—moderately deep; Upshur—deep
Permeability: Gilpin—moderate; Upshur—slow
Available water capacity: Gilpin—low; Upshur—moderate
Surface runoff: Gilpin—rapid; Upshur—very rapid
Shrink-swell potential: Gilpin—low; Upshur—high

Composition

Gilpin soil and similar inclusions: 45 percent
Upshur soil and similar inclusions: 40 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of moderately well drained Guernsey soils near seep spots
- Areas of moderately well drained Westgate soil in less sloping areas

Similar inclusions:
- Areas of severely eroded soils near the lower edge of some slopes

Use and Management

Land use: Dominant uses—pasture or cropland; other use—woodland

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when its not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion, equipment limitation, seedling mortality, windthrow hazard
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
- Constructing water bars and planting cover crops helps to control erosion.
- Mulching barren areas helps to control erosion.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
- Spreading the roots of seedlings and increasing soil-root contact reduce the seedling mortality rate.
- Frequent light thinning and harvesting will increase stand vigor and reduce the windthrow hazard.

Buildings

Suitability: Poorly suited
Major management concerns in areas of the Gilpin soil:

Dwellings with basements—slope, depth to rock; dwellings without basements—slope
Major management concerns in areas of the Upshur soil: Dwellings with basements—slope, shrinking and swelling, slippage; dwellings without basements—slope, shrinking and swelling, slippage
Suitable management practices:
• Building designs are needed that conform to the natural slope of the land.
• Designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
• Ripping through rock is needed in excavating for a basement.
• Avoiding landslips, seeps, and gullies decreases damage to the foundation caused by slippage and wetness.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Gilpin—depth to rock, slope; Upshur—slope, restricted permeability, slippage
• Installing distribution lines in suitable fill material helps to improve the ability of the field to absorb effluent and to decrease possible ground water contamination.
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Poorly suited
Major management concerns: Gilpin—slope; Upshur—slope, shrinking and swelling, low strength
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Gilpin soil—4R; Upshur soil—4R on north aspects, 3R on south aspects
Pasture and hayland suitability group: Gilpin—F-1; Upshur—F-5

GhE2—Gilpin-Upshur complex, 20 to 35 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Gilpin—back slopes; Upshur—benches
Distinctive landscape features: Bedrock escarpments, landslips, seep spots
Shape of areas: Long and narrow
Size of areas: 10 to 100 acres

Typical Profile

Gilpin

Surface layer:
0 to 3 inches—brown, friable silt loam

Subsoil:
3 to 19 inches—yellowish brown, friable silt loam and firm channery silt loam
19 to 34 inches—yellowish brown, firm very channery silt loam

Bedrock:
34 to 36 inches—fractured, light olive brown siltstone

Upshur

Surface layer:
0 to 4 inches—brown, friable silty clay loam

Subsoil:
4 to 45 inches—yellowish red and reddish brown, firm silty clay

Substratum:
45 to 80 inches—yellowish red, firm silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Gilpin—moderately deep; Upshur—very deep
Root zone: Gilpin—moderately deep; Upshur—deep or very deep
Permeability: Gilpin—moderate; Upshur—slow
Available water capacity: Gilpin—low; Upshur—moderate
Surface runoff: Very rapid
Shrink-swell potential: Gilpin—low; Upshur—high

Composition

Gilpin soil and similar inclusions: 45 percent
Upshur soil and similar inclusions: 40 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of moderately well drained Guernsey soils near seep spots on benches
- Areas of sandstone bedrock escarpments on the steepest part of the slope

Use and Management

Land use: Dominant use—woodland; other use—pasture

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Slope

Pasture

Suitability: Poorly suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, erosion, equipment limitation, windthrow hazard, seedling mortality
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
- Constructing water bars and planting cover crops helps to control erosion.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
- The windthrow hazard on the Upshur soil can be reduced by harvest methods that do not isolate the unharvested trees or leave them widely spaced.
- Planting seedlings that have been transplanted once will reduce the seedling mortality rate.
- Spreading the roots of seedlings and increasing soil-root contact reduce the seedling mortality rate on the Upshur soil.

Buildings

Suitability: Generally unsuited
Major limitations or hazards: Gilpin—slope; Upshur—slope, shrinking and swelling, slippage

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Gilpin—depth to rock, slope; Upshur—slope, restricted permeability, slippage

Local roads and streets

Suitability: Poorly suited
Major management concerns: Gilpin—slope; Upshur—slope, shrinking and swelling, low strength
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Gilpin soil—4R; Upshur soil—4R on north aspects; 3R on south aspects
Pasture and hayland suitability group: Gilpin—F-2; Upshur—F-6

GhF—Gilpin-Upshur complex, 35 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Gilpin—hillsides; Upshur—benches
Distinctive landscape features: Bedrock escarpments
Shape of areas: Long and narrow
Size of areas: 10 to 150 acres

Typical Profile

Gilpin

Surface layer:
0 to 2 inches—dark brown, friable silt loam

Subsoil:
2 to 16 inches—yellowish brown, friable silt loam and channery silt loam
16 to 24 inches—yellowish brown, firm very channery silt loam

Substratum:
24 to 34 inches—yellowish brown, firm extremely channery loam

Bedrock:
34 to 36 inches—fractured, olive brown siltstone

Upshur

Surface layer:
0 to 6 inches—brown, friable silty clay loam

Subsoil:
6 to 46 inches—yellowish red and reddish brown, firm silty clay

Substratum:
46 to 80 inches—yellowish red, firm silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Gilpin—moderately deep; Upshur—very deep
Root zone: Gilpin—moderately deep; Upshur—deep or very deep
Permeability: Gilpin—moderate; Upshur—slow
Available water capacity: Gilpin—low; Upshur—moderate
Surface runoff: Very rapid
Shrink-swell potential: Gilpin—low; Upshur—high

Composition

Gilpin soil and similar inclusions: 45 percent
Upshur soil and similar inclusions: 35 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
- Areas of moderately deep Berks soils are near bedrock escarpments
- Areas of Elba soils on the lower part of some slopes

Similar inclusions:
- Some areas that have a channery or very channery surface layer

Use and Management

Land use: Dominant use—woodland

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Slope

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, erosion hazard, equipment limitation, seedling mortality, windthrow hazard
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion.
- Constructing water bars and planting cover crops help to control erosion.
- Planting seedlings that have been transplanted once will reduce the seedling mortality rate.
- Spreading the roots of seedlings and increasing soil-root contact reduce the seedling mortality rate.
- Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope
Suitable management practices:
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Gilpin soil—4R; Upshur soil—4R on north aspects, 3R on south aspects
Pasture and hayland suitability group: H-1

GnB—Glenford silt loam, 2 to 6 percent slopes

Setting

Landform: Terraces
Position on the landform: Gently sloping areas
Shape of areas: Long and narrow
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 8 inches—brown, friable silt loam

Subsoil:
8 to 16 inches—yellowish brown, friable silt loam
16 to 52 inches—strong brown and yellowish brown, mottled, friable and firm silty clay loam

Substratum:
52 to 80 inches—yellowish brown and brown mottled, firm silty clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate
Available water capacity: High
Surface runoff: Medium
Shrink-swell potential: Moderate

Composition

Glenford soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of the somewhat poorly drained Euclid soils near drainageways
- Areas of steeper soils on slope breaks

Similar inclusions:
- Areas of well drained soils in positions slightly higher than those of the Glenford soil

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Well suited
Major management concerns: Erosion, frost action, wetness
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Draining seeps allows timely equipment operations.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion and surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness; dwellings without basements—wetness, shrinking and swelling
Suitable management practices:
- Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.

Septic tank absorption fields

Suitability: Moderately well suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
- Installing drains around the distribution area decreases wetness.
- Enlarging the distribution area increases absorption of effluent.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, frost action
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Installing surface and subsurface drains decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 5A
Pasture and hayland suitability group: A-6

GsD2—Guernsey-Upshur complex, 12 to 20 percent slopes, eroded

Setting

Landform: Hill slopes on uplands

Position on the landform: Guernsey—upper part of benches; Upshur—lower part of benches
Distinctive landscape features: Seeps, springs, landslips, gullies
Shape of areas: Long and wide
Size of areas: 25 to 200 acres

Typical Profile

Guernsey

Surface layer:
0 to 7 inches—brown, friable silt loam

Subsoil:
7 to 14 inches—yellowish brown, friable silty clay loam
14 to 45 inches—yellowish brown, mottled, firm silty clay loam and silty clay

Substratum:
45 to 80 inches—yellowish brown and grayish brown, firm channery silty clay and channery silty clay loam

Upshur

Surface layer:
0 to 4 inches—brown, firm silty clay loam

Subsoil:
4 to 37 inches—yellowish red and reddish brown, firm silty clay

Substratum:
37 to 70 inches—reddish brown, firm silty clay loam

Bedrock:
70 to 80 inches—calcareous reddish brown shale

Soil Properties and Qualities

Drainage class: Guernsey—moderately well drained; Upshur—well drained
Seasonal high water table: Guernsey—at a depth of 1.5 to 3.0 feet; Upshur—at a depth of more than 6 feet
Depth class: Very deep or deep
Root zone: Deep or very deep
Permeability: Guernsey—moderately slow or slow; Upshur—slow
Available water capacity: Moderate
Surface runoff: Guernsey—rapid; Upshur—very rapid
Shrink-swell potential: High

Composition

Guernsey soil and similar inclusions: 45 percent
Upshur soil and similar inclusions: 30 percent
Contrasting inclusions: 25 percent

Inclusions

Contrasting inclusions:

- Areas of Westgate soils that have less clay in the upper part of the subsoil in the smooth, strongly sloping areas between drainageways
- Areas of the somewhat poorly drained Claysville soils in seep areas associated with limestone bedrock
- Areas of the moderately deep Gilpin soils on the steep, lower edge of some slopes
- Areas of stony or bouldery areas below sandstone bedrock escarpments

Use and Management

Land use: Dominant use—pasture; other uses—cropland and woodland

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion, wetness, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Draining seeps and springs allows timely equipment operations.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion, equipment limitation, seedling mortality, windthrow hazard.
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Building roads and skidding logs on the contour help to control erosion.
- Spreading the roots of seedlings and increasing soil-root

contact reduce the seedling mortality rate on the Upshur soil.
• Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.
• Constructing water bars and planting cover crops help to control erosion.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Poorly suited
Major management concerns in areas of the Guernsey soil: Dwellings with basements—slope, wetness, shrinking and swelling; dwellings without basements—slope, shrinking and swelling, slippage
Major management concerns in areas of the Upshur soil: Dwellings with basements—slope, shrinking and swelling, slippage; dwellings without basements—slope, shrinking and swelling, slippage
Suitable management practices:
• Building designs are needed that conform to the natural slope of the land.
• Design buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
• Avoiding landslips, seeps, springs,and gullies decreases damage to the foundation caused by slippage and wetness.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, restricted permeability, slippage, wetness

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, shrinking and swelling, low strength
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Guernsey soil—4R; Upshur soil—4R on north aspects; 3R on south aspects
Pasture and hayland suitability group: Guernsey—A-6; Upshur—F-5

LcB—Licking silt loam, 0 to 6 percent slopes

Setting

Landform: Terraces
Position on the landform: Flats and gently sloping areas
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 7 inches—brown, friable silt loam

Subsurface layer:
7 to 12 inches—brown and yellowish brown, friable silty clay loam

Subsoil:
12 to 19 inches—yellowish brown, firm silty clay loam
19 to 40 inches—yellowish brown, mottled, firm silty clay
40 to 68 inches—yellowish brown, and brown mottled, firm and friable silty clay and silty clay loam

Substratum:
68 to 80 inches—brown, mottled, friable silty clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 1.5 to 3.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Medium
Shrink-swell potential: High

Composition

Licking soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Small areas of somewhat poorly drained soils in slight depressions

• Areas of Glenford soils, in similar positions, that have more silt in the subsoil
Similar inclusions:
• Areas of alluvial fans, near the base of steep slopes, that contain more rock fragments in the surface layer

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion, wetness, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.
• Surface and subsurface drainage is needed to remove excess water.
• Seeding legumes and grasses that tolerate some periods of standing water is needed.

Pasture

Suitability: Well suited
Major management concerns: Erosion
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.
• Seeding grasses and legumes that tolerate some periods of standing water is needed.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, windthrow hazard
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Harvesting practices that do not leave the remaining trees widely spaced or isolated reduces the windthrow hazard.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness, shrinking and swelling; dwellings without basements—shrinking and swelling
Suitable management practices:
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
• Installing distribution lines in suitable fill material helps to improve the ability of the field to absorb effluent.
• Enlarging the distribution area increases absorption of effluent.
• Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Shrinking and swelling, low strength, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Installing surface and subsurface drains decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4C
Pasture and hayland suitability group: A-6

LcC2—Licking silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Terraces

Position on the landform: Terrace risers
Distinctive landscape features: Deep drainageways
Shape of areas: Long and narrow
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 21 inches—yellowish brown, firm silty clay loam and silty clay
21 to 40 inches—dark yellowish brown, mottled, firm silty clay

Substratum:
40 to 80 inches—dark yellowish brown, mottled, firm silty clay

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 1.5 to 3.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Licking soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
• Areas of severely eroded soils, along drainageways, that have a surface layer of silty clay loam
Contrasting inclusions:
• Areas of seeps at the head of drainageways
• Areas of somewhat poorly drained soils in depressions

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Poorly suited
Major management concerns: Wetness, erosion, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Draining seeps allows timely equipment operations.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, windthrow hazard
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Mulching barren areas helps to control erosion.
• Harvesting practices that do not leave the remaining trees widely spaced or isolated reduces the windthrow hazard.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness, slope, shrinking and swelling; dwellings without basements—shrinking and swelling, slope
Suitable management practices:
• Avoiding seeps and drainageways decreases damage to the foundation caused by wetness.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.

• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
• Installing distribution lines in suitable fill material helps to improve the ability of the field to absorb effluent.
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.
• Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Shrinking and swelling, low strength, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Installing surface and subsurface drains decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4C
Pasture and hayland suitability group: A-6

Ld—Lobdell silt loam, channery substratum, occasionally flooded

Setting

Landform: Flood plains
Position on the landform: Flats
Slope: 0 to 3 percent
Distinctive landscape features: Shallow stream meanders, channery natural levees
Shape of areas: Long and narrow
Size of areas: 10 to 20 acres

Typical Profile

Surface layer:
0 to 8 inches—dark grayish brown, friable silt loam

Subsoil:
8 to 18 inches—brown, friable silt loam
18 to 31 inches—brown, mottled, friable silt loam

Substratum:
31 to 80 inches—dark grayish brown and brown, friable channery loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate
Available water capacity: High
Surface runoff: Slow
Flooding: Occasional

Composition

Lobdell soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
• Areas of small alluvial fans where short, steep drains enter the flood plain
Contrasting inclusions:
• A few, small, somewhat poorly drained seep areas adjacent to steep or very steep hillsides
• Some areas of soils at a depth of less than 60 inches to bedrock

Use and Management

Land use: Dominant use—pasture; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Occasional flooding, wetness, small irregular areas of land
Suitable management practices:
• A review of flooding history is needed before growing high value specialty crops.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Draining seeps allows timely equipment operations.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Occasional flooding
Suitable management practices:
• A review of flooding history prevents potential damage to livestock.

• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings

Suitability: Generally unsuited
Major limitations or hazards: Dwellings with basements—flooding, wetness; dwellings without basements—flooding

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Flooding, wetness

Local roads and streets

Suitability: Poorly suited
Major management concerns: Flooding, frost action
Suitable management practices:
• Elevating roads above the known high water level is needed.
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 5A
Pasture and hayland suitability group: A-5

LoD2—Lowell silt loam, 12 to 20 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges
Shape of areas: Long and narrow
Size of areas: 10 to 60 acres

Typical Profile

Surface layer:
0 to 7 inches—brown, friable silt loam

Subsoil:
7 to 13 inches—brown, firm silty clay loam
13 to 43 inches—brown and yellowish brown, firm silty clay and clay

Substratum:
43 to 60 inches—yellowish brown and light yellowish brown, firm silty clay and channery silty clay

Bedrock:
60 to 62 inches—fractured, olive siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep and very deep
Root zone: Deep
Permeability: Moderately slow
Available water capacity: Moderate
Surface runoff: Rapid
Shrink-swell potential: Moderate

Composition

Lowell soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• A narrow band of moderately deep Gilpin soils on the upper part of slopes
• Areas of moderately well drained Westgate soils, in less sloping areas, that have less clay in the upper part of the subsoil

Use and Management

Land use: Dominant uses—pasture and cropland; other use—woodland

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.

Pasture

Suitability: Moderately well suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.

• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion, equipment limitation
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Building roads and skidding logs on the contour help to control erosion.
• Constructing water bars and planting cover crops help to control erosion.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Poorly suited
Major management concerns: Slope
Suitable management practices:
• Building designs are needed that conform to the natural slope of the land.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Slope, restricted permeability
Suitable management practices:
• Installing the distribution lines in suitable fill material helps to improve the ability of the field to absorb effluent.
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Poorly suited
Major management concerns: Low strength, shrinking and swelling, slope
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 5R
Pasture and hayland suitability group: A-1

LrE2—Lowell-Gilpin complex, 20 to 35 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Back slopes
Distinctive landscape features: Deep drainageways, escarpments
Shape of areas: Long and narrow
Size of areas: 20 to 100 acres

Typical Profile

Lowell

Surface layer:
0 to 5 inches—brown, friable silty clay loam

Subsoil:
5 to 20 inches—yellowish brown, friable and firm silty clay loam
20 to 42 inches—yellowish brown, firm silty clay, and clay

Substratum:
42 to 76 inches—yellowish brown and brown, firm channery clay

Bedrock:
76 to 78 inches—fractured, olive brown siltstone

Gilpin

Surface layer:
0 to 4 inches—brown, friable silt loam

Subsoil:
4 to 19 inches—yellowish brown, friable silty clay loam and firm channery silty clay loam
19 to 28 inches—yellowish brown, firm channery silty clay loam

Bedrock:
28 to 30 inches—fractured, olive brown siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet

Depth class: Lowell—deep and very deep; Gilpin—moderately deep
Root zone: Lowell—deep or very deep; Gilpin—moderately deep
Permeability: Lowell—moderately slow; Gilpin—moderate
Available water capacity: Lowell—moderate; Gilpin—low
Surface runoff: Very rapid
Shrink-swell potential: Lowell—moderate; Gilpin—low

Composition

Lowell soil and similar inclusions: 60 percent
Gilpin soil and similar inclusions: 25 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Small areas of the moderately well drained Guernsey soils near seep spots
- Areas of Berks soils that have more rock fragments in the subsoil on the upper part of back slopes

Use and Management

Land use: Dominant use—pasture; other use—woodland

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Erosion, slope

Pasture

Suitability: Poorly suited
Major management concerns: Erosion, slope, surface compaction in overgrazed areas
Suitable management practices:
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Building roads and skidding logs on the contour help to control erosion.
- Constructing water bars and planting cover crops help to control erosion.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Lowell—low strength, slope; Gilpin—slope
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Lowell soil—5R; Gilpin soil—4R
Pasture and hayland suitability group: Lowell—A-3; Gilpin—F-2

LrF—Lowell-Gilpin complex, 35 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Back slopes
Distinctive landscape features: Sandstone rock outcrops and colluvial benches
Shape of areas: Long and narrow
Size of areas: 25 to 200 acres

Typical Profile

Lowell

Forest litter:
1 inch to 0—leaf litter
Surface layer:
0 to 3 inches—dark grayish brown, friable silty clay loam

Subsoil:
3 to 20 inches—yellowish brown, firm silty clay loam
20 to 36 inches—yellowish brown, firm silty clay

Substratum:
36 to 44 inches—brown, firm channery clay

Bedrock:
44 to 46 inches—light gray limestone

Gilpin

Forest litter:
1 inch to 0—leaf litter

Surface layer:
0 to 3 inches—very dark grayish brown, friable channery silt loam

Subsoil:
3 to 17 inches—yellowish brown, friable channery silt loam
17 to 26 inches—yellowish brown, firm very channery silty clay loam

Bedrock:
26 to 28 inches—fractured, olive brown siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Lowell—deep and very deep; Gilpin—moderately deep
Root zone: Lowell—deep; Gilpin—moderately deep
Permeability: Lowell—moderately slow; Gilpin—moderate
Available water capacity: Lowell—moderate; Gilpin—low
Surface runoff: Very rapid
Shrink-swell potential: Lowell—moderate; Gilpin—low

Composition

Lowell soil and similar inclusions: 45 percent
Gilpin soil and similar inclusions: 40 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of sandstone bedrock escarpments near the top of hillsides
- Areas of limestone bedrock escarpments near the bottom of some hillsides
- Areas of the moderately well drained Brookside soils at the foot of slopes and on narrow benches

Use and Management

Land use: Dominant use—woodland; other use—pasture

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Slope

Woodland

Suitability: Moderately well suited
Major management concerns: Erosion, plant competition, equipment limitation, seedling mortality
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Spreading roots of seedlings increases soil-root contact on the Lowell soil.
- Mulching around seedlings reduces seedling mortality on the Gilpin soil.
- Building roads and skidding logs on the contour help to control erosion.
- Constructing water bars and planting cover crops help to control erosion.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope
Suitable management practices:
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Lowell soil—5R; Gilpin soil—4R
Pasture and hayland suitability group: H-1

MaD2—Markland silty clay loam, 12 to 25 percent slopes, eroded

Setting

Landform: Terraces
Position on the landform: Terrace risers
Distinctive landscape features: Short slopes
Shape of areas: Long and very narrow
Size of areas: 5 to 10 acres

Typical Profile

Surface layer:
0 to 4 inches—brown, friable silty clay loam

Subsoil:
4 to 40 inches—yellowish brown, firm and very firm silty clay loam and silty clay

Substratum:
40 to 80 inches—dark yellowish brown, firm silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of 3.0 to 6.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Very rapid

Shrink-swell potential: High

Composition

Markland soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
- Areas of soils that have a surface layer of silt loam

Contrasting inclusions:
- Areas of Elba soils that have a few limestone rock fragments on the surface
- Areas of severely eroded soils that have a firm, silty clay surface layer

Use and Management

Land use: Dominant use—pasture; other uses—woodland, cropland

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Slope, erosion

Pasture

Suitability: Poorly suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Erosion, equipment limitation, windthrow hazard, seedling mortality, plant competition
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Spreading roots of seedlings increases soil-root contact.
- Mulching around seedlings reduces the seedling mortality rate.
- Constructing water bars and planting cover crops help to control erosion.
- Mulching barren areas helps to control erosion.
- Harvesting practices that do not leave the remaining trees widely spaced or isolated reduces the windthrow hazard.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Poorly suited
Major management concerns: Slope, shrinking and swelling
Suitable management practices:
- Building designs are needed that conform to the natural slope of the land.
- Designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
- Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
- Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
- Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, wetness, restricted permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Shrinking and swelling, low strength, slope
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: 4R
Pasture and hayland suitability group: F-5

Md—Melvin silt loam, ponded

Setting

Landform: Flood plains
Position on the landform: Flats
Slope: 0 to 2 percent

Distinctive landscape features: Scattered, small pockets of open water
Shape of areas: Long and narrow
Size of areas: 10 to 30 acres

Typical Profile

Surface layer:
0 to 4 inches—very dark grayish brown, friable silt loam

Substratum:
4 to 80 inches—olive gray, friable silt loam

Soil Properties and Qualities

Drainage class: Poorly drained
Seasonal high water table: Between 2.0 feet above the surface and a depth of 0.5 feet
Depth class: Very deep
Root zone: Moderately deep
Permeability: Moderate
Available water capacity: High
Surface runoff: Ponded
Flooding: Frequent, very long duration

Composition

Melvin soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
• Areas adjacent to the steeper Morristown soils that are covered with 1 to 3 feet of sandy and gravelly overwash
Contrasting inclusions:
• Narrow bands of Newark soils adjacent to scattered, shallow channels

Use and Management

Land use: Dominant use—wetland

Cropland and pasture

Suitability: Poorly suited
Major limitations or hazards: Ponding, flooding, wetness

Wetland wildlife habitat

Suitability: Well suited
Major management concerns: Artificial drainage

Woodland

Suitability: Poorly suited
Major limitations or hazards: Equipment limitation, seedling mortality, windthrow hazard, plant competition
Suitable management practices:
• Planting only species that tolerate wetness decreases the seedling mortality rate.
• Planting seedlings that have been transplanted once also decreases the seedling mortality rate.
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Frequent, light thinning and harvesting increases stand vigor and reduces the windthrow hazard.
• Woodland harvesting and planting are feasible when the soil is not flooded.

Buildings and septic tank absorption fields

Suitability: Poorly suited
Major limitations or hazards: Flooding, ponding

Local roads and streets

Suitability: Generally unsuited
Major limitations or hazards:
Flooding, ponding, low strength

Interpretive Groups

Land capability classification: Vw
Woodland ordination symbol: 5w
Pasture and hayland suitability group: Not assigned

MnB—Morristown silty clay loam, 0 to 6 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Surface-mined summits that have been graded and covered with a layer of silty clay loam or clay loam
Shape of areas: Long and narrow to irregular
Size of areas: 5 to 15 acres

Typical Profile

Surface layer:
0 to 12 inches—mixed dark yellowish brown and yellowish brown, firm silty clay loam

Substratum:
12 to 25 inches—dark grayish brown, firm very channery clay loam
25 to 80 inches—variegated yellowish brown, gray, and olive, firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Shallow to deep depending on surface compaction
Permeability: Moderately slow

Available water capacity: Low
Surface runoff: Slow
Shrink-swell potential: Moderate

Composition

Morristown soil and similar inclusions: 100 percent
Contrasting inclusions: 0 percent

Inclusions

Similar inclusions:
- Some areas of soils that are silty clay loam or clay loam to a depth between 2 and 3 feet
- Some areas of soils that have more rock fragments in the surface layer
- Some areas of soils that have more clay in the surface layer

Use and Management

Land use: Dominant use—cropland; other use—pasture

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion, surface compaction, droughtiness, surface ponding
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.
- Surface and subsurface drainage is needed to remove excess water from slight depressions.

Pasture

Suitability: Moderately well suited
Major management concerns: Droughtiness, and surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Droughtiness
Suitable management practices:
- Planting species that tolerate droughtiness and high content of lime reduces the seedling mortality rate.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—unstable fill; dwellings without basements—unstable fill
Suitable management practices:
- If fill is determined to be stable, installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
- If fill is determined to be stable, backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling of the soil.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability, unstable fill
Suitable management practices:
- If fill is determined to be stable and slight depressions are avoided, enlarging the distribution area increases absorption of effluent.
- Installing the distribution lines in suitable fill material also increases absorption of effluent.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Unstable fill, low strength, frost action
Suitable management practices:
- If fill is determined to be stable, adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIs
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: B-4

MnD—Morristown silty clay loam, 6 to 20 percent slopes

Setting

Landform: Surface mined hill slopes on uplands
Position on the landform: Summits and side slopes that have been graded and covered with a layer of silty clay loam or clay loam
Distinctive landscape features: Landslips, gullies
Shape of areas: Irregular

Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 12 inches—mixed dark yellowish brown and yellowish brown, firm silty clay loam

Substratum:
12 to 40 inches—dark grayish brown, firm very channery clay loam
40 to 80 inches—variegated yellowish brown, gray and olive, firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Shallow to deep depending on surface compaction
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Rapid
Shrink-swell potential: Moderate

Composition

Morristown soil and similar inclusions: 100 percent
Contrasting inclusions: 0 percent

Inclusions

Similar inclusions:
• Some areas of soils that are silty clay loam or clay loam between a depth of 2 and 3 feet
• Some areas of soils that have more rock fragments in the surface layer
• Some areas of soils that have more clay in the surface layer

Use and Management

Land use: Dominant use—cropland; other use—pasture

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion, surface compaction, droughtiness
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when its not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Poorly suited
Major management concerns: Slope, erosion, droughtiness, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Droughtiness, equipment limitation
Suitable management practices:
• Planting species that tolerate droughtiness and high content of lime reduces the seedling mortality rate.
• Avoiding active slopes as locations for haul roads and log landings helps to prevent soil failure during log removal.
• Cutting and filling to a more desirable slope improves sites for log landings.

Buildings

Suitability: Poorly suited
Major management concerns: Slope, unstable fill
Suitable management practices:
• If fill is determined to be stable, building designs are needed that conform to the natural slope of the land.
• If fill is determined to be stable, designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
• Avoiding landslips, seeps, springs, and gullies decreases damage to the foundation caused by slippage and wetness.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited

Major management concerns: Restricted permeability, slope, unstable fill
Suitable management practices:
• If fill is determined to be stable, enlarging the distribution area increases absorption of effluent.
• If fill is determined to be stable, installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Slope, unstable fill, low strength, frost action
Suitable management practices:
• If fill is determined to be stable, adding a suitable base material decreases damage to the road surface.
• If fill is determined to be stable, constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVs
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: B-4

MnE—Morristown silty clay loam, 20 to 35 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Surface mined side slopes that have been graded and covered with a layer of silty clay loam or clay loam
Distinctive landscape features: Landslips, gullies
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 10 inches—mixed dark yellowish brown and yellowish brown, firm silty clay loam

Substratum:
10 to 32 inches—dark grayish brown, very firm very channery clay loam
32 to 80 inches—variegated yellowish brown, gray and olive, very firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Shallow to deep depending on surface compaction
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Very rapid
Shrink-swell potential: Moderate

Composition

Morristown soil and similar inclusions: 100 percent
Contrasting inclusions: 0 percent

Inclusions

Similar inclusions:
• Some areas of soils that are silty clay loam or clay loam to a depth of 2 feet
• Some areas of soils that have more rock fragments in the surface layer
• Some areas of soils that have more clay in the surface layer

Use and Management

Land use: Dominant use—pasture; other use—idle land

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Slope, erosion, surface compaction, droughtiness

Pasture

Suitability: Poorly suited
Major management concerns: Slope, erosion, droughtiness, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Poorly suited
Major management concerns: Erosion, droughtiness
Suitable management practices:
• Planting species that tolerate droughtiness and high content of lime reduces the seedling mortality rate.
• Constructing water bars and establishing vegetative cover help to control erosion.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, unstable fill

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, unstable fill, low strength, frost action
Suitable management practices:
• If fill is determined to be stable, adding a suitable base material decreases damage to the road surface.
• If fill is determined to be stable, constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: E-2

MpB—Morristown channery clay loam, 0 to 6 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Surface mined summits that have been graded
Shape of areas: Irregular
Size of areas: 5 to 15 acres

Typical Profile

Surface layer:
0 to 2 inches—dark grayish brown, firm channery clay loam

Substratum:
2 to 80 inches—variegated yellowish brown, gray and olive, very firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Shallow to deep depending on surface compaction
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Slow
Shrink-swell potential: Moderate

Composition

Morristown soil and similar inclusions: 100 percent
Contrasting inclusions: 0 percent

Inclusions

Similar inclusions:
• Some areas of soils that have more rock fragments in the surface layer than does the Morristown soil

Use and Management

Land use: Dominant use—woodland

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Stones, surface compaction, droughtiness, surface ponding

Woodland

Suitability: Poorly suited
Major management concerns: Droughtiness
• Planting species that tolerate droughtiness and high content of lime reduces the seedling mortality rate.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—unstable fill; dwellings without basements—unstable fill
Suitable management practices:
• If fill is determined to be stable, installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• If fill is determined to be stable, backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling of the soil.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability, unstable fill
Suitable management practices:
• If fill is determined to be stable and depressions are avoided, enlarging the distribution area increases absorption of effluent.
• If fill is determined to be stable and depressions are avoided, installing distribution lines in suitable fill material also increases absorption of effluent.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Unstable fill, low strength, frost action
Suitable management practices:
• If fill is determined to be stable, adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: E-3

MpD—Morristown channery clay loam, 6 to 20 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Surface mined and graded summits and side slopes
Distinctive landscape features: Landslips, gullies
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—dark grayish brown, firm channery clay loam

Substratum:
2 to 80 inches—variegated yellowish brown, gray and olive, very firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Shallow to deep depending on surface compaction
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Rapid
Shrink-swell potential: Moderate

Composition

Morristown soil and similar inclusions: 100 percent
Contrasting inclusions: 0 percent

Inclusions

Similar inclusions:
• Some areas of soils that have more rock fragments in the surface layer

Use and Management

Land use: Dominant use—woodland

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Slope, erosion, stones, surface compaction, droughtiness

Woodland

Suitability: Poorly suited
Major management concerns: Erosion, droughtiness
Suitable management practices:
• Erosion can be reduced by using water bars, establishing vegetative cover, or other erosion control practices.
• Planting species that tolerate droughtiness and high content of lime reduces the seedling mortality rate.

Buildings

Suitability: Poorly suited
Major management concerns: Slope, unstable fill
Suitable management practices:
• If fill is determined to be stable, building designs are needed that conform to the natural slope of the land.
• If fill is determined to be stable, designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
• Avoiding landslips, seeps, springs, and gullies helps to decrease damage to the foundation caused by slippage and wetness.
• If fill is determined to be stable, installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• If fill is determined to be stable, backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling of the soil.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability, slope, unstable fill
Suitable management practices:
• If fill is determined to be stable, installing distribution lines on the contour decreases seepage of effluent to the surface.
• If fill is determined to be stable, enlarging the distribution area increases absorption of effluent.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Slope, unstable fill, low strength, frost action
Suitable management practices:
• If fill is determined to be stable, constructing roads on the contour helps to control erosion.
• If fill is determined to be stable, adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: VIs
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: E-3

MrF—Morristown channery clay loam, 20 to 70 percent slopes, very stony

Setting

Landform: Hill slopes on uplands
Landscape position: Surface mined side slopes
Distinctive landscape features: Small and large stones, landslips, and highwalls adjacent to narrow pools of water
Shape of areas: Long and narrow
Size of areas: 20 to 200 acres

Typical Profile

Surface layer:
0 to 4 inches—dark grayish brown, friable channery clay loam

Substratum:
4 to 15 inches—grayish brown, friable channery clay loam
15 to 80 inches—variegated yellowish brown, yellowish red and olive, firm very channery clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderately slow
Available water capacity: Low
Surface runoff: Very rapid
Shrink-swell potential: Moderate

Composition

Morristown soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Long, winding highwalls adjacent to permanent pools of water
- Very narrow, flat ridgetops

Use and Management

Land use: Dominant use—woodland

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Slope, very stony surface

Woodland

Suitability: Poorly suited
Major management concerns: Erosion hazard, equipment limitation, seedling mortality
Suitable management practices:
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
- Mulching around seedlings reduces the seedling mortality rate.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, unstable fill
Suitable management practices:
- If fill is determined to be stable, constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: H-1

Ne—Newark silt loam, frequently flooded

Setting

Landform: Flood plains
Position on the landform: Flats
Slope: 0 to 3 percent
Distinctive landscape features: Wet spots
Shape of areas: Long and narrow
Size of areas: 5 to 30 acres

Typical Profile

Surface layer:
0 to 6 inches—dark grayish brown, friable silt loam

Subsoil:
6 to 12 inches—brown, mottled, friable silty clay loam
12 to 20 inches—grayish brown, mottled, friable silty clay loam
20 to 27 inches—brown, mottled, friable silty clay loam

Substratum:
27 to 80 inches—yellowish brown, light brownish gray, and dark gray, mottled, friable silty clay loam

Soil Properties and Qualities

Drainage class: Somewhat poorly drained
Seasonal high water table: At a depth of 0.5 to 1.5 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate

Available water capacity: High
Surface runoff: Very slow
Flooding: Frequent

Composition

Newark soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of moderately well drained Lobdell soils, along streambanks, that have a channery substratum
- Areas of very poorly drained soils in old channels

Use and Management

Land use: Dominant use—pasture; other uses—woodland and cropland

Cropland

Suitability: Poorly suited to most crops; better suited to corn and legume-grass mixtures that can withstand some wetness than to small grains and deep-rooted perennial crops
Major management concerns: Flooding, wetness, frost heaving
Suitable management practices:
- Review local flooding history before growing winter wheat, hay for sale, or high- value specialty crops
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Surface and subsurface drainage is needed to remove excess water.
- Seeding legumes and grasses that tolerate some periods of standing water ensures good growth.

Pasture

Suitability: Well suited
Major management concerns: Wetness
Suitable management practices:
- Controlling weeds, rotating pastures, and avoiding overstocking helps to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.
- Seeding grasses and legumes that tolerate some periods of standing water ensures good growth.

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, windthrow hazard, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting practices that do not leave the remaining trees widely spaced or isolated reduces the windthrow hazard.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Flooding, wetness

Local roads and streets

Suitability: Poorly suited
Major management concerns: Low strength, wetness, flooding
Suitable management practices:
- Elevating roads above the known high water level is needed.
- Adding a suitable base material decreases damage to the road surface.
- Installing surface and subsurface drains decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 5W
Pasture and hayland suitability group: C-3

No—Nolin silt loam, occasionally flooded

Setting

Landform: Flood plains
Position on the landform: Flats
Slope: 0 to 3 percent
Shape of areas: Long and narrow
Size of areas: 10 to 80 acres

Typical Profile

Surface layer:
0 to 10 inches—brown, friable silt loam

Subsoil:
10 to 52 inches—dark yellowish brown, friable silt loam

Substratum:
52 to 80 inches—dark yellowish brown, friable silt loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of 3.0 to 6.0 feet
Depth class: Very deep

Root zone: Deep or very deep
Permeability: Moderate
Available water capacity: High
Surface runoff: Slow
Flooding: Occasional

Composition

Nolin soil and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Inclusions

Contrasting inclusions:
- Areas of natural levees along streambanks that have more sand and less silt
- Areas of small, narrow, winding, somewhat poorly drained soils adjacent to higher elevations

Use and Management

Land use: Dominant use—cropland and pasture; other use—woodland

Cropland

Suitability: Well suited
Major management concerns: Controlling johnsongrass, frost action
Suitable management practices:
- Row-cropped soybeans and alfalfa or alfalfa-grass hay can be grown while controlling johnsongrass with chemicals or mowing.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Controlling weeds, rotating pastures, and avoiding overstocking maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
- Applying gravel or crushed stone on haul roads and log landings improves soil strength.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Flooding

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, frost action, flooding
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 5A
Pasture and hayland suitability group: A-5

Np—Nolin silt loam, frequently flooded

Setting

Landform: Flood plains
Position on the landform: Flats
Slope: 0 to 3 percent
Distinctive landscape features: Stream meanders
Shape of areas: Long and narrow
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 8 inches—brown, friable silt loam

Subsoil:
8 to 40 inches—dark yellowish brown, friable silt loam

Substratum:
40 to 80 inches—dark yellowish brown, friable silt loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of 3.0 to 6.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate
Available water capacity: High
Surface runoff: Slow
Flooding: Frequent

Composition

Nolin soil and similar inclusions: 80 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
- Small areas of highly sorted sands and silts in stream meanders
- Areas of soils that have more clay in the subsoil and are redder
- Small areas of somewhat poorly drained Newark soils adjacent to higher elevations

Use and Management

Land use: Dominant uses—pasture and cropland; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Flooding, frost action
Suitable management practices:
- A review of local flooding history is needed before growing winter wheat, hay for sale, or high-value specialty crops.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Controlling weeds, rotating pastures, and avoiding overstocking maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Flooding

Local roads and streets

Suitability: Poorly suited
Major management concerns: Flooding, low strength, frost action
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Elevating roads above the known high water level is needed.

Interpretive Groups

Land capability classification: IIw
Woodland ordination symbol: 5A
Pasture and hayland suitability group: A-5

OmB—Omulga silt loam, 2 to 6 percent slopes

Setting

Landform: Preglacial valleys
Position on the landform: Gently sloping areas
Shape of areas: Irregular
Size of areas: 5 to 10 acres

Typical Profile

Surface layer:
0 to 7 inches—brown, friable silt loam

Subsoil:
7 to 24 inches—yellowish brown, friable silt loam
24 to 35 inches—yellowish brown, mottled, firm silt loam
35 to 56 inches—yellowish brown, mottled, very firm and slightly brittle silt loam (fragipan)
56 to 71 inches—yellowish brown, mottled, very firm silt loam

Substratum:
71 to 80 inches—yellowish brown, firm silt loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Depth class: Very deep
Root zone: Moderately deep
Permeability: Moderate above fragipan, slow in fragipan
Available water capacity: Moderate
Surface runoff: Medium
Shrink-swell potential: Moderate

Composition

Omulga soil and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
- Areas of soils, near slope breaks, that have more clay and that are redder in the lower part of the subsoil and substratum

Contrasting inclusions:
- Areas of soils that do not have a fragipan
- Areas of somewhat poorly drained soils in low areas

Use and Management

Land use: Dominant use—cropland; other use—pasture and woodland

Cropland

Suitability: Well suited
Major management concerns: Erosion, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water (fig. 6).
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, windthrow hazard
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting practices that do not leave the remaining trees widely spaced or isolated reduce the windthrow hazard.
- Harvesting when the surface layer is frozen or is not soft

Figure 5.—Hayland on Omulga silt loam, 2 to 6 percent slopes.

and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness; dwellings without basements—wetness, shrinking and swelling
Suitable management practices:
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
• Installing drains around the distribution area decreases wetness.
• Enlarging the distribution area increases absorption of effluent.

Local roads and streets

Suitability: Well suited
Major management concerns: Low strength, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4D
Pasture and hayland suitability group: F-3

OmC2—Omulga silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Preglacial valleys
Position on the landform: Slope breaks
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 19 inches—yellowish brown, mottled, friable silt loam
19 to 31 inches—yellowish brown, mottled, firm silt loam
31 to 50 inches—yellowish brown, mottled, very firm and slightly brittle silt loam (fragipan)
50 to 65 inches—yellowish brown, mottled, firm silt loam

Substratum:
65 to 80 inches—yellowish brown, firm silt loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Depth class: Very deep
Root zone: Moderately deep
Permeability: Moderate above fragipan, slow in fragipan
Available water capacity: Moderate
Surface runoff: Rapid
Shrink-swell potential: Moderate

Composition

Omulga soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
• Areas of soils that have more clay and that are redder in the lower part of the subsoil and substratum
Contrasting inclusions:
• Areas of soils that do not have a fragipan
• Areas of somewhat poorly drained soils in depressions

Use and Management

Land use: Dominant use—cropland; other use—pasture and woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:

• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, windthrow hazard
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Harvesting practices that do not leave the remaining trees widely spaced or isolated reduces the windthrow hazard.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness; dwellings without basements—wetness, shrinking and swelling, slope
Suitable management practices:
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Building designs are needed that conform to the natural slope of the land.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
• Installing drains around the distribution area decreases wetness.
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4D
Pasture and hayland suitability group: F-3

Pg—Pits, gravel

Setting

Landform: Terraces
Position on the landform: Terrace treads and risers
Slope: 0 to 70 percent
Distinctive landscape features: Nearly vertical eroding pit sidewalls, a few water-filled pits
Shape of areas: Rectangular
Size of areas: 5 to 100 acres

Typical Profile

Substratum
0 to 24 inches—highly variable, light gray, stratified gravelly loam, very coarse sand, and fine sand to olive brown channery loam

Bedrock:
24 to 28 inches—hard, light gray limestone

Soil Properties and Qualities

Drainage class: Very poorly drained to well drained
Seasonal high water table: Between 2.0 feet above the surface and a depth of 6.0 feet
Depth class: Shallow
Root zone: Shallow
Permeability: Very slow to rapid
Available water capacity: Very low
Surface runoff: Rapid to ponded
Shrink-swell potential: Low

Composition

Pits, gravel and similar inclusions: 75 percent
Contrasting inclusions: 25 percent

Inclusions

Similar inclusions:
• Areas of unsorted sand and gravel piled 10 to 30 feet high
• Areas of fine and very fine sand piled 5 to 20 feet high
Contrasting inclusions:
• Small piles of topsoil and subsoil

- Areas of very steep highwalls 10 to 30 feet high
- Fan-shaped areas of sediment near highwalls
- Reclaimed areas that have been graded and covered with 6 to 10 inches of stockpiled silt loam or loam from the surface layer and subsoil

Use and Management

Land use: Dominant use—abandoned land; other use—wetlands

Wildlife habitat

Suitability: Well suited to poorly suited to wetland wildlife habitat

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Droughtiness, ponding, siltation, slope

Woodland

Suitability: Poorly suited
Major management concerns: Droughtiness, ponding, erosion

Buildings and sanitary facilities

Suitability: Generally unsuited
Major limitations or hazards: Ponding, restricted permeability, depth to bedrock, slope

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Ponding, slope

Interpretive Groups

Land capability classification: Not assigned
Woodland ordination symbol: Not assigned
Pasture and hayland suitability group: Not assigned

RvE—Richland-Vandalia complex, 20 to 35 percent slopes

Setting

Landform: Hill slopes on uplands
Landscape position: Richland—upper part of foot slope; Vandalia—lower part of foot slope
Distinctive landscape features: Landslips
Shape of areas: Long and narrow
Size of areas: 5 to 10 acres

Typical Profile

Richland

Surface layer:
0 to 15 inches—dark brown and brown, friable loam

Subsoil:
15 to 23 inches—brown, friable silt loam
23 to 41 inches—brown and strong brown, friable and firm channery loam
41 to 72 inches—brown, mottled, firm channery loam and channery silt loam

Vandalia

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 68 inches—brown and reddish brown, firm silty clay loam and channery silty clay loam

Substratum:
68 to 80 inches—brown, firm channery silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: Richland—at a depth of 3.0 to 6.0 feet; Vandalia—at a depth of 4.0 to 6.0 feet
Depth class: Very deep
Root zone: Deep
Permeability: Richland—moderate; Vandalia—moderately slow or slow
Available water capacity: Moderate
Surface runoff: Very rapid
Shrink-swell potential: Richland—moderate; Vandalia—high

Composition

Richland soil and similar inclusions: 45 percent
Vandalia soil and similar inclusions: 40 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
- Areas of soils that have more rock fragments in the upper part of the subsoil

Contrasting inclusions:
- Areas of moderately well drained soils on flatter parts of the slope

Use and Management

Land use: Dominant use—woodland

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Slope

Pasture

Suitability: Poorly suited

Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Erosion hazard, equipment limitation, seedling mortality, plant competition, windthrow
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Spreading roots of seedlings increases soil-root contact.
• Constructing water bars and planting cover crops help to control erosion.
• Mulching around seedlings reduces the seedling mortality rate.
• Building roads and skid trails on the contour helps to control erosion and to overcome the equipment limitation.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.

Buildings

Suitability: Generally unsuited
Major limitations or hazards in areas of the Richland soil: Dwellings with basements—slope; dwellings without basements—slope
Major management concerns in areas of the Vandalia soil: Dwellings with basements—slope, restricted permeability, slippage; dwellings without basements—shrinking and swelling, slope, slippage

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Richland—slope, wetness; Vandalia—slope, restricted permeability, slippage

Local roads and streets

Suitability: Poorly suited
Major management concerns: Richland—slope, possible slippage; Vandalia—low strength, slope
Suitable management practices:
• Adding a suitable base material improves soil strength and reduces pavement cracking.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: Richland soil—5R on north aspects, 4R on south aspects; Vandalia soil—4R
Pasture and hayland suitability group: Richland—A-3; Vandalia—F-6

StF—Steinsburg loam, 25 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Back slopes
Distinctive landscape features: Sandstone rock outcrops
Shape of areas: Long and narrow
Size of areas: 5 to 10 acres

Typical Profile

Surface layer:
0 to 4 inches—dark grayish brown, friable loam

Subsoil:
4 to 8 inches—brown, friable loam
8 to 27 inches—yellowish brown, friable loam and sandy loam

Bedrock:
27 to 28 inches—yellowish brown sandstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Moderately deep
Root zone: Moderately deep
Permeability: Moderately rapid
Available water capacity: Low
Surface runoff: Very rapid

Composition

Steinsburg soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of deep Richland soils at the base of the slope
• Areas of soils that are less than 20 inches to bedrock

Use and Management

Land use: Dominant use—woodland; other use—pasture

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Erosion, slope, rock outcrops

Pasture

Suitability: Poorly suited on 25 to 40 percent slopes; generally unsuited on 40 to 70 percent slopes
Major limitations or hazards: Slope, erosion
Suitable management practices:
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, seedling mortality, erosion hazard, equipment limitation
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Mulching around seedlings reduces the seedling mortality rate.
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Constructing water bars and planting cover crops help to control erosion.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: North aspect—4R; south aspect—3R
Pasture and hayland suitability group: 25 to 40 percent slopes—F-2; 40 to 70 percent slopes—H-1

Ud—Udorthents

Setting

Landform: Terraces, and hill slopes on uplands
Shape of areas: Rectangular
Size of areas: 5 to 30 acres

Typical Profile

0 to 6 inches—brown or yellowish brown, friable or firm silty clay loam or loam
6 to 80 inches—yellowish brown or light gray, firm channery clay loam or very gravelly sandy loam

Soil Properties and Qualities

Available water capacity: Very low to medium
Surface runoff: Slow to very rapid
Hazard of water erosion: Moderate or severe

Composition

Udorthents and similar inclusions: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
• Areas of Elba soils near the edge of some mapped areas of Udorthents
• Areas of Chavies soils near the edge of some mapped areas of Udorthents

Use and Management

Land use: Former use—pasture and cropland; current uses—sanitary land fill and reclaimed gravel pit
Suitable management practices:
• Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None
Woodland ordination symbol: None
Pasture and hayland suitability group: None

UpC2—Upshur silty clay loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges, shoulder slopes, and benches
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 6 inches—brown, friable silty clay loam

Subsoil:
6 to 29 inches—yellowish red, firm silty clay

Substratum:
29 to 46 inches—reddish brown, firm silty clay loam

Bedrock:
46 to 50 inches—fractured, olive brown siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep and very deep
Root zone: Deep
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Upshur soil and similar inclusions: 80 percent
Contrasting inclusions: 20 percent

Inclusions

Similar inclusions:
• Areas of less sloping Woodsfield soils that have a surface layer of silt loam
Contrasting inclusions:
• Severely eroded areas, on the crest of knolls, that have a surface layer of silty clay
• Small areas of moderately well drained Guernsey soils in seep areas

Use and Management

Land use: Dominant uses—pasture and cropland; other uses—woodland

Cropland

Suitability: Poorly suited
Major management concerns: Erosion
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.

Pasture

Suitability: Moderately well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, seedling mortality, windthrow hazard
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Mulching barren areas reduces seedling mortality.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Spreading the roots of seedlings and increasing soil-root contact reduce the seedling mortality rate.
• Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.

Buildings

Suitability: Moderately well suited
Major management concerns: Shrinking and swelling
Suitable management practices:
• Designing buildings that minimize cutting and filling decreases damage to the foundation caused by slippage.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability
Suitable management practices:
• Adding suitable fill material increases absorption of effluent.
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Moderately well suited

Major management concerns: Shrinking and swelling, low strength
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 3C
Pasture and hayland suitability group: F-5

UpD2—Upshur silty clay loam, 12 to 20 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Benches
Distinctive landscape features: Landslips, gullies
Shape of areas: Long and wide
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 4 inches—reddish brown, friable silty clay loam

Subsoil:
4 to 42 inches—yellowish red, red, and dark red, firm silty clay

Substratum:
42 to 58 inches—dark reddish brown and light olive brown, firm silty clay loam
58 to 84 inches—light olive brown, dark reddish brown, and dark red, firm silty clay loam

Bedrock:
84 to 90 inches—reddish brown shale

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep and very deep
Root zone: Deep
Permeability: Slow
Available water capacity: Moderate
Surface runoff: Very rapid
Shrink-swell potential: High

Composition

Upshur soil and similar inclusions: 80 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
• Small areas of moderately deep Gilpin soils near slope breaks to lower elevations
• Small areas of moderately well drained Guernsey soils at the head of drainageways

Use and Management

Land use: Dominant use—pasture; other use—woodland

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Slope, erosion

Pasture

Suitability: Poorly suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, erosion, seedling mortality, equipment limitation, windthrow hazard
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Spreading roots of seedlings increases soil-root contact.
• Building roads and skid trails on the contour helps to control erosion and to overcome the equipment limitation.
• Constructing water bars and planting cover crops help to control erosion.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.
• Applying gravel or crushed stone on haul roads and log landings improves soil strength.
• Avoiding active slips in locating haul roads and log landings helps to control erosion during log removal.

Buildings

Suitability: Poorly suited

Major management concerns: Slope, shrinking and swelling, slippage
Suitable management practices:
• Building designs are needed that conform to the natural slope of the land.
• Designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
• Avoiding landslips, seeps, springs, and gullies decreases damage to the foundation caused by slippage and wetness.
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, restricted permeability, slippage

Local roads and streets

Suitability: Poorly suited
Major management concerns: Slope, shrinking and swelling, low strength
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: North aspect—4R; south aspect—3R
Pasture and hayland suitability group: F-5

VaE2—Vandalia silt loam, 20 to 35 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Foot slopes
Distinctive landscape features: Landslips, deep drainageways
Shape of areas: Long and narrow
Size of areas: 20 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—brown, friable silt loam

Subsoil:
6 to 27 inches—brown and reddish brown, firm silty clay loam and channery silty clay loam
27 to 68 inches—reddish brown, firm channery silty clay and silty clay

Substratum:
68 to 80 inches—brown, firm channery silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of 4.0 to 6.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderately slow or slow
Available water capacity: Moderate
Surface runoff: Very rapid
Shrink-swell potential: High

Composition

Vandalia soil and similar inclusions: 80 percent
Contrasting inclusions: 20 percent

Inclusions

Contrasting inclusions:
• Small areas of moderately well drained Guernsey soils in seep areas near the head of drainageways
• A few large stones or boulders on the surface

Use and Management

Land use: Dominant uses—woodland or brushland; other use—pasture

Cropland

Suitability: Generally unsuited
Major limitations or hazards: Erosion, slope

Pasture

Suitability: Poorly suited
Major management concerns: Erosion, slope, slippage, surface compaction in overgrazed areas
Suitable management practices:
• Liming, fertilizing, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion, seedling mortality, equipment limitation, windthrow hazard.
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Spreading roots of seedlings increases soil-root contact.
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Constructing water bars and planting cover crops help to control erosion.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.
• Applying gravel or crushed stone on haul roads and log landings improves soil strength.
• Avoiding active slips as a location for haul roads and log landings helps to prevent soil failure during log removal.
• Cutting and filling to a more desirable slope improves sites for log landings.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, shrinking and swelling, slippage, restricted permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Low strength, slope, shrinking and swelling
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: 4R
Pasture and hayland suitability group: F-6

VbD2—Vandalia-Brookside complex, 12 to 20 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Vandalia—lower part of foot slopes; Brookside—upper part of foot slopes
Distinctive landscape features: Landslips, seeps, springs
Shape of areas: Long and wide
Size of areas: 20 to 100 acres

Typical Profile

Vandalia

Surface layer:
0 to 4 inches—dark grayish brown, friable silty clay loam

Subsoil:
4 to 37 inches—yellowish red and reddish brown, firm silty clay
37 to 41 inches—yellowish red, firm silty clay loam

Substratum:
41 to 80 inches—dark reddish brown, mottled, firm silty clay loam

Brookside

Surface layer:
0 to 8 inches—dark brown, friable silt loam

Subsoil:
8 to 26 inches—brown, firm silty clay loam
26 to 43 inches—yellowish brown, mottled, firm silty clay loam

Substratum:
43 to 80 inches—yellowish brown, mottled, firm silty clay

Soil Properties and Qualities

Drainage class: Vandalia—well drained; Brookside—moderately well drained
Seasonal high water table: Vandalia—at a depth of 4.0 to 6.0 feet; Brookside—at a depth of 2.5 to 4.0 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Vandalia—moderately slow or slow; Brookside—moderately slow
Available water capacity: Vandalia—moderate; Brookside—high
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Vandalia soil and similar inclusions: 50 percent
Brookside soil and similar inclusions: 40 percent
Contrasting inclusions: 10 percent

Inclusions

Similar inclusions:
• Areas of moderately well drained soils that have more rock fragments and less clay on the upper part of the slope

Contrasting inclusions:
• Areas of well drained, moderately deep Gilpin soils on steep slope breaks to flood plains

Use and Management

Land use: Dominant use—pasture; other uses—cropland, woodland

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion, slippage, wetness, surface compaction, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Draining seeps and springs allows timely equipment operations.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Erosion, wetness, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Erosion hazard, equipment limitation, seedling mortality, plant competition, windthrow hazard
Suitable management practices:
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Spreading roots of seedlings increases soil-root contact.
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Using harvest methods that do not isolate the remaining trees or leave them widely spaced reduces the windthrow hazard.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope, shrinking and swelling, slippage, restricted permeability, wetness

Local roads and streets

Suitability: Poorly suited
Major management concerns: Vandalia—low strength, slope, shrinking and swelling; Brookside—slope, slippage, shrinking and swelling
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: Vandalia soil—4R; Brookside soil—5R on north aspects, 4R on south aspects
Pasture and hayland suitability group: Vandalia—F-5; Brookside—A-1

WeB—Wellston silt loam, 2 to 6 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges
Shape of areas: Long and narrow
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 8 inches—brown, friable silt loam

Subsoil:
8 to 33 inches—yellowish brown, friable silt loam and silty clay loam
33 to 43 inches—yellowish brown, firm silt loam

Bedrock:
43 to 55 inches—yellowish brown, weakly cemented sandstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep

Root zone: Deep
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Medium

Composition

Wellston soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Small areas of moderately deep Gilpin soils near slope breaks to lower elevations
- Areas of moderately well drained Zanesville soils near the center of mapped areas

Use and Management

Land use: Dominant uses—cropland and pasture; other uses—woodland

Cropland

Suitability: Well suited
Major management concerns: Erosion, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion and surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Applying gravel or crushed stone on haul roads and log landings improves soil strength.

Buildings

Suitability: Well suited
Major management concerns: None

Septic tank absorption fields

Suitability: Moderately well suited
Major management concerns: Depth to rock
Suitable management practices:
- Installing the distribution lines in suitable fill material decreases possible ground water contamination.

Local roads and streets

Suitability: Well suited
Major management concerns: Frost action
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4A
Pasture and hayland suitability group: A-6

WeC2—Wellston silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Summits and shoulder slopes
Shape of areas: Long and narrow
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 7 inches—brown and yellowish brown, friable silt loam

Subsoil:
7 to 32 inches—yellowish brown, friable silty clay loam
32 to 41 inches—yellowish brown, firm silt loam

Bedrock:
41 to 50 inches—yellowish brown, weakly cemented sandstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep

Root zone: Deep
Permeability: Moderate
Available water capacity: Moderate
Surface runoff: Rapid

Composition

Wellston soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Areas of moderately deep Gilpin soils near slope breaks
- Areas of moderately well drained Zanesville soils near the center of mapped areas

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.

Buildings

Suitability: Moderately well suited
Major management concerns: Slope
Suitable management practices:
- Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Moderately well suited
Major management concerns: Depth to rock, slope
Suitable management practices:
- Installing distribution lines in suitable fill material decreases possible ground water contamination.
- Installing distribution lines on the contour with a level decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Frost action
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Pasture and hayland suitability group: A-6

WfB—Westgate silt loam, 2 to 6 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges and benches
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 8 inches—brown, friable silt loam

Subsoil:
8 to 24 inches—yellowish brown, friable silty clay loam
24 to 40 inches—yellowish brown, mottled, firm silty clay loam
40 to 52 inches—yellowish red, firm silty clay

Substratum:
52 to 78 inches—dark reddish brown and light olive brown, mottled, firm silty clay and channery silty clay loam

Bedrock:
78 to 80 inches—dark reddish brown shale

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate in upper part of subsoil, slow in lower part
Available water capacity: High
Surface runoff: Medium
Shrink-swell potential: Moderate in upper part of the subsoil, high in lower part

Composition

Westgate soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
• Areas of soils, at the center of ridgetops, that are deeper to a subsoil of yellowish red silty clay
Contrasting inclusions:
• Areas of moderately deep Gilpin soils near slope breaks to lower elevations
• Areas of more sloping Aaron soils, which have more clay in the upper part of the subsoil

Use and Management

Land use: Dominant use—cropland; other uses—pasture and woodland

Cropland

Suitability: Well suited
Major management concerns: Erosion, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Applying gravel or crushed stone to haul roads and log landings improves soil strength.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness; dwellings without basements—wetness, shrinking and swelling
Suitable management practices:
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.

Septic tank absorption fields

Suitability: Moderately well suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
• Enlarging the distribution area increases absorption of effluent.
• Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Well suited
Major management concerns: Frost action, low strength
Suitable management practices:

• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4A
Pasture and hayland suitability group: A-6

WfC2—Westgate silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges and benches
Shape of areas: Long and narrow or irregular
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 7 inches—brown, friable silt loam

Subsoil:
7 to 30 inches—strong brown, friable silt loam and silty clay loam
30 to 48 inches—yellowish red and strong brown, mottled, firm clay and silty clay
48 to 62 inches—yellowish brown, firm channery silty clay loam

Substratum:
62 to 78 inches—yellowish brown and strong brown, mottled, firm silty clay loam

Bedrock:
78 to 82 inches—yellowish brown shale

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.5 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate in the upper part of subsoil, slow in the lower part
Available water capacity: High
Surface runoff: Rapid
Shrink-swell potential: Moderate in upper part of the subsoil, high in the lower part

Composition

Westgate soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Figure 7.—Corn shocks on Westgate silt loam, 6 to 12 percent slopes, eroded.

Inclusions

Contrasting inclusions:
- Areas of moderately deep Gilpin soils near slope breaks to lower elevations
- Areas of Aaron and Woodsfield soils, on severely eroded knobs, that have more clay in the upper part of the subsoil

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water (figs. 7 and 8).
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness; dwellings without basements—wetness, shrinking and swelling, slope
Suitable management practices:
- Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
- Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
- Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Moderately well suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
- Enlarging the distribution area increases absorption of effluent.
- Installing distribution lines on the contour decreases seepage of effluent to the surface.
- Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, frost action
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4A
Pasture and hayland suitability group: A-6

WgD2—Westmoreland-Guernsey complex, 12 to 20 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Landscape position: Westmoreland—back slopes; Guernsey—benches
Distinctive landscape features: Seeps
Shape of areas: Long and narrow or irregular
Size of areas: 10 to 30 acres

Typical Profile

Westmoreland

Surface layer:
0 to 5 inches—brown, friable silt loam

Subsoil:
5 to 20 inches—yellowish brown, friable silt loam and channery silt loam
20 to 28 inches—strong brown, firm channery loam and channery clay loam
28 to 36 inches—yellowish brown, firm very channery clay loam

Substratum:
36 to 44 inches—yellowish brown, firm extremely channery clay loam

Bedrock:
44 to 46 inches—fractured, olive brown siltstone

Guernsey

Surface layer:
0 to 3 inches—dark grayish brown, friable silt loam

Subsoil:
3 to 14 inches—brown and yellowish brown, friable and firm silt loam and channery silty clay loam
14 to 22 inches—yellowish brown, mottled, firm channery silty clay loam
22 to 52 inches—yellowish brown, mottled, firm silty clay loam

Substratum:
52 to 65 inches—variegated yellowish brown, gray, and dark gray silty clay loam

Bedrock:
65 to 71 inches—soft, gray shale

Soil Properties and Qualities

Drainage class: Westmoreland—well drained; Guernsey—moderately well drained
Seasonal high water table: Westmoreland—at a depth of more than 6 feet; Guernsey—at a depth of 1.5 to 3.0 feet
Depth class: Westmoreland—deep; Guernsey—very deep
Root zone: Deep or very deep
Permeability: Westmoreland—moderate; Guernsey—moderately slow or slow
Available water capacity: Westmoreland—low; Guernsey—moderate
Surface runoff: Rapid
Shrink-swell potential: Westmoreland—low; Guernsey—high

Composition

Westmoreland soil and similar inclusions: 45 percent
Guernsey soil and similar inclusions: 35 percent
Contrasting inclusions: 20 percent

Inclusions

Similar inclusions:
- Areas of moderately deep, well drained Gilpin soils on slope breaks

Contrasting inclusions:
- Areas of deep, moderately well drained Westgate soils on less sloping parts of benches
- Areas of moderately deep Berks soils on steeper parts of back slopes

Use and Management

Land use: Dominant uses—pasture and woodland; other use—cropland

Cropland

Suitability: Poorly suited
Major management concerns: Slope, erosion, wetness, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water (fig. 9).
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Draining seeps and springs allows timely equipment operations.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Moderately well suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion hazard, equipment limitation, seedling mortality.
Suitable management practices:

Figure 8.—Rill erosion on Westgate silt loam, 6 to 12 percent slopes, eroded.

- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
- Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
- Constructing water bars and planting cover crops help to control erosion.
- Planting seedlings that have been transplanted once will reduce the seedling mortality rate.

Buildings

Suitability: Poorly suited
Major management concerns in areas of the Westmoreland soil: Dwellings with basements—slope, depth to rock; dwellings without basements—slope
Major management concerns in areas of the Guernsey soil: Dwellings with basements—slope, wetness, shrinking and swelling; dwellings without basements—slope, slippage, shrinking and swelling
Suitable management practices:
- Building designs are needed that conform to the natural slope of the land.
- Designing buildings to minimize cutting and filling decreases damage to the foundation caused by slippage.
- Ripping through hard rock is needed in excavating for a basement.
- Avoiding landslips, seeps, springs, and gullies decreases damage to the foundation caused by slippage and wetness.
- Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
- Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
- Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Westmoreland—slope; Guernsey—slope, wetness, restricted permeability
- Installing distribution lines on the contour decreases seepage of effluent to the surface.
- Enlarging the distribution area increases absorption of effluent.
- Installing drains around the distribution area on Guernsey soils decreases wetness.

Local roads and streets

Suitability: Poorly suited
Major management concerns: Westmoreland—slope; Guernsey—slope, shrinking and swelling, low strength
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Installing surface and subsurface drains decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: IVe
Woodland ordination symbol: 4R
Pasture and hayland suitability group: Westmoreland—A-1; Guernsey—A-6

WgE2—Westmoreland-Guernsey complex, 20 to 35 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Westmoreland—back slopes; Guernsey—benches
Distinctive landscape features: Seeps
Shape of areas: Long and narrow
Size of areas: 10 to 30 acres

Typical Profile

Westmoreland

Surface layer:
0 to 5 inches—brown, friable silt loam

Subsoil:
5 to 18 inches—yellowish brown, friable silt loam and channery silt loam
18 to 26 inches—strong brown, firm channery loam and channery clay loam
26 to 36 inches—yellowish brown, firm channery clay loam

Substratum:
36 to 44 inches—yellowish brown, firm extremely channery clay loam

Bedrock:
44 to 46 inches—fractured, olive brown siltstone

Guernsey

Surface layer:
0 to 3 inches—brown, friable silt loam

Subsoil:
3 to 11 inches—yellowish brown, friable silt loam and silty clay loam
11 to 41 inches—yellowish brown, mottled, firm silty clay and silty clay loam
41 to 50 inches—variegated light olive brown and gray, mottled, firm silty clay loam

Substratum:
50 to 64 inches—variegated gray and light olive brown, firm silty clay loam

Bedrock:
64 to 70 inches—soft, grayish brown and dark reddish brown siltstone

Soil Properties and Qualities

Drainage class: Westmoreland—well drained; Guernsey—moderately well drained
Seasonal high water table: Westmoreland—at a depth of more than 6 feet; Guernsey—at a depth of 1.5 to 3.0 feet
Depth class: Westmoreland—deep; Guernsey—very deep
Root zone: Deep or very deep
Permeability: Westmoreland—moderate; Guernsey—moderately slow or slow
Available water capacity: Westmoreland—low; Guernsey—moderate
Surface runoff: Very rapid
Shrink-swell potential: Westmoreland—low; Guernsey—high

Composition

Westmoreland soil and similar inclusions: 45 percent
Guernsey soil and similar inclusions: 35 percent
Contrasting inclusions: 20 percent

Inclusions

Similar inclusions:
• Areas of moderately deep, well drained Gilpin soils on slope breaks
Contrasting inclusions:
• Areas of deep, moderately well drained Westgate soils on less sloping benches
• Areas of moderately deep Berks soils on the upper part of back slopes

Use and Management

Land use: Dominant uses—pasture and woodland

Cropland

Suitability: Generally unsuited

Major limitations or hazards: Slope, erosion

Pasture

Suitability: Poorly suited
Major management concerns: Slope, erosion, surface compaction in overgrazed areas
Suitable management practices:
• Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, erosion hazard, equipment limitation, seedling mortality
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Building roads and skidding logs on the contour help to control erosion and to overcome the equipment limitation.
• Constructing water bars and planting cover crops help to control erosion.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Planting seedlings that have been transplanted once will reduce the seedling mortality rate.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards in areas of the Westmoreland soil: Slope, depth to rock
Major limitations or hazards in areas of the Guernsey soil: Slope, wetness, shrinking and swelling, slippage, restricted permeability

Local roads and streets

Suitability: Poorly suited
Major management concerns: Westmoreland—slope; Guernsey—slope, shrinking and swelling, low strength
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.
• Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIe
Woodland ordination symbol: 4R
Pasture and hayland suitability group: A-3

WgF—Westmoreland-Guernsey complex, 35 to 70 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Westmoreland—back slopes; Guernsey—benches
Distinctive landscape features: Seeps, bedrock escarpments
Shape of areas: Long and narrow
Size of areas: 20 to 500 acres

Typical Profile

Westmoreland

Surface layer:
0 to 3 inches—dark grayish brown, friable silt loam

Subsoil:
3 to 19 inches—yellowish brown, friable and firm silt loam and silty clay loam
19 to 46 inches—yellowish brown, firm channery silty clay loam

Substratum:
46 to 50 inches—yellowish brown, firm very channery silty clay loam

Bedrock:
50 to 55 inches— fractured, olive siltstone

Guernsey

Surface layer:
0 to 3 inches—dark grayish brown, friable silt loam

Subsoil:
3 to 11 inches—brown and yellowish brown, friable and firm silt loam and channery silty clay loam
11 to 41 inches—yellowish brown, mottled, firm silty clay loam

Substratum:
41 to 50 inches—variegated yellowish brown, gray, and dark gray, firm silty clay loam

Bedrock:
50 to 56 inches—soft, grayish brown siltstone

Soil Properties and Qualities

Drainage class: Westmoreland—well drained; Guernsey—moderately well drained
Seasonal high water table: Westmoreland—at a depth of more than 6 feet; Guernsey—at a depth of 1.5 to 3.0 feet
Depth class: Deep
Root zone: Deep

Permeability: Westmoreland—moderate; Guernsey—moderately slow or slow
Available water capacity: Westmoreland—low; Guernsey—moderate
Surface runoff: Very rapid
Shrink-swell potential: Westmoreland—low; Guernsey—high

Composition

Westmoreland soil and similar inclusions: 60 percent
Guernsey soil and similar inclusions: 30 percent
Contrasting inclusions: 10 percent

Inclusions

Similar inclusions:
- Areas of soils that have more rock fragments in the surface layer and the upper part of the subsoil

Contrasting inclusions:
- Areas of moderately deep Berks soils near bedrock escarpments

Use and Management

Land use: Dominant use—woodland

Cropland and pasture

Suitability: Generally unsuited
Major limitations or hazards: Slope

Woodland

Suitability: Moderately well suited
Major management concerns: Plant competition, erosion hazard, equipment limitation, seedling mortality
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
- Contructing water bars and planting cover crops help to control erosion.
- Planting seedlings that have been transplanted once will reduce the seedling mortality rate.

Buildings and septic tank absorption fields

Suitability: Generally unsuited
Major limitations or hazards: Slope

Local roads and streets

Suitability: Poorly suited
Major management concerns: slope, shrinking and swelling, low strength
Suitable management practices:
- Adding a suitable base material decreases damage to the road surface.
- Constructing roads on the contour helps to control erosion.

Interpretive Groups

Land capability classification: VIIe
Woodland ordination symbol: 4R
Pasture and hayland suitability group: H-1

WyB—Woodsfield silt loam, 2 to 6 percent slopes

Setting

Landform: Hill slopes on uplands
Position on the landform: Ridges and benches
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 7 inches—dark grayish brown, friable silt loam

Subsoil:
7 to 17 inches—strong brown, friable silt loam and silty clay loam
17 to 47 inches—reddish brown and dark reddish brown, firm silty clay and silty clay loam

Substratum:
47 to 56 inches—variegated red, dark reddish brown, and light olive gray, firm silty clay loam

Bedrock:
56 to 60 inches—light brownish gray and yellowish brown shale

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Deep
Root zone: Deep
Permeability: Moderate in the upper part of subsoil, slow in the lower part
Available water capacity: Moderate
Surface runoff: Medium
Shrink-swell potential: High

Composition

Woodsfield soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
- Small areas of Upshur soils on low rises

Contrasting inclusions:
• Small areas of moderately well drained Westgate soils in shallow depressions
• Areas of moderately deep Gilpin soils near shoulder slopes

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Well suited
Major management concerns: Erosion, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Adding lime and fertilizer, controlling weeds, rotating pastures, and not overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, equipment limitation, windthrow hazard, seedling mortality
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Spreading roots of seedlings increases soil-root contact.
• Harvesting practices that do not leave the remaining trees widely spaced or isolated will reduce the windthrow hazard.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
• Applying gravel or crushed stone on haul roads and log landings improves soil strength.

Buildings

Suitability: Moderately well suited
Major management concerns: Shrinking and swelling
Suitable management practices:
• Installing poured, reinforced concrete foundations decreases damage to basement walls caused by shrinking and swelling.
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability
Suitable management practices:
• Installing the distribution lines in suitable fill material increases absorption of effluent.
• Enlarging the distribution area also increases absorption of effluent.

Local roads and streets

Suitability: Well suited
Major management concerns: Low strength, shrinking and swelling
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4C
Pasture and hayland suitability group: A-1

WyC2—Woodsfield silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Landscape position: Summits, shoulder slopes, and benches
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 5 inches—brown, friable silt loam

Subsoil:
5 to 17 inches—yellowish brown, friable silty clay loam
17 to 46 inches—dark red and dark reddish brown, firm silty clay

Substratum:

46 to 70 inches—variegated dark reddish brown, reddish brown, dusky red, and light olive brown, firm silty clay loam and silty clay

Bedrock:
70 to 75 inches—soft, olive brown siltstone

Soil Properties and Qualities

Drainage class: Well drained
Seasonal high water table: At a depth of more than 6 feet
Depth class: Very deep
Root zone: Deep or very deep
Permeability: Moderate in the upper part of subsoil, slow in the lower part
Available water capacity: Moderate
Surface runoff: Rapid
Shrink-swell potential: High

Composition

Woodsfield soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Similar inclusions:
• Areas of severely eroded soils that have a surface layer of silty clay loam
Contrasting inclusions:
• Areas of moderately well drained Westgate soils on the flatter part of slopes
• Areas of moderately deep Gilpin soils on shoulder slopes

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Adding lime and fertilizer, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, windthrow hazard, seedling mortality
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Spreading roots of seedlings increases soil-root contact.
• Harvesting practices that do not leave the remaining trees widely spaced or isolated will reduce the windthrow hazard.
• Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.

Buildings

Suitability: Moderately well suited
Major management concerns: Shrinking and swelling
Suitable management practices:
• Backfilling around foundations with material of low clay content decreases damage to basement walls caused by shrinking and swelling.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability
Suitable management practices:
• Installing distribution lines in suitable fill material increases absorption of effluent.
• Enlarging the distribution area also increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, shrinking and swelling
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4C
Pasture and hayland suitability group: A-1

ZnB—Zanesville silt loam, 2 to 6 percent slopes

Setting

Landform: Hill slopes on uplands
Landscape position: Summits
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 5 inches—brown, friable silt loam

Subsoil:
5 to 26 inches—yellowish brown, friable silty clay loam
26 to 34 inches—yellowish brown, mottled, firm and slightly brittle silty clay loam
34 to 48 inches—yellowish brown, mottled, firm silty clay loam

Bedrock:
48 to 54 inches—fractured, olive brown siltstone

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.0 feet
Depth class: Deep
Root zone: Moderately deep or deep
Permeability: Moderately slow or slow
Available water capacity: Moderate
Surface runoff: Medium

Composition

Zanesville soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
- Small areas of moderately deep Gilpin soils near slope breaks to lower elevations
- Areas of Westgate soils that have more clay in the lower part of the subsoil and in the substratum, on slight rises

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Cropland

Suitability: Well suited
Major management concerns: Erosion, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
- Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
- Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, frost action
Suitable management practices:
- Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
- Adding lime and fertilizer, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
- Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Plant competition, windthrow hazard.
Suitable management practices:
- Removing vines and the less desirable trees and shrubs helps to control plant competition.
- Harvesting when the surface layer is frozen or is not soft and sticky prevents deep ruts and excessive surface compaction.
- Harvesting practices that do not leave the remaining trees widely spaced reduce the windthrow hazard.

Buildings

Suitability: Moderately well suited
Major management concerns: Wetness
Suitable management practices:
- Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Wetness, restricted permeability
Suitable management practices:
- Enlarging the distribution area increases absorption of effluent.

• Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Well suited
Major management concerns: Low strength, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIe
Woodland ordination symbol: 4D
Pasture and hayland suitability group: F-3

ZnC2—Zanesville silt loam, 6 to 12 percent slopes, eroded

Setting

Landform: Hill slopes on uplands
Position on the landform: Summits and shoulder slopes
Shape of areas: Long and narrow
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 7 inches—dark yellowish brown, friable silt loam

Subsoil:
7 to 27 inches—yellowish brown, friable silty clay loam
27 to 37 inches—yellowish brown, mottled, firm and slightly brittle silty clay loam

Substratum:
37 to 57 inches—yellowish brown, firm silty clay loam

Bedrock:
57 to 59 inches—fractured, olive brown siltstone

Soil Properties and Qualities

Drainage class: Moderately well drained
Seasonal high water table: At a depth of 2.0 to 3.0 feet
Depth class: Deep
Root zone: Moderately deep or deep
Permeability: Moderately slow or slow
Available water capacity: Moderate
Surface runoff: Rapid

Composition

Zanesville soil and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Inclusions

Contrasting inclusions:
• Areas of moderately deep, well drained Gilpin soils on shoulder slopes
• Areas of Westgate soils that have more clay in the lower part of the subsoil and in the substratum, on knolls

Use and Management

Land use: Dominant uses—cropland and pasture; other use—woodland

Figure 9.—Contour stripcropping on Westmoreland-Guernsey complex, 12 to 20 percent slopes, eroded.

Cropland

Suitability: Moderately well suited
Major management concerns: Erosion, frost action
Suitable management practices:
• Maintaining surface residue with conservation tillage, stripcropping, cover crops, and grasses and legumes helps to control erosion and to conserve water.
• Tilling the soil when it is not soft and sticky prevents excessive clodding, surface compaction, and crusting.
• Seeding alfalfa with grasses decreases damage of frost heave.

Pasture

Suitability: Well suited
Major management concerns: Erosion, surface compaction in overgrazed areas
Suitable management practices:
• Maintaining surface residue with conservation tillage and companion crops helps to control erosion and to conserve water.
• Adding lime and fertilizer, controlling weeds, rotating pastures, and avoiding overstocking help to maintain stands of key forage plants.
• Restricting grazing when the soil is soft and sticky prevents excessive surface compaction.

Woodland

Suitability: Well suited
Major management concerns: Windthrow hazard, plant competition
Suitable management practices:
• Removing vines and the less desirable trees and shrubs helps to control plant competition.
• Harvesting practices that do not leave the remaining trees widely spaced will reduce the windthrow hazard.

Buildings

Suitability: Moderately well suited
Major management concerns: Dwellings with basements—wetness; dwellings without basements—slope, wetness
Suitable management practices:
• Building designs are needed that conform to the natural slope of the land.
• Installing drains below foundation level decreases wetness of the basement floor caused by a seasonal high water table.
• Maintaining plant cover wherever possible helps to control erosion.

Septic tank absorption fields

Suitability: Poorly suited
Major management concerns: Restricted permeability, wetness
Suitable management practices:
• Enlarging the distribution area increases absorption of effluent.
• Installing distribution lines on the contour decreases seepage of effluent to the surface.
• Installing drains around the distribution area decreases wetness.

Local roads and streets

Suitability: Moderately well suited
Major management concerns: Low strength, frost action
Suitable management practices:
• Adding a suitable base material decreases damage to the road surface.

Interpretive Groups

Land capability classification: IIIe
Woodland ordination symbol: 4D
Pasture and hayland suitability group: F-3

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses (fig. 10). It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 22,500 acres in the survey area, or nearly 8 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the northwestern

Figure 10.—Corn has been harvested for silage on Chaviest loam, 0 to 6 percent slopes, which is a prime farmland soil.

part and along the Muskingum river, mainly in associations 1 and 3, which are described in the section "General Soil Map Units."

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

Soils that have limitations, such as a seasonal high water table or frequent flooding during the growing season, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures. About one-third of the acreage of prime farmland in Morgan County is frequently flooded and about 1,350 acres consist of somewhat poorly drained soils that need artificial drainage.

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 in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

Scott Miller, district conservationist, Natural Resources Conservation Service, helped to prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the 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 "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

In 1982, about 37,500 acres in Morgan County, or 14 percent of the total acreage, was used as cropland and 59,000 acres, or 22 percent, was used as pastureland. Of the cropland, 4,300 acres was used for corn, 24,500 acres for hay, 600 acres for wheat, 600 acres for soybeans, and 300 acres for oats. The rest of the cropland was used for nursery crops, small fruits, and vegetables, or was abandoned.

The paragraphs that follow describe the main concerns in managing the cropland and pasture in Morgan County. These concerns are water erosion, drainage, droughtiness, fertility, and tilth.

Water erosion is the major management concern on most of the cropland and pasture in the county. It can result in the removal of the surface layer of the soil. This is the layer that over the years has received most of the residue from the native and cultivated plants that have grown on the soil.

The addition of this residue results in a higher organic matter content in the surface layer than in the rest of the soil. The organic matter is responsible for the darker color of the surface layer. Because of its higher organic matter content, the surface layer is capable of storing and

releasing more available water and plant nutrients than other layers in the soil. Thus, loss of the surface layer considerably reduces the nutrient-supplying capacity of the soil.

The subsoil of Aaron, Woodsfield, and many other soils in the county has a higher clay content than the surface layer. If the surface layer is eroded, the plow layer contains a considerable amount of the more clayey subsoil material. As a result, tillage is difficult, tilth is poor, and a seedbed cannot be easily prepared.

Erosion reduces the depth to root-restricting layers, thus reducing the volume of soil available for root development. The fragipan restricts the root zone in the Omulga and Zanesville soils. Depth to bedrock restricts the root zone in the moderately deep Gilpin soils.

Conservation measures help to control erosion and to maintain the productive capacity of the soil. Measures used to control erosion include conservation tillage, contour farming, contour stripcropping, and a cropping sequence that includes forage crops and management of crop residue.

No-till or other kinds of conservation tillage that leave crop residue on the surface help to control erosion on most soils in the county. Their effectiveness lies in reducing the amount of soil exposed to the impact of raindrops and the flow of runoff. They are suitable on both smooth and irregular slopes. On Euclid and other wet soils, a good drainage system is needed for effective conservation tillage. Contour farming, contour stripcropping, and conservation tillage further reduce the hazard of erosion.

Contour farming, or tilling across the slope, is quite effective on gently sloping soils that have a slope of 2 to 6 percent. For example, Chavies and Westgate soils, which commonly have uniform slopes, generally can be easily tilled across the slope. Woodsfield and other soils on short, irregular slopes generally cannot be uniformly tilled across the slopes.

Contour stripcropping has been used extensively in the county for many years, mainly on soils that have rather uniform slopes of 2 to 20 percent. It was used in many areas of the gently sloping to moderately steep Westgate and Lowell soils, which commonly are on smooth, uniform slopes. In recent years this practice has been replaced by continuous hay or no-till corn.

Management of crop residue and a cropping sequence that includes forage crops are equally applicable to smooth and irregular slopes. Returning crop residue to the soil helps to control erosion by reducing the impact of raindrops on the soil surface. Close-growing forage crops help to control erosion by reducing the runoff rate. The applicability of forage as an erosion-control measure depends to a large extent on the type of farming enterprise.

Grassed waterways can be established in low areas where runoff tends to collect and flow, especially if these areas are elongated. Gullies can form in such areas if water flows rapidly across a bare surface. Grassed waterways can be established in these gullies. Subsurface drains can carry off the normal flow in these areas; grassed waterways can carry off any excess surface water. Grassed waterways prevent the formation of gullies and help to prevent flooding and overwashing of crops.

Pastures are subject to erosion. Many permanent pastures are in moderately steep or steep areas where runoff is rapid or very rapid. Erosion control on pasture relies on maintaining a thick sod cover. Overgrazing, which damages this cover, increases soil loss. Applying fertilizer and lime and mowing to control weeds tends to increase the density of the stand and thus help to control erosion. Some of the pastures in Morgan County are on slopes that can be used occasionally for cultivated crops. Special care is needed to prevent excessive erosion when these slopes are cultivated. Using no-till to seed pasture permits resodding and minimizes soil loss.

The soils in Morgan County are dominantly well drained or moderately well drained. Except on small, wet, seepy areas, artificial drainage is seldom needed for crop production. By draining the wet areas, some fields are made more usable and productive. The somewhat poorly drained Newark and Euclid soils are on flood plains and low terraces. Some receive runoff from adjacent uplands, while others receive water from seeps and springs in nearby hillsides. Using diversions to intercept the runoff from hillsides allows these soils to dry faster. Surface and subsurface drains are used to remove water and allow earlier field operations.

Soil slippage is a major concern for any planned land use. On cropland and pasture, slips make fields difficult or hazardous to work with machinery. Soils that have slipped cause a broken or undulating surface and prevent mowing, planting, and harvesting. Upshur, Vandalia, Brookside, and Guernsey soils are prone to slippage. The high clay content of these soils makes them swell when wet, thus exerting tremendous horizontal or lateral pressures. This pressure and gravitational pull causes soil to slide downslope in sheets or blocky masses. The resulting unstable soil is difficult to repair and stabilize. Removing the excess water that not only swells the soil but helps to lubricate it for slippage seems to be the key to restoration. Surface and subsurface drainage can be installed above the slip to reduce ponding and intercept lateral movement of water. This technique is very difficult to accomplish and has proven to be only moderately successful. After drainage, land should be restored to an even grade that allows positive surface drainage.

Some precautions are needed when working on slip-prone soils. The land should be disturbed as little as

possible and increasing water infiltration and disturbing foot slopes should be avoided.

Droughtiness is a problem on Conotton, Gilpin, Morristown, and Westmoreland soils. These soils are high in content of coarse fragments, and do not hold an adequate reserve of available moisture. The lack of soil moisture available to plants limits crop growth on all droughty soils. Care is needed to keep a good sod, leaf litter, or plant residue on the soil to conserve moisture. Increasing organic matter on these soils also helps to increase moisture retention. When used for pasture they should not be overgrazed.

Maintaining levels of fertility that are adequate to sustain high yields of crops and pasture is a concern on all soils in the county except those on flood plains. The fertility of a soil depends upon its past use, management, and long-term fertility history. These factors differ widely from farm to farm, even on the same soil type. For this reason, differences in fertility are not considered in mapping soils. A regular program of soil testing is needed to determine the amount and kind of fertilizer needed on a given field at a given time to produce a certain crop.

While the amount and kind of fertilizer needed to build up fertility can differ widely even within soil types, the ability of the soil to store and release plant nutrients is a property of the soil itself. Soils that have a high content of clay and organic matter have a high capacity for storing and releasing plant nutrients. Soils that have less clay and organic matter have a lower capacity for storing and releasing nutrients. On eroded soils, the plow layer has a lower content of organic matter than on uneroded soils of the same series. Thus, eroded soils have a reduced capacity for storing and releasing plant nutrients.

If a large amount of fertilizer and lime is applied to steep or very porous soils, much is likely to be lost through runoff or leaching before it is held by the soil in a form that can be used by plants. For this reason, frequent, light applications of fertilizer and lime are more effective on such soils than a single large application.

Most crops commonly grown in the area require a pH value of at least 5.5 in the rooting zone for best growth. Alfalfa, however, grows best at a pH value of 6.5 or more.

The availability of phosphorus is closely dependent on pH. Much of the phosphate fertilizer applied to very acid soils combines with iron and aluminum and is not available to plants.

Earthworms are most active at pH values near neutral. Their activities, which incorporate plant residue into the soil, result in better soil structure.

The organic matter in the soil releases considerable nitrogen and phosphorus and some micronutrients as it breaks down. It improves soil structure and makes the soil easier to work. It also has a high capacity for storing and releasing plant nutrients. Additions of crop residue and barnyard manure are especially beneficial in restoring productivity to severely eroded Upshur soils.

Use and Management of Lands Surface Mined for Coal

In 1985, about 15,000 acres had been surface mined for coal. About 90 percent of this acreage was mined prior to the 1972 Ohio reclamation law, and consists mainly of graded and ungraded ridges and piles of spoils where no soil material was replaced. These soils are mapped as unreclaimed Barkcamp, Bethesda, and Morristown soils and Udorthents.

Legislation in 1972 required the restoration of all land to be mined. The land must be restored to the approximate original contour and covered with topsoil and subsoil of natural soils. This technique has been used in reclaiming Morristown silty clay loam, 6 to 20 percent slopes, and other soils (fig. 11). About 2,540 acres of reclaimed surface mined soils are in Morgan County. Even though these soils have greater potential for agricultural production than unreclaimed mined land, their limitations must be overcome with good management practices.

The current law requires soils identified as Prime Farmland soils to be replaced in natural sequence of soil layers to a depth of as much as 48 inches following mining. Most soils in areas of surface mining 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 mined soils than in natural soils.

High bulk densities are common in both the replaced soil material and in the underlying graded spoil of mined soils. This compaction is caused by (1) heavy machinery, especially wheeled type vehicles used in reclamation, (2) excessive handling of topsoil material during stockpiling and spreading, (3) performing mining and reclamation activities during unfavorable moisture conditions, and (4) insufficient time for soil-forming processes to decrease the bulk density. The high bulk density reduces plant growth resulting in a reduction in crop yields.

Mine soils typically consist of 35 to 60 percent rock fragments compared to 0 to 15 percent rock fragments in the surface layer of most soils. Rock fragments and high bulk density reduce the effective root zone and the available water capacity of mine soils. Roots tend to concentrate along soil-rock fragment interfaces, and few roots penetrate the underlying compact, massive spoil material.

Adapted forages should be used to increase the organic matter content, improve soil structure, reduce soil compaction, and increase water infiltration, pore space, and root growth in mine soils. Forage crops are better for

soil building than row crops and are more effective in reducing runoff and erosion. Reseeding should be done when stands are thin. Reseeding with companion crops or by the no-till or trash mulch seeding method helps to control erosion. Mine soils are generally unsuited to winter grazing when the soils are wet because of soil compaction, damage to plants, and the erosion hazard. Frequent, light applications of fertilizer are better suited to these soils than larger applications because of loss of plant nutrients through runoff and the concentration of roots in the upper few inches of the soil.

Yields per Acre

Jim Rex, county executive director, Agricultural Stabilization and Conservation Service, and Scott R. Miller, district conservationist, Natural Resources Conservation Service, helped to prepare this section.

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 of each map unit 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 pasture and hayland, woodland, and engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (*10*). Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

Figure 11.—Hayland on Morristown silty clay loam, 6 to 20 percent slopes. These are reclaimed soils from surface mining for coal.

only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Pasture and Hayland Management

About 22 percent of Morgan County is used for pastureland. Much of the cropland is farmed using a rotation that includes hayland as part of the crop sequence. Some areas of potential pasture and hayland are idle and reverting to brush and young tree growth.

Most of the pasture and hayland acreage is on hillsides. These areas are subject to erosion. The most common pasture grass is bluegrass. Alfalfa is the most common legume grown for hay.

Some pastures and meadows have been overgrazed. The result of this abuse and neglect is weedy, low-producing forage and an increased hazard of erosion. The soils in these fields commonly are acid and have low levels of phosphorus and potassium. Good management can, in time, restore these soils to much higher productivity. A system of controlled grazing is needed in maintaining a stand of legumes in the forage mixture of a pasture.

Forage crops can be successfully established contingent on selection of quality seed of adapted species. Reseeding requires proper seedbed preparation, proper seeding methods at the correct time, and the use of recommended applications of lime and fertilizer.

Forage renovation requires that the existing grass and weeds be killed or suppressed before reseeding the desired species. Killing the existing sod and leaving it on or near the surface as a dead mulch helps to control erosion. Nearly level and gently sloping pasture can be plowed. Vegetation on strongly sloping and moderately

steep soils should be killed or suppressed. Tillage and seeding on the contour is required whenever possible. A herbicide can be used with the trash mulch method in reducing the amount of tillage needed to kill existing vegetation.

No-till is effective on most soils in Morgan County except poorly drained soils. However, vegetation should be suppressed or killed by grazing or herbicides.

March and April or August are usually the best times to seed forages. Forages can be seeded with a small grain, which frequently results in reduced stands because of plant competition for light, moisture, and nutrients.

Seeding mixtures based on soil type and the desired pasture management system are needed. Legumes increase the nutrient value of the forage and provide nitrogen for grass growth. Alfalfa and red clover should be seeded on soils with good drainage. Ladino and alsike clovers are better adapted to wetter soils. Birdsfoot trefoil, bromegrass, lespedeza, warm-season grasses, and vetches are generally not grown as forages in Morgan County.

Application of lime and fertilizer according to soil tests will insure good productivity and lengthen the life of the stand. Mowing, clipping, and spraying to control weeds is important for continued high production. Weeds should be mowed before going to seed. Control of insects, such as alfalfa weevil and leaf hopper, may be necessary. In pesticide use, observe all label restrictions.

Harvesting hay, silage, or pasture is needed at the proper stage of maturity to obtain the maximum quality feed for animals. Refer to the current Agronomy Guide for proper management of forage species (*7*).

Rotational grazing of pastures is necessary to maintain stands of productive forage species, especially alfalfa, and to control grazing. Rotational grazing results in improved growth and optimum use by reducing selective grazing, animal trampling, and waste.

Suitability for Pasture and Hayland

Pasture and hayland suitability groups can be used by farmers, farm managers, conservationists, and extension agents in planning the use of the soil for pasture and hay crops. Soils on slopes of more than 20 percent generally are not recommended for hayland. Soils on slopes of more that 35 percent generally are not recommended for pasture.

The pasture and hayland suitability group symbol for each soil is given in the section "Detailed Soil Map Units" and in the listing of "Interpretive Groups" following the tables. Soils assigned the same suitability group symbol require the same general management and have about the same potential productivity. The pasture and hayland suitability groups organize the soils by soil characteristics and limitations. Only the soil characteristics and limitations found in Morgan County are listed in the suitability groups discussions.

Group A soils have few limitations for the management and growth of climatically adapted plants. Group A-1 consists of deep and very deep, well drained or moderately well drained soils. The surface layer is silt loam, loam, or silty clay loam. Available water capacity ranges from low to high. Some of these soils are droughty. These soils will respond favorably to additions of lime. For Brookside soils, however, frequent applications may be needed to maintain an adequate pH level. The low pH of the subsoil will shorten the life of some deep-rooted legumes in a stand. Slope ranges, on average, from 2 to 20 percent.

Group A-3 consists of deep and very deep, well drained or moderately well drained soils. The surface layer is silt loam, loam, or silty clay loam. Available water capacity ranges from low to high. Average slopes range from 20 to 35 percent. This group generally is not recommended for hayland. On pasture, slope interferes with mechanical application of lime and fertilizer and with clipping, mowing, or spraying for weed control. Slope increases the risk of erosion if the pasture is overgrazed.

Group A-5 consists of very deep, well drained or moderately well drained soils on flood plains. These soils are subject to frequent or occasional flooding. Flooding limits these soils for pasture during periods of stream overflow and sediment lowers the quality of forage. The surface layer is silt loam. Available water capacity is high. Slopes, on average, are 0 to 3 percent.

Group A-6 consist of deep and very deep, well drained or moderately well drained soils that are subject to frost action. The surface layer is silt loam. Available water capacity is moderate or high. Frost action may damage legumes. Including grasses in a seeding mixture will help to protect the legumes from frost heave. Slopes range, on average, from 0 to 20 percent. In Group B soils droughtiness limits growth and production. Group B-1 consists of very deep, well drained soils. The surface layer is gravelly loam. Available water capacity is low. These soils are droughty. These soils will respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. The low pH of the subsoil will shorten the life of some deep-rooted legumes in a stand. The subsoil of B-1 soils is very gravelly or extremely gravelly. Slopes range, on average, from 0 to 12 percent.

Group B-4 consists of very deep, well drained, reclaimed soils that were surface mined for coal. The surface layer is silty clay loam. Available water capacity is low. These soils are droughty. These soils will respond favorably to additions of lime. The substratum of these

soils contains a high percentage of coarse fragments. The root zone generally is 20 to 30 inches. Slope ranges, on average, from 0 to 20 percent.

Group C consists of soils that are normally wet from a high seasonal water table or of soils that are saturated during the growing season. Group C-2 consists of very deep, somewhat poorly drained soils on benches. The surface layer is silty clay loam. Available water capacity is high. A high seasonal water table limits the rooting depth of deep-rooted forage plants. Shallow-rooted species grow well on these soils. Subsurface drains are seldom used to lower the seasonal high water table. Effectiveness of subsurface drainage is generally limited by the permeability and slippage of the subsoil. Slopes range, on average, from 8 to 15 percent.

Group C-3 consists of very deep, somewhat poorly drained soils on low terraces and flood plains. They are subject to frequent or rare flooding. Flooding limits these soils for pasture during periods of stream overflow and sediment lowers the quality of the forage. The surface layer is silt loam. Available water capacity is high. Frost action may damage legumes. Including grasses in a seeding mixture will help protect the legumes from frost heave. A seasonal high water table limits the rooting depth of deep-rooted forage plants. Shallow-rooted species grow well on these soils. Subsurface drains are used to lower the seasonal high water table. Effectiveness of subsurface drainage is limited by landscape position of the soil. Slopes, on average, are 0 to 3 percent.

Group E soils consists of very deep, well drained soils that restrict root growth to less than 20 inches. The substratum of these soils contain a high percentage of coarse fragments. These soils will respond better to forages with a fibrous root system rather than to deep-rooted species because of the shallow root zone. Group E-2 consists of very deep, well drained, reclaimed soils that were surface mined for coal. The surface layer is silty clay loam. Available water capacity is low. These soils are droughty. The soils in this group generally are not recommended for hayland. On pasture, the slope of these soils will interfere with mechanical application of lime and fertilizer and with clipping, mowing, or spraying for weed control. Slope will increase the risk of erosion if overgrazed. Slopes range, on average, from 20 to 35 percent.

Group E-3 consists of very deep, well drained, unreclaimed soils that were surface mined for coal. The surface texture is very channery clay loam. Available water capacity is low. These soils are droughty. Slopes range, on average, from 0 to 20 percent.

Group F consist of soils where restricted root growth of climatically adapted plants is less than 40 inches but more than 20 inches. These soils will respond better to forages that do not have a tap root because of the moderately deep root zone. Group F-1 consists of moderately deep, well drained soils. The surface texture is silt loam. Available water capacity is low. These soils are droughty. They will respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. The low pH of the subsoil will shorten the life of some deep-rooted legumes in a stand. Slopes range, on average, from 6 to 20 percent.

Group F-2 consists of moderately deep, well drained soils. The surface layer is silt loam. Available water capacity is low. These soils are droughty. They will respond favorably to additions of lime where practical. Frequent applications may be needed to maintain an adequate pH level. The low pH of the subsoil will shorten the life of some deep-rooted legumes. This group generally is not recommended for hayland. For pasture, slope interferes with mechanical applications of lime and fertilizer and with clipping, mowing, or spraying for weed control. Slope will increase the risk of erosion if overgrazed. Slopes range, on average, from 20 to 35 percent.

Group F-3 consists of deep and very deep, moderately well drained soils that are moderately deep to a slightly brittle layer. These soils will respond favorably to additions of lime. Frequent applications may be needed to maintain an adequate pH level. The low pH of the subsoil will shorten the life of some deep-rooted legumes in a stand. The surface layer is silt loam. Available water capacity is moderate. Slopes range, on average, from 2 to 12 percent.

Group F-5 consists of deep and very deep, well drained soils that have a high clay content. The surface layer is silty clay loam. Available water capacity is moderate. These soils will respond to additions of lime. Except Upshur soils on 6 to 12 percent slopes and Markland soils, the low pH of the subsoil will shorten the life of some legumes. Slopes range, on average, from 6 to 20 percent.

Group F-6 consists of deep, well drained soils that have a high clay content. The surface layer is silt loam or silty clay loam. Available water capacity is low or moderate. These soils will respond to additions of lime. Except Elba soils, the low pH of the subsoil will shorten the life of some deep-rooted legumes in a stand. This group generally is not recommended for hayland. For pasture, slope interferes with mechanical application of lime and fertilizer and with clipping, mowing, or spraying for weed control. Slope increases the hazard of erosion if overgrazed. Slopes range, on average, from 20 to 35 percent.

Group H consists of soils that are not adapted to forage species. Group H-1 consists of soils on slopes of more than 40 percent. Also included is surface mined land whose soil characteristics prohibit use as pasture. This

group generally is not recommended for pasture or hayland.

Miscellaneous land types are not assigned a rating. Also not assigned a rating are ponded soils. These soils generally are not used for forage production.

Woodland Management and Productivity

Dave Berna, woodland conservationist, Natural Resources Conservation Service, and Peter Suerkin, service forester, Ohio Department of Natural Resources, Division of Forestry, helped to prepare this section.

Woodland is an important land use in Morgan County. In 1982, about 129,600 acres, or nearly 49 percent of the county, was wooded. The wooded acreage consists mainly of privately owned stands of timber and farm woodlots (fig. 12). The Forest Service owns 3,234 acres, part of the Wayne National Forest, in the western part of the county. The most extensive wooded areas are in the Westmoreland-Guernsey and Morristown-Lowell-Gilpin associations, which are dominantly in the western and northeast parts of the county.

Woodland consists mainly of mixed hardwoods. The dominant woodland species are oak, yellow-poplar, black cherry, red maple, sugar maple, ash, and beech. Most of the wooded acreage is in areas of steep and very steep soils that formed in residuum and colluvium derived from sandstone, siltstone, limestone, and shale bedrock. Guernsey, Westmoreland, Morristown, Lowell, and Gilpin soils are the dominant soils. Many of the narrow ridgetops and flood plains also are wooded. Woodland is not a dominant land use, however, on the wider ridgetops and flood plains; these areas are better suited to farming. The wooded acreage has increased in recent years, particularly in the steeper areas. Many abandoned areas have been planted to trees, mainly eastern white pine. Black locust trees have been planted on a large acreage that has been surface mined for coal and not reclaimed.

In places woodland shows the result of abuse and neglect. Heavy cutting without planning for future timber production has resulted in understocked stands of trees near maturity. High grading has continually removed the best trees and left diseased or damaged trees, which take up valuable growing space on soils that are excellent woodland sites. Low-value white elm and hollow beech and poorly formed black cherry and red maple now cover thousands of acres where yellow-poplar, oak, black walnut, and sugar maple were once prevalent. Grazing has resulted in damaged or destroyed leaf litter and desirable seedlings, damaged roots, and surface compaction. In most wooded areas grapevines have not been controlled. Good management can restore this woodland to a higher level of production. Additional information about 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 as woodland. The factors that influence growth of trees are about the same as those for production of annual crops and forage.

The major difference is that tree roots extend deeper into the soil, especially around rock fragments in the lower part of the soil. The direction of exposure, or aspect, and the position of the soil on the landscape are also important. Other important properties are slope, past erosion, acidity, and fertility level.

Aspect is the direction in which a slope faces. Trees grow better on north and east aspects because of less exposure to the prevailing wind and the sun and because soil moisture is more abundant. South and west aspects are less suitable for woodland because of a higher soil temperature resulting from more direct sunrays, high evaporation by the prevailing wind, an earlier snowmelt, and a greater degree of freezing and thawing.

The position of the soil on the landscape is important in determining the moisture supply for the growth of trees. The supply of soil moisture increases as elevation decreases, partly because of downslope seepage. Also, the soils on the lower part of slopes are generally deeper than those on the upper part, lose less moisture through evaporation, and have a somewhat lower temperature.

Slope is an important factor in woodland management. Steep and very steep slopes seriously limit the use of equipment. As slope increases, the rate of water infiltration decreases and the rate of runoff and the hazard of erosion increases.

Erosion reduces the volume of soil available for water storage. Severe erosion removes the surface layer and exposes the subsoil. Because the subsoil is commonly less porous, the runoff rate increases and the rate of water intake decreases. Both tree growth and natural reseeding are adversely affected.

Soil reaction and fertility influence the growth of trees. For example, black walnut grows better on Elba and Nolin soils than on other soils. The natural content of lime in the subsoil of these soils favors the growth of this species. The growth rate is slower on soils that are low in fertility.

Christmas trees have been grown in a few areas of the county. They can grow well on many of the soils but are adversely affected by various soil properties. Drainage and texture affect the species that can be successfully grown. For example, blue spruce and frazier fir do not grow well on the somewhat poorly drained Euclid, Claysville, and Newark soils. Frazier fir does not grow well on Lowell and Upshur soils, which have a fine textured subsoil. Other factors are fertility, available water capacity, potential for frost action, and depth to bedrock. Wellston and Westmoreland soils are better suited to spruce and fir

than Berks and Steinsburg soils because they have a higher available water capacity, are deeper to bedrock, and are more fertile. Spruce and fir are also susceptible to frost damage. Frost damage is most likely in narrow, steep-sided valleys.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol,* a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce in a pure stand under natural conditions. The number 1 indicates low potential productivity; 2 or 3, moderate; 4 or 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*, excess 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*, a high content of rock fragments in the soil; and *L*, low strength. 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 L.

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.

Figure 12.—Natural reforestation on Westmoreland-Guernsey complex, 12 to 20 percent slopes, eroded.

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 suitable for commercial wood production.

The equipment commonly used in forest management is subject to many soil-related conditions. Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Four forestry activities have been identified for special interpretations; haul roads, log landings, logging areas and skid trails, and site preparation and planting.

Haul roads are access roads leading from log landings to primary or surfaced roads. Generally, these are unpaved roads and not graveled. The intent of this rating is to indicate the degree and kind of limitation for location of haul roads.

Log landing refers to areas where logs are assembled for transportation. Areas that require little or no surface preparation or cutting or filling are desired. Considerable soil compaction in these areas can be expected. The intent of this rating is to indicate the degree and kind of limitation for location of log landings.

Logging areas and skid trails refer to areas that are being partially or completely logged. It includes the logging operations from stump to log landings areas with rubber-tired equipment. Other log-moving equipment sometimes used will reduce or overcome the site limitations.

Site preparation and planting are the mechanized operations for site preparation, planting, row seeding, or all three. The ratings are based on both limitations to efficient equipment operation and hazards to the site from operation of the equipment. It is assumed that operating techniques are used that do not displace or remove topsoil from the site or create channels to concentrate storm runoff.

There are three ratings used to describe the degree and kind of limitation for the four forestry activities listed; slight, moderate, and severe. A "slight" rating implies that there are no serious limitations on use. A "moderate" rating means that there are some limitations that can be overcome with proper management or construction techniques. A "severe" rating implies that there are limitations that require special or expensive techniques or both to overcome. Also listed for "moderate" and "severe" ratings are the factors causing the limitation.

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 evergreen shrubs and 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 the local offices of the Natural Resources Conservation Service or the Ohio State University Extension, a commercial nursery, or the Ohio Department of Natural Resources, Division of Forestry.

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 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

Jeff Hetrict, wildlife biologist, and Tim Varga, wildlife biologist, Division of Wildlife, Ohio Department of Natural Resources, helped to prepare this section.

Wildlife is an important natural resource in Morgan County. The major wildlife species are deer, wild turkey, canada geese, fox, squirrel, rabbit, raccoon, beaver, muskrat, grouse, and wood duck. A limited number of quail and mallard nesting areas are located in the county.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover (fig. 13). They also affect the construction of water impoundments. The kind and abundance of wildlife depends largely on the amount and distribution of food, cover, and water and on the diversity of land use. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, by promoting the natural establishment of desirable plants, and by providing an adequate water supply.

Wildlife management could be improved on most soils in the county. About 11,376 acres of unreclaimed coal surface mined land classified as Bethesda and Morristown soils is used primarily for wildlife habitat. Habitat improvement on these soils is a major management concern. These soils are droughty, have poor tilth, contain many rock fragments, and have a limited zone favorable for root development. Wildlife habitat has been improved in the last 30 years by nature and man through seeding of a wide variety of plants. The wildlife plants that grow best on these soils are black locust, black alder, red pine, red maple, sweetgum, Tatarian honeysuckle, and autumn-olive. About 2,539 acres of reclaimed land surface mined for coal and classified as Morristown reclaimed soils are managed with open water areas as nesting areas for Canada geese.

In many areas of woodland, better management for wildlife is needed. The soils play an important part in determining which species grow best on a specific site. A good example is black walnut, which grows best in very deep, well drained soils, such as Chagrin and Nolin soils.

Establishing farm ponds for ducks, muskrat, raccoon,

and other species is a common conservation practice. But wildlife will underuse ponds unless vegetation protects them from predators. The suitability for ponds is site specific. Guernsey and Lowell soils are good sites for ponds. Many areas of wet soils, such as Melvin, ponded, soils, are undrained. If well managed, they can be developed into excellent habitat for wood duck, raccoon, and other species. Some woody plants that tolerate wet conditions and are beneficial to wildlife are pin oak, black alder, silky and gray dogwood, and elderberry.

Additional information or assistance on improving wildlife habitat can be obtained from the Ohio Department of Natural Resources, Division of Wildlife; the Cooperative Extension Service; or the Natural Resources Conservation Service.

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, orchard grass, bromegrass, clover, and alfalfa.

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

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

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

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, duckweed, reed canary grass, 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

Figure 13.—Melvin silt loam, ponded, is well suited to habitat for wetland wildlife.

marshes, waterfowl feeding areas, shallow ponds, and unreclaimed pits from surface mining for coal.

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, ground hog, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous or coniferous trees 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 and red fox, raccoon, deer, coyote, and bear.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

Engineering

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

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

may be included within the mapped areas of a specific soil.

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

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

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

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

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

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

Building Site Development

Table 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 not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and 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, and shrink-swell potential can cause the movement of footings (fig. 14). 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. Some of the moderately steep, steep, and very steep soils in the county are subject to hillside slippage, which can damage buildings.

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, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 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.

Figure 14.—A poured, reinforced concrete basement wall designed to counter subsoil pressure exerted by high shrinking and swelling. The soil is Elba silty clay loam, 20 to 35 percent slopes, eroded.

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, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 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 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 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 or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 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, or organic matter. 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 and permeability of the aquifer. 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; 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. 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 wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 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. 15). "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 10 inches in diameter and 3 to 10 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 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

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; *high*, more than 6 percent; and *very high*, greater than 9 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.64. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that

can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In 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 based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a 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 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, and water standing in swamps and marshes is considered ponding rather than flooding.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

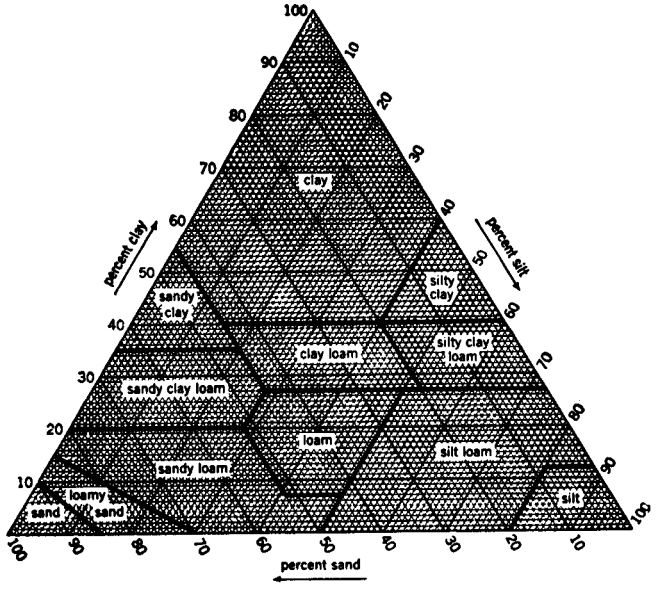

Figure 15.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. 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 observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched, apparent, or artesian; 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. Only saturated zones within a depth of about 6 feet are indicated.

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. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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 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

Many of the soils in Morgan County were sampled by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in classifying and correlating the soils and in evaluating their behavior under various land uses. Three pedons were selected as representative of their respective series and are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Chavies series (MO-14), Claysville series (MO-15), and Woodsfield series (MO-13).

In addition to the data from Morgan County, laboratory data are also available from nearby counties that have many of the same soils. These data and the data from Morgan County 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.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 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; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *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, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (*14*). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (*11*) and in "Keys to Soil Taxonomy" (*13*). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Aaron Series

Depth class: Deep
Drainage class: Moderately well drained
Permeability: Slow
Parent material: Residuum derived from interbedded limestone, calcareous siltstone, and shale
Landform: Upland hillslopes
Slope: 6 to 12 percent
Adjacent soils: Gilpin, Westgate, and Westmoreland
Taxonomic class: Fine, mixed, mesic Aquic Hapludalfs

Typical Pedon

Aaron silt loam, 6 to 12 percent slopes, eroded, about 1.3 miles north of Centerville, in Center Township, 1,160 feet

west and 80 feet south of the northeast corner of sec. 3 T. 6 N., R. 10 W.:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; common fine and few medium roots; specks of (10YR 5/6) Bt material included; strongly acid; clear smooth boundary.

Bt1—9 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; strongly acid; clear smooth boundary.

Bt2—16 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; moderate coarse and medium subangular blocky structure; firm; few fine roots; many distinct brown (7.5YR 4/4) clay films on faces of peds; few distinct black (N 2/0) stains of iron oxide and manganese oxide; strongly acid; gradual wavy boundary.

Bt3—23 to 29 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; common distinct light brownish gray (10YR 6/2) and few faint brown (7.5YR 4/4) clay films on faces of peds; few faint black (N 2/0) stains of iron oxide and manganese oxide; common soft weathered shale fragments; strongly acid; diffuse wavy boundary.

Bt4—29 to 39 inches; light olive brown (2.5Y 5/4) silty clay loam; many medium faint grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; common faint grayish brown (10YR 5/2) clay films on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; common soft weathered shale fragments; strongly acid; gradual wavy boundary.

BC—39 to 45 inches; olive brown (2.5Y 4/4) silty clay loam; common fine faint gray (10YR 5/1) mottles; weak coarse and medium subangular blocky structure; firm; few fine roots; few faint grayish brown (10YR 5/2) and common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; many soft weathered shale fragments; slightly acid; clear smooth boundary.

Cr—45 to 50 inches; calcareous olive brown (2.5Y 4/4) shale bedrock.

Range in Characteristics

Thickness of the solum: 30 to 50 inches
Depth to bedrock: 40 to 60 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bt horizon—0 to 10 percent

Ap horizon:
Color—hue of 10YR, value of 4, and chroma of 3
Texture—typically silt loam, but silty clay loam in some pedons

Bt horizon:
Color—hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4 to 6
Texture—silty clay loam or silty clay

Barkcamp Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid and rapid
Parent material: Mixed, partly weathered, ultra acid loamy fine earth material and fragments of medium and coarse grained sandstone from surface coal mining
Landform: Surface mined uplands
Slope: 20 to 70 percent
Adjacent soils: Bethesda, Gilpin, Lowell
Taxonomic class: Loamy-skeletal, siliceous, acid, mesic Typic Udorthents

Typical Pedon

Barkcamp channery sandy loam, 20 to 70 percent slopes, about 1.25 miles north of Wrightstown, in Homer Township, about 1,450 feet east and 925 feet south of the northwest corner of fractional sec. 2, T. 7 N., R. 13 W.:

A—0 to 1 inches; light yellowish brown (10YR 6/4) channery sandy loam; weak fine and medium granular structure; friable; 20 percent sandstone fragments; ultra acid; abrupt smooth boundary.

C1—1 to 12 inches; olive brown (2.5Y 4/4) (80 percent) and light gray (10YR 6/1) (20 percent) very channery sandy loam; massive; friable; common soft shale fragments; 40 percent siltstone and shale fragments; ultra acid; clear wavy boundary.

C2—12 to 80 inches; yellowish brown (10YR 5/6) (80 percent) and light brownish gray (2.5Y 6/2) (20 percent) very channery loam; massive; firm; many soft shale fragments; 40 percent sandstone and shale fragments; ultra acid.

Range in Characteristics

Depth to bedrock: More than 60 inches
Content of rock fragments: A horizon—15 to 50 percent; C horizon—35 to 75 percent

A horizon:
Color—hue of 10YR to 2.5Y, value of 5 or 6, and chroma of 1 to 8

Texture—typically, channery loam, but channery sand loam, very channery sandy loam, or very channery loam in some pedons

C horizon:
Color—hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 8
Texture—very channery sandy loam, extremely channery sandy loam, very channery loam, or extremely channery loam

Berks Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate and moderately rapid
Parent material: Interbedded shale, siltstone, and sandstone
Landform: Hillslopes on uplands
Slope: 35 to 70 percent
Adjacent soils: Gilpin, Guernsey, Lowell, and Westmoreland
Taxonomic class: Loamy-skeletal, mixed, mesic Typic Dystrochrepts

Typical Pedon

Berks channery silt loam, in an area of Berks-Westmoreland complex, 35 to 70 percent slopes, about 4.3 miles northwest of Eaglesport, in York Township, 1,300 feet west and 1,850 feet south of the northeast corner of sec. 20 T. 10 N., R. 13 W.:

A—0 to 3 inches; brown (10YR 4/3) channery silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many fine roots; 15 percent siltstone fragments; very strongly acid; clear smooth boundary.
Bw1—3 to 7 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; 50 percent siltstone fragments; strongly acid; clear smooth boundary.
Bw2—7 to 19 inches; yellowish brown (10YR 5/4) extremely channery silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; few faint dark yellowish brown (10YR 4/4) clay films on siltstone fragments; few distinct black (N 2/0) stains of iron oxide and manganese oxide on siltstone fragments; 75 percent siltstone fragments; strongly acid; gradual wavy boundary.
C—19 to 23 inches; yellowish brown (10YR 5/4) extremely channery silt loam; massive; friable; few fine and medium roots; few distinct black (N 2/0) stains of iron oxide and manganese oxide on siltstone fragments; 90 percent siltstone fragments; strongly acid; abrupt smooth boundary.
Cr—23 to 25 inches; fractured light olive brown (2.5Y 5/4) siltstone bedrock.

Range in Characteristics

Thickness of the solum: 12 to 30 inches
Depth to bedrock: 20 to 40 inches
Content of rock fragments: A horizon—10 to 35 percent; Bw horizon—25 to 75 percent; C horizon—50 to 90 percent

A horizon:
Color—hue of 10YR, value of 3 to 5, and chroma of 2 to 4
Texture—typically, channery silt loam but is silt loam in some pedons

Bw horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 4 to 6
Texture—channery silt loam, very channery silt loam, or extremely channery silt loam

C horizon:
Color—hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 4 to 6
Texture—very channery silt loam, extremely channery silt loam, very channery loam, or extremely channery loam

Bethesda Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Parent material: A mixture of partly weathered acid, loamy, fine earth material, and fragments of shale, siltstone, and sandstone from surface coal mining
Landform: Surface mined uplands
Slope: 20 to 70 percent
Adjacent soils: Barkcamp, Gilpin, and Lowell
Taxonomic class: Loamy-skeletal, mixed, acid, mesic Typic Udorthents

Typical Pedon

Bethesda channery loam, 20 to 70 percent slopes, about 1.25 miles north of Wrightstown, in Homer Township, about 1,720 feet south and 1,060 feet east of the northwest corner of fractional sec. 2, T. 7 N., R. 13 W.:

Oi—1 to 0 inches; mixed, deciduous leaf litter
A—0 to 2 inches; brown (10YR 4/3) (75 percent) and yellowish brown (10YR 5/6) (25 percent) channery loam; weak medium granular structure; friable;

common fine roots; 20 percent shale fragments; very strongly acid; abrupt smooth boundary.

C1—2 to 9 inches; variegated yellowish brown (10YR 5/6), gray (10YR 5/1), and pale olive (5Y 6/3) very channery clay loam; weak coarse subangular blocky structure; firm; few fine roots; 45 percent siltstone, sandstone, and coal fragments; extremely acid; clear smooth boundary.

C2—9 to 20 inches; variegated yellowish brown (10YR 5/4) and gray (10YR 5/1) very channery clay loam; massive; firm; few fine roots; 35 percent siltstone, sandstone, and coal fragments; extremely acid; gradual wavy boundary.

C3—20 to 80 inches; variegated yellowish brown (10YR 5/6), dark grayish brown (2.5Y 4/2), and gray (10YR 5/1) very channery clay loam; massive; firm; 45 percent siltstone, sandstone, and coal fragments; extremely acid.

Range in Characteristics

Depth to bedrock: More than 60 inches

Content of rock fragments: A horizon—20 to 45 percent; C horizon—35 to 80 percent

A horizon:

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 0 to 8

Texture—typically, channery loam, but very channery loam, channery clay loam, very channery clay loam, channery silty clay loam, or very channery silty clay loam in some pedons

C horizon:

Color—hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 0 to 8

Texture—very channery clay loam, extremely channery clay loam, very channery silty clay loam, or extremely channery silty clay loam

Brookside Series

Depth class: Very deep

Drainage class: Moderately well drained

Permeability: Moderately slow

Parent material: Clayey colluvium from calcareous shale, limestone, siltstone, and sandstone

Landform: Hillslopes on uplands

Slope: 12 to 35 percent

Adjacent soils: Gilpin, Guernsey, Lowell, Vandalia, and Westmoreland

Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Brookside silty clay loam, 20 to 35 percent slopes, about 0.83 mile northeast of Durant, in Bloom Township, about 2,510 feet east and 1,780 feet south of northwest corner of sec. 5, T. 10 N., R. 12 W.:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam; light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; common medium and few fine roots; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; 10 percent sandstone fragments; neutral; clear smooth boundary.

BA—10 to 15 inches; mixed dark yellowish brown (10YR 4/4) (60 percent) and dark grayish brown (10YR 4/2) (40 percent) silty clay loam; moderate fine and medium subangular blocky structure; firm; few fine roots; 10 percent sandstone and siltstone fragments; neutral; gradual wavy boundary.

Bt1—15 to 25 inches; dark yellowish brown (10YR 4/4) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; 20 percent sandstone and siltstone fragments; neutral; gradual wavy boundary.

Bt2—25 to 35 inches; yellowish brown (10YR 5/4) channery silty clay loam; common medium distinct gray (10YR 5/1) and common fine faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common faint black (N 2/0) soft accumulations of iron oxide and manganese oxide; 25 percent sandstone and siltstone fragments; neutral; gradual wavy boundary.

Bt3—35 to 54 inches; yellowish brown (10YR 5/4) channery silty clay loam; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few fine roots; common faint brown (10YR 4/3) clay films on faces of peds; common faint black (N 2/0) soft accumulations of iron oxide and manganese oxide; 25 percent sandstone and siltstone fragments; slightly acid; gradual wavy boundary.

BC—54 to 66 inches; yellowish brown (10YR 5/4) channery silty clay loam; common medium distinct grayish brown (10YR 5/2) and brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; common faint brown (10YR 4/3) clay films on faces of peds; few faint iron stains; 25 percent sandstone, siltstone, and shale fragments; slightly acid; gradual wavy boundary.

C—66 to 80 inches; yellowish brown (10YR 5/4) channery silty clay loam; common medium distinct grayish brown (10YR 5/2) and common fine faint yellowish brown (10YR 5/6) mottles; massive; firm; few faint iron

stains; 25 percent sandstone, siltstone, and shale fragments; slightly acid.

Range in Characteristics

Thickness of the solum: 40 to 80 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Ap horizon—5 to 15 percent; Bt horizon—10 to 25 percent; C horizon—10 to 35 percent

Ap horizon:
Color—hue of 10YR or 7.5YR, value of 3 to 5 (6 dry), and chroma of 2 to 4
Texture—silty clay loam, silt loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam, silty clay, clay loam, channery silty clay loam, or channery clay loam

C horizon:
Color—hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6
Texture—silty clay loam, silty clay, clay loam, channery silty clay loam, or channery clay loam

Chagrin Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Parent material: Recent alluvium
Landform: Flood plains
Slope: 0 to 3 percent
Adjacent soils: Gilpin, Licking, Upshur, and Vandalia
Taxonomic class: Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts

Typical Pedon

Chagrin silt loam, frequently flooded, about 1.1 mile east of Brokaw, in Windsor Township, about 2,640 feet north of the intersection of County road 45 and an unnumbered road, then 1,450 feet west:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many fine and common medium roots; medium acid; clear smooth boundary.
Bw1—6 to 13 inches; brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common fine and few medium roots; medium acid; clear smooth boundary.
Bw2—13 to 27 inches; brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; common faint iron stains; medium acid; clear smooth boundary.
Bw3—27 to 36 inches; dark yellowish brown (10YR 4/4) loam; weak coarse subangular blocky structure; friable; few fine roots; many distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; medium acid; gradual smooth boundary.
C1—36 to 76 inches; brown (10YR 4/3) loam with strata of fine sandy loam; massive; friable; few fine roots; few faint dark grayish brown (10YR 4/2) organic coatings on faces of peds; medium acid; clear wavy boundary.
C2—76 to 80 inches; dark yellowish brown (10YR 4/4) fine sandy loam; massive; friable; slightly acid.

Range in Characteristics

Thickness of the solum: 30 to 48 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Ap horizon—0 to 10 percent; Bw horizon—0 to 15 percent; C horizon—0 to 15 percent

Ap horizon:
Color—hue of 10YR, value of 4, and chroma of 2 to 4
Texture—silt loam

Bw horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silt loam and loam

C horizon:
Color—hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6
Texture—silt loam or loam; strata of fine sandy loam occurs below a depth of 40 inches

Chavies Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Parent material: Mixed alluvium
Landform: Terraces
Slope: 0 to 6 percent
Adjacent soils: Brookside, Conotton, and Nolin
Taxonomic class: Coarse-loamy, mixed, mesic Ultic Hapludalfs

Typical Pedon

Chavies loam, 0 to 6 percent slopes, about 0.2 mile south of Rokeby Lock, in Bloom Township, about 2,110 feet west and 1,710 feet south of the northeast corner of sec. 17 T. 11 N., R. 12 W.:

Ap—0 to 10 inches; brown (10YR 4/3) loam; pale brown

(10YR 6/3) dry; moderate fine and medium granular structure; friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

BA—10 to 14 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; friable; common fine and few medium roots; few faint brown (7.5YR 4/4) clay films on faces of peds; 20 percent brown (10YR 4/3) Ap material; medium acid; gradual smooth boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; few faint black (N 2/0) soft accumulations of iron oxide and manganese oxide; strongly acid; gradual wavy boundary.

Bt2—20 to 31 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; strong brown (7.5YR 5/8) iron stains; strongly acid; gradual wavy boundary.

Bt3—31 to 43 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 4/4) and brown (10YR 4/3) clay films on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; strong brown (7.5YR 5/8) vertical iron streaks; light yellowish brown (10YR 6/4) sand grains on faces of peds; strongly acid; gradual wavy boundary.

BC—43 to 48 inches; yellowish brown (10YR 5/4) fine sandy loam; weak coarse subangular blocky structure; friable; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common faint strong brown (7.5YR 5/6) iron stains on faces of peds; light yellowish brown (10YR 6/4) sand grains on faces of peds; very strongly acid; gradual wavy boundary.

C1—48 to 62 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; common faint strong brown (7.5YR 5/6) iron stains on faces of peds; few strata of fine sand; very strongly acid; gradual wavy boundary.

C2—62 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; strongly acid.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bt horizon—0 to 5 percent; C horizon—0 to 25 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—typically loam, but fine sandy loam in some pedons

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silt loam, loam, or fine sandy loam

C horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—loam, fine sandy loam, sandy loam, gravelly loam, gravelly fine sandy loam, or gravelly sandy loam

The Chavies soils in this county have a lower base saturation at a depth of about 64 inches than is defined as the range for the series. This difference, however, does not significantly affect the use or management of the soils.

Claysville Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow
Parent material: Clayey colluvium derived from limestone and calcareous shale and siltstone
Landform: Hillslopes on uplands
Slope: 8 to 15 percent
Adjacent soils: Gilpin, Guernsey, Lowell, and Upshur
Taxonomic class: Fine, mixed, mesic Aquic Hapludolls

Typical Pedon

Claysville silty clay loam, in an area of Claysville-Guernsey complex, 8 to 15 percent slopes, about 4.1 miles northwest of Bristol, in Bristol Township, about 2,475 feet north and 743 feet west of the southeast corner of sec. 5, T. 11 N., R. 11 W.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam; gray (10YR 5/1) dry; moderate medium granular structure; friable; many medium roots; few siltstone fragments; slightly acid; clear smooth boundary.

A—9 to 17 inches; very dark grayish brown (10YR 3/2) silty clay; gray (10YR 5/1) dry; few medium faint dark grayish brown (10YR 4/2) mottles; strong coarse granular structure; firm; common medium roots; many distinct black (10YR 2/1) organic coatings on faces of peds; few siltstone fragments; neutral; gradual smooth boundary.

Bw1—17 to 25 inches; dark grayish brown (2.5Y 4/2) clay; common fine and medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular

blocky structure; firm; few fine roots; common distinct dark gray (10YR 4/1) coatings on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; few distinct grayish brown (10YR 5/2) pressure faces; few siltstone fragments; neutral; gradual wavy boundary.

Bw2—25 to 34 inches; olive brown (2.5Y 4/4) silty clay loam; common medium distinct light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark gray (10YR 4/1) and few faint brown (10YR 5/3) coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; few siltstone fragments; neutral; gradual wavy boundary.

Bw3—34 to 42 inches; olive brown (2.5Y 4/4) silty clay loam; common coarse distinct yellowish brown (10YR 5/6) and common medium faint light olive brown (2.5Y 5/6) mottles; moderate coarse and medium angular blocky structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct gray (10YR 5/1) and few faint brown (10YR 5/3) coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; light gray (10YR 7/2) and white (10YR 8/2) lime coatings; 5 percent siltstone fragments; 1 percent sandstone boulder; mildly alkaline; gradual wavy boundary.

BC—42 to 60 inches; light olive brown (2.5Y 5/4) silty clay; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; weak medium subangular blocky structure; firm; few fine roots; many distinct gray (10YR 5/1) and dark gray (10YR 4/1) coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; slight effervesence, mildly alkaline; gradual wavy boundary.

C—60 to 80 inches; variegated grayish brown (2.5Y 5/2) and dusky red (2.5YR 3/2) silty clay and silty clay loam; common medium faint light olive brown (2.5Y 5/4) mottles; firm; massive; strong effervesence, mildly alkaline.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Thickness of the mollic epipedon: 10 to 18 inches
Depth to bedrock: More than 60 inches
Depth to carbonates: 30 to 60 inches
Content of rock fragments: Ap horizon—0 to 15 percent; Bw horizon—0 to 15 percent; C horizon—0 to 15 percent

A horizon:
Color—hue of 10YR, value of 2 or 3 (5 or less dry), and chroma of 1 to 3
Texture—silty clay loam, silty clay

Bw horizon:
Color—hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 to 6
Texture—silty clay, clay, or silty clay loam

C horizon:
Color—hue of 5Y to 2.5YR, value of 3 to 6, and chroma of 2 to 6
Texture—silty clay loam, silty clay, or clay

Conotton Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Rapid
Parent material: Stratified gravelly outwash
Landform: Terraces
Slope: 0 to 12 percent
Adjacent soils: Brookside, Chavies, Gilpin, and Lowell
Taxonomic class: Loamy-skeletal, mixed, mesic Typic Hapludalfs

Typical Pedon

Conotton gravelly loam, 6 to 12 percent slopes, eroded, about 1.3 miles north of Eagleport, in Bloom Township, about 1,850 feet north and 700 feet east of the southwest corner of sec. 5, T. 10 N., R. 12 W.:

Ap—0 to 5 inches; brown (10YR 4/3) gravelly loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; 20 percent rock fragments; strongly acid; clear smooth boundary.

Bt1—5 to 11 inches; yellowish brown (10YR 5/6)(80%) and brown (10YR 4/3)(20%) very gravelly loam; weak medium subangular blocky structure; friable; common fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; 35 percent rock fragments; very strongly acid; clear smooth boundary.

Bt2—11 to 18 inches; yellowish brown (10YR 5/6) very gravelly loam; moderate medium subangular blocky structure; friable; common fine roots; common faint yellowish brown (10YR 5/4) clay films and bridges; 50 percent rock fragments; very strongly acid; clear wavy boundary.

Bt3—18 to 26 inches; brown (7.5YR 4/4) very gravelly loam; weak medium subangular blocky structure; friable; few fine roots; common faint brown (7.5YR 4/2) clay films on faces of peds; 60 percent rock fragments; strongly acid; gradual wavy boundary.

Bt4—26 to 33 inches; brown (7.5YR 4/4) very gravelly loam; moderate medium subangular blocky structure; friable; few fine roots; many faint dark brown (7.5YR 3/2) clay films and bridges between sand grains;

pockets of very gravelly clay loam; 60 percent rock fragments; strongly acid; gradual wavy boundary.
Bt5—33 to 50 inches; brown (7.5YR 4/4) very gravelly loam; weak coarse subangular blocky structure; friable; few fine roots; common faint dark brown (7.5YR 3/2) clay films and bridges between sand grains; pockets of extremely gravelly clay loam; 60 percent rock fragments; strongly acid; clear wavy boundary.
Bt6—50 to 54 inches; brown (10YR 4/3) very gravelly sandy loam; massive; very friable; few clay bridges between sand grains and rock fragments; 60 percent rock fragments; neutral; clear smooth boundary.
C—54 to 80 inches; brown (10YR 4/3) stratified extremely gravelly coarse sand very gravelly loamy coarse sand; single grained, loose; 65 percent rock fragments; strong effervesence; mildly alkaline.

Range in Characteristics

Thickness of the solum: 40 to 80 inches
Depth to bedrock: More than 60 inches
Depth to carbonates: More than 40 inches
Content of rock fragments: Ap horizon—15 to 35 percent; Bt—35 to 60 percent; C horizon—35 to 65 percent

Ap horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3
Texture—gravelly loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—very gravelly loam or very gravelly sandy loam

C horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—very gravelly sand, extremely gravelly sand, very gravelly coarse sand, extremely gravelly coarse sand, or very gravelly loamy coarse sand

Elba Series

Depth class: Deep
Drainage class: Well drained
Permeability: Slow
Parent material: Residuum derived from limestone and calcareous siltstone and shale
Landform: Hillslopes on uplands
Slope: 20 to 35 percent
Adjacent soils: Gilpin, Lowell, and Upshur
Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Elba silty clay loam, 20 to 35 percent slopes, eroded, about 2.5 miles north of McConnelsville, in Bloom Township, about 2,400 feet east and about 800 feet north of the southwest corner of sec. 22 T. 10 N., R. 12 W.:

Ap—0 to 5 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; many medium roots; neutral; abrupt smooth boundary.
Bt1—5 to 11 inches; dark yellowish brown (10YR 4/4) silty clay; strong medium subangular blocky structure; firm; common fine roots; common distinct brown (10YR 4/3) and dark yellowish brown (10YR 4/4) clay films on faces of peds; 5 percent limestone fragments; neutral; clear smooth boundary.
Bt2—11 to 20 inches; light olive brown (2.5Y 5/4) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure parting to weak medium subangular blocky; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; one very dark grayish brown (10YR 3/2) krotovina; common fragments of soft shale; 5 percent limestone fragments; neutral; gradual wavy boundary.
BC—20 to 28 inches; variegated yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and olive (5Y 5/4) very channery silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; 50 percent limestone fragments; common pale yellow (2.5Y 8/4) partly weathered limestone fragments; strong effervesence; moderately alkaline; clear irregular boundary.
C1—28 to 41 inches; yellowish brown (10YR 5/6) (70 percent) and olive gray (5Y 5/2) (30 percent) channery silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; 30 percent limestone fragments; strong effervesence; moderately alkaline; gradual irregular boundary.
Cr—41 to 50 inches; gray (5Y 5/1) and brownish yellow (10YR 6/8) fractured, calcareous siltstone bedrock.

Range in Characteristics

Thickness of the solum: 24 to 44 inches
Depth to bedrock: 40 to 60 inches
Depth to carbonates: 10 to 30 inches
Content of limestone fragments: Ap horizon—0 to 15 percent; Bt horizon—0 to 35 percent; C horizon—10 to 50 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 or 3
Texture—silty clay loam

Bt horizon:
Color—hue of 10YR, 7.5YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam, channery silty clay loam, silty clay, or channery silty clay

C horizon:
Color—hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6
Texture—silty clay loam, channery silty clay loam, or very channery silty clay loam

Euclid Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Parent material: Silty sediments
Landform: Terraces
Slope: 0 to 3 percent
Adjacent soils: Glenford, Licking, Newark, and Nolin
Taxonomic class: Fine-silty, mixed, nonacid, mesic Aeric Haplaquepts

Typical Pedon

Euclid silt loam, rarely flooded, about 0.28 mile southeast of Rose Farm, in York Township, about 2,500 feet west and 1,880 feet north of the southwest corner of sec. 34, T. 14 N., R. 13 W.:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; many fine and few medium roots; a thin layer of soft coal fragments in the lower 3 inches; strongly acid; clear smooth boundary.

BA—10 to 15 inches; brown (10YR 5/3) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; common fine roots; common distinct grayish brown (10YR 5/2) coatings on faces of peds; few faint black (N 2/0) stains of iron oxide and manganese oxide; strongly acid; gradual wavy boundary.

Bw—15 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; many distinct light brownish gray (2.5Y 6/2) coatings on faces of peds; few distinct black (N 2/0) soft accumulations and stains of iron oxide and manganese oxide; strongly acid; gradual wavy boundary.

BC—28 to 43 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; common distinct black (N 2/0) soft accumulations and stains of iron oxide and manganese oxide; strongly acid; gradual wavy boundary.

Cg—43 to 55 inches; light brownish gray (10YR 6/2) loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; few medium roots; many distinct black (N 2/0) soft accumulations and stains of iron oxide and manganese oxide; medium acid; gradual wavy boundary.

C—55 to 80 inches; brown (10YR 4/3) loam; common medium distinct grayish brown (10YR 5/2) and common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; few medium roots; common distinct gray (10YR 6/1) seams; many distinct black (N 2/0) soft accumulations and stains of iron oxide and manganese oxide; medium acid.

Range in Characteristics

Thickness of the solum: 40 to 55 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Bw horizon—0 to 2 percent; C horizon—0 to 5 percent

Ap horizon:
Color—hue of 10YR, value of 4, and chroma of 2 or 3
Texture—silt loam

Bw horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam or silt loam

C horizon:
Color—hue of 10YR, value of 4 to 6, and chroma of 1 to 6
Texture—loam, silt loam, or silty clay loam

Gilpin Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderate
Parent material: Residuum derived from interbedded siltstone, shale, and sandstone
Landform: Hillslopes on uplands
Slope: 6 to 70 percent
Adjacent soils: Lowell and Upshur
Taxonomic class: Fine-loamy, mixed, mesic Typic Hapludults

Typical Pedon

Gilpin silt loam, in an area of Gilpin-Upshur complex, 20 to 35 percent slopes, eroded, about 5 miles southeast of

Hackney, in Center Township, about 105 feet north and 200 feet west of southeast corner of sec. 24, T. 6 N., R. 10 W.:

Ap—0 to 3 inches; brown (10YR 4/3) silt loam; pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; 5 percent siltstone fragments; neutral; abrupt smooth boundary.

BE—3 to 8 inches; yellowish brown (10YR 5/4) silt loam; moderate coarse subangular blocky structure parting to weak medium subangular blocky; friable; common fine roots; 5 percent siltstone fragments; strongly acid; clear smooth boundary.

Bt1—8 to 19 inches; yellowish brown (10YR 5/6) channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on vertical faces of peds; common faint pale brown (10YR 6/3) silt coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; 20 percent siltstone fragments; very strongly acid; gradual wavy boundary.

Bt2—19 to 26 inches; yellowish brown (10YR 5/6) very channery silt loam; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on vertical faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; 35 percent siltstone fragments; very strongly acid; clear smooth boundary.

BC—26 to 34 inches; yellowish brown (10YR 5/4) very channery silt loam; weak medium coarse subangular blocky structure; firm; 55 percent siltstone fragments; very strongly acid; abrupt smooth boundary.

Cr—34 to 36 inches; light olive brown (2.5Y 5/4) fractured siltstone bedrock.

Range in Characteristics

Thickness of the solum: 18 to 36 inches
Depth to bedrock: 20 to 40 inches
Content of rock fragments: Ap or A horizon—5 to 25 percent; Bt horizon—5 to 40 percent; C horizon, where present—35 to 70 percent

Ap or A horizon:
Color—hue of 10YR, value of 3 to 5, and chroma of 2 to 4
Texture—silt loam and channery silt loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6
Texture—silt loam, channery silt loam, very channery silt loam, silty clay loam, channery silty clay loam, very channery silty clay loam, loam, channery loam, or very channery loam

C horizon, where present:
Color—hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6
Texture—very channery silt loam, extremely channery silt loam, very channery loam, or extremely channery loam

Glenford Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Parent material: Silty sediments
Landform: Terraces
Slope: 2 to 6 percent
Adjacent soils: Euclid, Licking, Newark, and Nolin
Taxonomic class: Fine-silty, mixed, mesic Aquic Hapludalfs

Typical Pedon

Glenford silt loam, 2 to 6 percent slopes, on Rose Farm, in York Township, about 2,180 feet north and 660 feet east of the southwest corner of sec. 4, T. 14 N., R. 14 W.:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; very strongly acid; abrupt smooth boundary.

BE—8 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt1—ll to 16 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint brown (10YR 4/3) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—16 to 24 inches; strong brown (7.5YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; few faint black (N 2/0) soft accumulations of iron oxide and manganese oxide; strongly acid; clear wavy boundary.

Bt3—24 to 35 inches; strong brown (7.5YR 5/6) silty clay loam; common medium distinct light gray (10YR 6/1) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; very few fine roots; common distinct light gray (10YR 6/1) clay films on vertical faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and

manganese oxide; strongly acid; gradual wavy boundary.

BC—35 to 52 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate coarse prismatic structure; firm; many distinct grayish brown (2.5Y 5/2) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; pockets of silt loam; slightly acid; gradual wavy boundary.

C1—52 to 68 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; massive with some vertical seams; firm; many distinct grayish brown (2.5Y 5/2) coatings along seams; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; slightly acid; gradual wavy boundary.

C2—68 to 80 inches; brown (10YR 5/3) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and common coarse distinct light gray (10YR 6/1) mottles; massive with some vertical seams; firm; many distinct grayish brown (2.5Y 5/2) coatings along seams; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; slightly acid.

Range in Characteristics

Thickness of the solum: 30 to 60 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: C horizon—0 to 5 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 or 3
Texture—silt loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6
Texture—silt loam and silty clay loam

C horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 3 to 6
Texture—silt loam and silty clay loam

Guernsey Series

Depth class: Deep or very deep
Drainage class: Moderately well drained
Permeability: Moderately slow or slow
Parent material: Colluvium and residuum derived from interbedded siltstone, shale, and limestone
Landform: Hillslopes on uplands
Slope: 12 to 70 percent
Adjacent soils: Brookside, Claysville, Gilpin, Lowell, Upshur, and Westmoreland
Taxonomic class: Fine, mixed, mesic Aquic Hapludalfs

Typical Pedon

Guernsey silt loam, in an area of Westmoreland-Guernsey complex, 20 to 35 percent slopes, eroded, about 3.3 miles south of Portersville, in Union Township, about 1,055 feet north and 700 feet east of the southwest corner of sec. 6, T. 8 N., R. 13 W.:

Ap—0 to 3 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; 5 percent sandstone fragments; strongly acid; abrupt smooth boundary.

BE—3 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common faint brown (10YR 5/3) silt coatings on faces of peds; brown (10YR 4/3) organic coatings on faces of peds and root channels; common soft siltstone fragments; 10 percent sandstone fragments; strongly acid; clear smooth boundary.

Bt1—6 to 11 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common soft siltstone fragments; 5 percent siltstone fragments; very strongly acid; clear smooth boundary.

Bt2—11 to 18 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (2.5Y 5/2) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common soft siltstone and shale fragments; 5 percent siltstone fragments; very strongly acid; clear wavy boundary.

Bt3—18 to 29 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (2.5Y 6/2) and many medium faint strong brown (7.5YR 5/6) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) and light brownish gray (2.5Y 6/2) clay films on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; common soft siltstone and shale fragments; 5 percent siltstone fragments; very strongly acid; clear wavy boundary.

2Bt4—29 to 41 inches; yellowish brown (10YR 5/6) silty clay; common fine distinct light brownish gray (2.5Y 6/2) mottles; moderate medium angular blocky structure; firm few fine and medium roots; common

distinct yellowish brown (10YR 5/4) and light brownish gray (2.5Y 6/2) coatings on horizontal and vertical faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; 5 percent siltstone fragments; strongly acid; clear wavy boundary.

2BC—41 to 50 inches; variegated light olive brown (2.5Y 5/4) and gray (10YR 5/1) silty clay loam; common medium faint yellowish brown (10YR 5/6) and gray (N 6/0) mottles; weak coarse prismatic structure; firm; few fine roots; few distinct black (N 2/0) stains of iron oxide and manganese oxide; common soft siltstone fragments, 5 percent siltstone fragments; neutral; clear wavy boundary.

2C—50 to 64 inches; variegated gray (N 5/0) and light olive brown (2.5Y 5/4) silty clay loam; massive; firm; few fine roots; many soft siltstone fragments; 5 percent siltstone fragments; neutral; clear wavy boundary.

2Cr—64 to 70 inches; variegated grayish brown (2.5Y 5/2) and dark reddish brown (2.5YR 3/4) soft siltstone bedrock.

Range in Characteristics

Thickness of the solum: 32 to 60 inches
Depth to bedrock: More than 50 inches
Depth to carbonates: More than 30 inches
Content of rock fragments: Ap horizon—5 to 15 percent; Bt horizon—5 to 25 percent; C horizon—5 to 35 percent

Ap horizon:
Color—hue of 10YR, value of 3 or 4, and chroma of 2 to 4
Texture—silt loam

Bt horizon:
Color—hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 3 to 6
Texture—silty clay loam, channery silty clay loam, silty clay, or channery silty clay

2C horizon:
Color—Neutral, or hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 0 to 6
Texture—silty clay, channery silty clay, silty clay loam, and channery silty clay loam

Licking Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Slow
Parent material: Loess and clayey lacustrine sediments
Landform: Terraces
Slope: 0 to 12 percent
Adjacent soils: Euclid, Gilpin, Glenford, Lowell, Newark, Nolin, and Upshur
Taxonomic class: Fine, mixed, mesic Aquic Hapludalfs

Typical Pedon

Licking silt loam, 0 to 6 percent slopes; about 2.75 miles southeast of Hackney, in Center Township, about 620 feet east and 400 feet south of the northwest corner of fractional sec. 33, T. 9 N., R. 10 W.:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate fine and medium granular structure; friable; common fine roots; strongly acid; clear smooth boundary.

A/B—7 to 12 inches; brown (10YR 4/3) (75 percent) and yellowish brown (10YR 5/6) (25 percent) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; strongly acid; abrupt smooth boundary.

Bt1—12 to 19 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films and common distinct brown (10YR 5/3) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

2Bt2—19 to 30 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct strong brown (7.5YR 5/8) clay films and common distinct brown (10YR 5/3) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

2Bt3—30 to 40 inches; yellowish brown (10YR 5/4) silty clay; few medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; many distinct gray (7.5YR N 6/0) and dark yellowish brown (10YR 4/4) clay films and common distinct brown (10YR 5/3) silt coatings on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; strongly acid; gradual smooth boundary.

2Bt4—40 to 55 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct gray (N 5/0) mottles; weak coarse subangular blocky structure; firm; many distinct gray (10YR 5/1) and dark yellowish brown (10YR 4/4) clay films on faces of peds; few thin strata of silty clay loam; common distinct black (N 2/0) stains of iron oxide and manganese oxide; slightly acid; clear smooth boundary.

2BC—55 to 68 inches; brown (10YR 4/3) silty clay loam; few fine distinct gray (10YR 5/1) mottles; massive parting to weak medium platy structure; friable; common distinct dark greenish gray (5BG 4/1) and

brown (7.5YR 4/4) coatings on horizontal surfaces of peds; strong effervesence in seams; weak effervesence; mildly alkaline; gradual smooth boundary.

2C—68 to 80 inches; brown (10YR 4/3) silty clay loam; few fine distinct gray (N 5/0) mottles; massive; friable; strong effervesence, mildly alkaline.

Range in Characteristics

Thickness of the solum: 40 to 70 inches
Depth to bedrock: More than 60 inches
Depth to carbonates: More than 40 inches
Thickness of the loess mantle: 12 to 30 inches

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6
Texture—silt loam or silty clay loam

2Bt horizon:
Color—hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 4 to 6
Texture—silty clay or clay stratified with silt loam and silty clay loam

2C horizon:
Color—hue of 7.5YR, 10YR, 2.5Y, or 5Y, value of 3 to 5, and chroma of 3 to 6
Texture—silty clay loam or silty clay

Lobdell Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate in the solum and moderate or moderately rapid in the substratum
Parent material: Recent alluvium
Landform: Flood plains
Adjacent soils: Brookside, Gilpin, Guernsey, Lowell, Upshur, and Westmoreland
Taxonomic class: Fine-loamy, mixed, mesic Fluvaquentic Eutrochrepts

Typical Pedon

Lobdell silt loam, channery substratum, occasionally flooded, about 4.6 miles east of McConnelsville, in Meigsville Township, about 1,400 feet east and 1,280 feet north of the southwest corner of sec. 3, T. 10 N., R. 11 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; many fine and common medium roots; neutral; clear smooth boundary.

Bw1—8 to 18 inches; brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; common fine and few medium roots; many distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; neutral; clear smooth boundary.

Bw2—18 to 25 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; weak medium subangular block structure; friable; few fine roots; few distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; neutral; gradual wavy boundary.

BC—25 to 31 inches; brown (10YR 4/3) silt loam; many medium distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular block structure; friable; few fine roots; common faint dark grayish brown (10YR 4/2) organic coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; neutral; clear wavy boundary.

Cg1—31 to 40 inches; dark grayish brown (10YR 4/2) channery loam; massive; friable; few fine roots; 15 percent rock fragments; neutral; clear smooth boundary.

Cg2—40 to 46 inches; dark grayish brown (10YR 4/2) channery loam; massive; friable; 20 percent rock fragments; neutral; gradual wavy boundary.

C—46 to 80 inches; brown (10YR 5/3) channery loam; massive; friable; 30 percent rock fragments; neutral.

Range in Characteristics

Thickness of the solum: 30 to 50 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bw horizon—0 to 10 percent; C horizon—15 to 30 percent

Ap horizon:
Color—hue of 10YR, value of 2 to 4, and chroma of 3 or 4
Texture—silt loam

Bw horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3
Texture—silt loam, silty clay loam, or clay loam

C horizon:
Color—hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 8
Texture—channery loam

Lowell Series

Depth class: Deep and very deep
Drainage class: Well drained
Permeability: Moderately slow
Parent material: Residuum derived from limestone, siltstone, and shale
Landform: Hillslopes on uplands
Slope: 12 to 70 percent
Adjacent soils: Brookside, Claysville, Elba, Gilpin, Guernsey, and Westgate
Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Lowell silty clay loam, in an area of Lowell-Gilpin complex, 20 to 35 percent slopes, eroded, about 2.1 miles southwest of Malta, in Malta Township, about 792 feet east and 1,420 feet north of the southwest corner of sec. 17, T. 9 N., R. 13 W.:

Ap—0 to 5 inches; brown (10YR 4/3) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many fine roots; few siltstone fragments; strongly acid; abrupt smooth boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds; few siltstone fragments; strongly acid; gradual smooth boundary.

Bt1—10 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; strong medium subangular blocky structure; firm; common fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; few siltstone fragments; strongly acid; clear smooth boundary.

Bt2—20 to 30 inches; yellowish brown (10YR 5/6) silty clay; common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; common soft siltstone fragments; 5 percent siltstone fragments; strongly acid; gradual wavy boundary.

Bt3—30 to 37 inches; yellowish brown (10YR 5/4) clay; common medium distinct red (2.5YR 4/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; common soft siltstone fragments; 10 percent siltstone fragments; strongly acid; gradual wavy boundary.

BC—37 to 42 inches; yellowish brown (10YR 5/4) clay; common medium distinct yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; common soft siltstone fragments; 14 percent siltstone fragments; strongly acid; gradual wavy boundary.

C1—42 to 50 inches; yellowish brown (10YR 5/4) channery clay; common medium faint brown (7.5YR 5/4) and few medium distinct olive yellow (2.5Y 6/8) mottles; massive; firm; few fine roots; many distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; common soft siltstone fragments; 25 percent siltstone fragments; medium acid; gradual wavy boundary.

C2—50 to 76 inches; brown (7.5YR 5/4) channery clay; massive; firm; common distinct black (N 2/0) soft accumulation of iron oxide and manganese oxide; 20 percent siltstone fragments; medium acid; abrupt smooth boundary.

R—76 to 78 inches; fractured olive brown (2.5Y 4/4) siltstone bedrock.

Range in Characteristics

Thickness of the solum: 36 to 54 inches
Depth to bedrock: More than 40 inches
Depth to carbonates: More than 30 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bt horizon—0 to 5 percent in the upper part and 0 to 15 percent in the lower part; C horizon—5 to 35 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam and silty clay loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6
Texture—silty clay loam, silty clay, and, in the lower part, clay

C horizon:
Color—hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 4 to 6
Texture—silty clay, channery silty clay, clay, or channery clay

Markland Series

Depth class: Very deep

Drainage class: Well drained
Permeability: Slow
Parent material: Clayey lacustrine sediments
Landform: Terraces
Slope: 12 to 25 percent
Adjacent soils: Elba, Gilpin, Glenford, Licking, Lowell, and Nolin
Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Markland silty clay loam, 12 to 25 percent slopes, eroded, about 1.5 miles northwest of Unionville, in Meigsville Township, about 2,000 feet north and 1,850 feet east of the southwest corner of sec. 11, T. 10 N., R. 11 W.:

Ap—0 to 4 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many fine and common medium roots; medium acid; abrupt smooth boundary.
BA—4 to 7 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; common fine and medium roots; common faint brown (10YR 4/3) and dark yellowish brown (10YR 4/4) organic coatings on faces of peds; medium acid; clear smooth boundary.
Bt1—7 to 17 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure parting to moderate medium angular blocky; firm; common fine and medium roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few faint black (N 2/0) soft accumulations of iron oxide and manganese oxide; slightly acid; clear smooth boundary.
Bt2—17 to 28 inches; yellowish brown (10YR 5/6) silty clay loam; moderate coarse subangular blocky structure; firm; few fine roots; common distinct brown (10YR 4/3) clay films on face of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; weak effervesence on faces of peds; neutral; gradual wavy boundary.
BC—28 to 40 inches; yellowish brown (10YR 5/6) silty clay; moderate medium prismatic structure parting to moderate medium subangular blocky; very firm; few fine roots; many distinct brown (10YR 4/3) coatings on faces of peds; common distinct gray (N 5/0) lime coatings that are strongly effervescent; slight effervesence; mildly alkaline; gradual smooth boundary.
C1—40 to 50 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; massive; firm; few fine roots; thin strata of silt loam; strong effervescence; moderately alkaline; clear smooth boundary.
C2—50 to 70 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; thin strata of very fine sandy loam; common distinct white (10YR 8/2) lime coatings; strong effervesence; moderately alkaline; gradual wavy boundary.
C3—70 to 80 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; strong effervesence; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 40 inches
Depth to bedrock: More than 60 inches
Depth to carbonates: 17 to 40 inches

Ap horizon:
Color—hue of 10YR, value of 4 to 6, and chroma of 2 to 4
Texture—silty clay loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam and silty clay

C horizon:
Color—hue of 2.5Y and 10YR, value of 4 to 6, and chroma of 2 to 6
Texture—silty clay loam and silty clay that has thin strata of silt loam and very fine sandy loam

Melvin Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Parent material: Recent alluvium
Landform: Flood plains
Slope: 0 to 2 percent
Adjacent soils: Lowell, Morristown, and Nolin
Taxonomic class: Fine-silty, mixed, nonacid, mesic Typic Fluvaquents

Typical Pedon

Melvin silt loam, ponded, about 3.7 miles northwest of Reinersville, in Manchester Township, about 1,300 feet south and 2,200 feet east of the northwest corner of sec. 7, T. 7 N., R. 10 W.:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak coarse granular structure; friable; many medium roots; strong effervescence; mildly alkaline; abrupt smooth boundary.
Cg—4 to 29 inches; olive gray (5Y 5/2) silt loam; common medium distinct light brownish gray (2.5Y 6/2) and brown (10YR 5/3) mottles; massive; friable; common fine roots; fine distinct yellowish brown (10YR 5/6) stains; mildly alkaline; clear wavy boundary.

Cg2—29 to 80 inches; olive gray (5Y 5/2) silt loam; common medium distinct brown (10YR 5/3) mottles; massive; friable; mildly alkaline.

Range in Characteristics

Depth to bedrock: More than 60 inches
Content of rock fragments: A horizon—0 to 5 percent; Cg horizon—0 to 5 percent

A horizon:
Color—hue of 10YR or 2.5Y, value of 3, and chroma of 1 or 2
Texture—silt loam

Cg horizon:
Color—hue of 10YR to 5Y or neutral, value of 4 to 6, and chroma of 0 to 2
Texture—silt loam and silty clay loam, and, in some pedons below a depth of 40 inches, loam

Morristown Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Parent material: Calcareous, partly weathered fine earth material and fragments of limestone, shale, and lesser amounts of medium grained sandstone and siltstone from surface mining for coal
Landform: Surface mined uplands
Slope: 0 to 70 percent
Adjacent soils: Gilpin, Lowell, Melvin, Nolin, and Upshur
Taxonomic class: Loamy-skeletal, mixed (calcareous) mesic Typic Udorthents

Typical Pedon

Morristown channery clay loam, 20 to 70 percent slopes, very stony, about 2 miles north of Reinersville, in Manchester Township, about 2,000 feet south and about 1,850 feet east of the northwest corner of sec. 17, T. 7 N., R. 10 W.:

A—0 to 4 inches; dark grayish brown (10YR 4/2) channery clay loam, light brownish gray (10YR 6/2) dry; moderate medium and fine subangular blocky structure; friable; many fine and common medium roots; 20 percent rock fragments; strong effervesence; moderately alkaline; clear smooth boundary.
C1—4 to 15 inches; grayish brown (2.5Y 5/2) channery clay loam; weak medium subangular blocky structure; friable; common medium roots; common soft fragments, 20 percent rock fragments; strong effervesence; moderately alkaline; gradual wavy boundary.
C2—15 to 80 inches; variegated yellowish brown (10YR 5/4), yellowish red (5YR 4/6), and olive (5Y 5/3) very channery clay loam; massive; firm; common medium and fine roots decreasing with depth to about 40 inches; common distinct white (10YR 8/1) partly weathered limestone fragments; many soft calcareous shale and limestone fragments; 40 percent rock fragments; strong effervesence; moderately alkaline.

Range in Characteristics

Depth to bedrock: More than 60 inches
Depth to carbonates: 0 to 12 inches
Content of rock fragments: A horizon—0 to 35 percent; C horizon—35 to 70 percent in most pedons; in some pedons, thin subhorizons as low as 20 percent

A horizon:
Color—hue of 7.5YR, 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 8
Texture—typically, channery clay loam or silty clay loam, but clay loam or channery silty clay loam in some pedons

C horizon:
Color—hue of 5YR to 5Y or neutral, value of 2 to 6, and chroma of 0 to 8
Texture—channery clay loam, very channery clay loam, extremely channery clay loam, channery silty clay loam, very channery silty clay loam, or extremely channery silty clay loam

Newark Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Parent material: Recent alluvium
Landform: Flood plains
Slope: 0 to 3 percent
Adjacent soils: Euclid, Glenford, Licking, and Nolin
Taxonomic class: Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents

Typical Pedon

Newark silt loam, frequently flooded, about 3.8 miles southeast of Corning (Perry County), in Union Township, about 1,980 feet west and 790 feet south of the northeast corner of sec. 30, T. 8 N., R. 13 W.:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; many fine and common medium roots; slightly acid; abrupt smooth boundary.
Bw—6 to 12 inches; brown (10YR 5/3) silty clay loam; common medium distinct strong brown (7.5YR 5/6)

and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; neutral; gradual wavy boundary.

Bg—12 to 20 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct strong brown (7.5YR 5/6) and gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; few fine and medium roots; common faint black (N 2/0) stains of iron oxide and manganese oxide; neutral; gradual smooth boundary.

B'w—20 to 27 inches; brown (10YR 5/3) silty clay loam; common medium distinct brown (7.5YR 4/4) and gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; few fine and medium roots; common distinct black (N 2/0) soft accumulations and stains of iron oxide and manganese oxide; neutral; gradual wavy boundary.

C—27 to 36 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; massive; friable; few fine and medium roots; common distinct black (N 2/0) stains (iron and manganese oxides; gray (10YR 5/1) coatings in root channels; neutral; gradual wavy boundary.

Cg1—36 to 66 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct brown (7.5YR 4/4), yellowish brown (10YR 5/6), and grayish brown (10YR 5/2) mottles; massive; friable; few fine roots; medium acid; gradual wavy boundary.

Cg2—66 to 80 inches; dark gray (N 4/0) silty clay loam; many medium distinct olive brown (2.5Y 4/4) mottles; massive; friable; medium acid.

Range in Characteristics

Thickness of the solum: 22 to 44 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Ap horizon—0 to 3 percent; Bw and Bg horizon—0 to 5 percent; C and Cg horizon—0 to 5 percent above 40 inches and 0 to 20 percent below

Ap horizon:
Color—hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3
Texture—typically silt loam, but silty clay loam in some pedons

Bw and Bg horizons:
Color—hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam or silty clay loam

C and Cg horizons:
Color—hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 0 to 2 in the Cg horizon and 2 to 4 in the C horizon
Texture—dominantly silt loam and silty clay loam that has thin strata of loam, gravelly loam, gravelly silt loam, and gravelly silty clay loam in some pedons

Nolin Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Parent material: Recent alluvium
Landform: Flood plains
Slope: 0 to 3 percent
Adjacent soils: Chavies, Euclid, Gilpin, Glenford, Licking, Markland, Newark, Upshur, and Vandalia
Taxonomic class: Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts

Typical Pedon

Nolin silt loam, occasionally flooded, about 4.3 miles northeast of Stockport, in Windsor Township, about 5,400 feet south of the intersection of State Route 266 and Township Road 178 along State Route 266, 720 feet east:

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine and medium roots; slight effervesence; mildly alkaline; abrupt smooth boundary.

Bw1—10 to 26 inches; dark yellowish brown (10YR 4/4) silt loam; moderate coarse subangular blocky structure; friable; many distinct brown (10YR 4/3) organic coatings on ped faces and in root channels, pores, and wormcasts; few lenses of yellowish brown (10YR 5/6) loam at 13 to 16 inches; slight effervesence; mildly alkaline, gradual wavy boundary.

Bw2—26 to 52 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable; few fine roots; common distinct brown (10YR 4/3) organic coatings on ped surfaces and in root channels, pores, and wormcasts; slight effervesence; mildly alkaline; gradual wavy boundary.

C—52 to 80 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; slight effervesence; mildly alkaline.

Range in Characteristics

Thickness of the solum: 40 to 55 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bw horizon—0 to 5 percent; C horizon—0 to 30 percent

Ap horizon:
Color—hue of 10YR, value of 4, and chroma of 2 or 3
Texture—silt loam

Bw horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4
Texture—silt loam or silty clay loam

C horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4
Texture—silty clay loam, silt loam, loam, gravelly loam, gravelly fine sandy loam, or fine sandy loam

The Nolin soils in this county are calcareous at shallower depths than is defined as the range for the series. This difference, however, does not significantly affect the use or management of the soils.

Omulga Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate above the fragipan and slow in the fragipan
Parent material: Loess or old alluvium
Landform: Preglacial valleys
Slope: 2 to 12 percent
Adjacent soils: Gilpin, Upshur, and Vandalia
Taxonomic class: Fine-silty, mixed, mesic Typic Fragiudalfs

Typical Pedon

Omulga silt loam, 2 to 6 percent slopes, about 3.8 miles northeast of Beverly, (Washington County), in Center Township, about 200 feet south and 225 feet west of the northeast corner of sec. 26, T. 6 N., R. 10 W.:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

BA—7 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common distinct brown (10YR 4/3) organic coatings on faces of peds; strongly acid; clear smooth boundary.

Bt1—11 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide; strongly acid; clear wavy boundary.

Bt2—24 to 35 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct brown (10YR 5/3) silt coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; very strongly acid; clear wavy boundary.

Btx—35 to 56 inches; yellowish brown (10YR 5/4) silt loam; common medium faint light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate coarse angular blocky; very firm, slightly brittle; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct light brownish gray (10YR 6/2) and many distinct yellowish brown (10YR 5/4) coatings on vertical faces of peds with strong brown (7.5YR 5/6) rinds; common distinct black (N 2/0) stains of iron oxide and manganese oxide on faces of prisms; strongly acid; gradual wavy boundary.

BC—56 to 71 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very firm; common distinct black (N 2/0) stains and soft accumulations of iron oxide and manganese oxide; very strongly acid; gradual wavy boundary.

C—71 to 80 inches; yellowish brown (10YR 5/6) silt loam; massive; firm; many distinct black (N 2/0) and yellowish red (5YR 4/6) soft accumulations of iron oxide and manganese oxide; very strongly acid.

Range in Characteristics

Thickness of the solum: 40 to 80 inches or more
Depth to bedrock: More than 60 inches
Depth to fragipan: 20 to 36 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bt and Btx horizon—0 to 5 percent; C horizon—0 to 10 percent

Ap horizon:
Color—hue of 10YR, value of 4, and chroma of 2 or 3
Texture—silt loam

Bt horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 3 to 6
Texture—silt loam or silty clay loam

Btx horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 3 to 6
Texture—silt loam or silty clay loam

C horizon:
Color—hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 6

Texture—silt loam or silty clay loam

Richland Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Parent material: Loamy colluvium weathered from fine grained sandstone, siltstone, and shale
Landform: Hillslopes on uplands
Slope: 20 to 35 percent
Adjacent soils: Gilpin, Upshur, and Vandalia
Taxonomic class: Fine-loamy, mixed, mesic Typic Hapludalfs

Typical Pedon

Richland loam, in an area of Richland-Vandalia complex, 20 to 35 percent slopes, about 4 miles southwest of Beverly (Washington County), in Windsor Township, about 478 feet west of the intersection of Township Road 40 extension and the Washington County line along Township Road 40 extension, then 195 feet north:

A1—0 to 3 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; 5 percent rock fragments; strongly acid; clear wavy boundary.

BA1—3 to 15 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common fine and few coarse roots; 10 percent rock fragments; strongly acid; gradual wavy boundary.

BA2—15 to 23 inches; 60 percent brown (10YR 4/3) and 40 percent brown (7.5YR 5/4) silt loam; weak medium subangular blocky structure; friable; few medium roots; 10 percent rock fragments; strongly acid; clear smooth boundary.

Bt1—23 to 32 inches; brown (7.5YR 5/4) channery loam; moderate medium subangular blocky structure; friable; few fine roots; common faint brown (7.5YR 4/4) clay films on faces of peds; few distinct black (N 2/0) stains of iron oxide and manganese oxide on faces of peds; 15 percent rock fragments; strongly acid; gradual wavy boundary.

Bt2—32 to 41 inches; strong brown (7.5YR 5/6) channery loam; moderate medium subangular blocky structure; firm; few fine roots; common faint brown (7.5YR 4/4) clay films on faces of peds; few distinct black (N 2/0) stains of iron oxide and manganese oxide on faces of peds; 20 percent rock fragments; strongly acid; clear wavy boundary.

Bt3—41 to 51 inches; brown (7.5YR 5/4) channery loam; common medium faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; few fine roots; common medium faint brown (7.5YR 4/4) clay films on faces of peds; common distinct black (N 2/0) stains of iron oxide and manganese oxide on faces of peds; 30 percent rock fragments; strongly acid; gradual wavy boundary.

Bt4—51 to 72 inches; brown (7.5YR 4/4) channery silt loam; common medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; few fine faint brown (7.5YR 5/4) clay films on faces of peds; firm; common distinct black (N 2/0) stains of iron oxide and manganese oxide on faces of peds; 20 percent rock fragments; strongly acid.

Range in Characteristics

Thickness of the solum: 44 to 80 inches
Depth to bedrock: More than 60 inches
Content of rock fragments: A horizon—5 to 20 percent; Bt horizon—15 to 20 percent in the upper part and 20 to 35 percent in the lower part

A horizon:
Color—hue of 10YR, value of 3 or 4, and chroma of 3 or 4
Texture—typically loam, but channery loam in some pedons

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—channery loam, channery clay loam, or channery silt loam

Steinsburg Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderately rapid
Parent material: Sandstone residuum
Landform: Hillslopes on uplands
Slope: 25 to 70 percent
Adjacent soils: Gilpin, Guernsey, Wellston, and Westmoreland
Taxonomic class: Coarse-loamy, mixed, mesic Typic Dystrochrepts

Typical Pedon

Steinsburg loam, 25 to 70 percent slopes, about 1.6 miles southeast of Chesterhill, in Marion Township, about 1,850 feet north and 1,190 feet west of the southeast corner of sec. 8, T. 8 N., R. 12 W.:

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

BA—4 to 8 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; friable; few fine and

medium roots; many faint dark grayish brown (10YR 4/2) organic coatings on faces of peds; 5 percent sandstone fragments; strongly acid; clear smooth boundary.

Bw1—8 to 17 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; few fine roots; few distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds and in root channels; 5 percent sandstone fragments; very strongly acid; gradual wavy boundary.

Bw2—17 to 24 inches; yellowish brown (10YR 5/4) loam; common medium distinct strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; few fine roots; common faint brown (10YR 5/3) silt coatings on faces of peds; 5 percent sandstone fragments; very strongly acid; gradual wavy boundary.

BC—24 to 27 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; very few fine roots; many soft sandstone fragments; 5 percent sandstone fragments; very strongly acid; abrupt smooth boundary.

R—27 to 28 inches; yellowish brown (10YR 5/4) coarse grained sandstone bedrock.

Range in Characteristics

Thickness of the solum: 12 to 27 inches
Depth to bedrock: 20 to 40 inches
Content of rock fragments: Ap horizon—0 to 10 percent; Bw horizon—0 to 20 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—typically loam, but sandy loam in some pedons

Bw horizon:
Color—hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6
Texture—loam, channery loam, sandy loam, or channery sandy loam

Upshur Series

Depth class: Deep and very deep
Drainage class: Well drained
Permeability: Slow
Parent material: Residuum derived from shale
Landform: Hillslopes on uplands
Slope: 6 to 70 percent
Adjacent soils: Gilpin, Guernsey, Vandalia, and Woodsfield
Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Upshur silty clay loam, 12 to 20 percent slopes, eroded, about 0.8 mile west of Wrightstown, in Homer Township, about 1,510 feet east and 790 feet north of the southwest corner of fractional sec. 7, T. 7 N., R. 13 W.:

Ap—0 to 4 inches; reddish brown (5YR 4/4) silty clay loam, light reddish brown (5YR 6/3) dry; moderate fine granular structure; friable; many fine roots; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.

Bt1—4 to 13 inches; yellowish red (5YR 4/6) silty clay; moderate fine and medium subangular blocky structure; firm; common fine roots; many faint reddish brown (5YR 4/4) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; gradual smooth boundary.

Bt2—13 to 26 inches; red (2.5YR 4/6) silty clay; moderate coarse subangular blocky structure; large slickensides at a depth of 23 inches; firm; plastic, sticky; few fine roots; common faint red (2.5YR 4/6) clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt3—26 to 42 inches; dark red (10R 3/6) silty clay; weak coarse subangular blocky structure; large slickensides at a depth of 33 inches; firm; plastic, sticky; few faint reddish brown (5YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; medium acid; gradual wavy boundary.

C1—42 to 58 inches; variegated dark reddish brown (5YR 3/4) and light olive brown (2.5Y 5/4) silty clay loam; massive with fine angular blocky rock structure; firm; weak effervesence; mildly alkaline; clear wavy boundary.

C2—58 to 84 inches; variegated light olive brown (2.5Y 5/4), dark reddish brown (5YR 3/4), and dark red (10R 3/6) silty clay loam; massive; firm; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; 10 percent coarse fragments; strong effervesence; moderately alkaline; abrupt smooth boundary.

Cr—84 to 90 inches; reddish brown (5YR 4/4) shale bedrock.

Range in Characteristics

Thickness of the solum: 26 to 50 inches
Depth to bedrock: More than 40 inches
Depth to carbonates: More than 18 inches
Content of rock fragments: Ap horizon—0 to 10 percent; Bt horizon—0 to 15 percent; C horizon—0 to 15 percent

Ap horizon:
Color—hue of 10YR to 2.5YR, value of 3 or 4, and chroma of 2 to 4
Texture—typically, silty clay loam, but silt loam or silty clay in some pedons

Bt horizon:
Color—hue of 5YR, 2.5YR, or 10R, value of 3 or 4, and chroma of 3 to 6
Texture—silty clay or clay

C horizon:
Color—dominantly hue of 10R, 5YR, 2.5Y, value of 3 or 4, and chroma of 3 to 6, but variegations of hue of 2.5Y, value 4 or 5, and chroma 4 to 6
Texture—silty clay loam, silty clay, or clay

Vandalia Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow or slow
Parent material: Colluvium derived from siltstone, shale, and sandstone
Landform: Hillslopes on uplands
Slope: 12 to 35 percent
Adjacent soils: Gilpin, Nolin, and Upshur
Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Vandalia silt loam, 20 to 35 percent slopes, eroded, about 3.8 miles east of Hackney, in Center Township, about 2,200 feet south and 375 feet west of the northeast corner of sec. 11, T. 6 N,. R. 10 W.:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; 10 percent sandstone fragments; very strongly acid; abrupt smooth boundary.

BE—6 to 14 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; common distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds; 5 percent sandstone fragments; very strongly acid; clear wavy boundary.

Bt1—14 to 27 inches; reddish brown (5YR 4/4) channery silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; common faint reddish brown (5YR 4/3) clay films on faces of peds; common distinct very pale brown (10YR 7/3) silt coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; 25 percent sandstone and siltstone fragments; very strongly acid; gradual wavy boundary.

Bt2—27 to 39 inches; reddish brown (5YR 4/4) channery silty clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; many distinct dark reddish brown (5YR 3/3) clay films and slickensides on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; many shale fragments; 20 percent sandstone and siltstone fragments; very strongly acid; clear wavy boundary.

Bt3—39 to 49 inches; reddish brown (5YR 4/3) silty clay; moderate coarse subangular blocky structure; firm; many distinct dark reddish brown (5YR 3/3) clay films and slickensides on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; many soft siltstone and shale fragments; 10 percent siltstone fragments; strongly acid; clear wavy boundary.

BC1—49 to 56 inches; reddish brown (5YR 4/3) silty clay; weak coarse subangular blocky structure; firm; many distinct reddish brown (5YR 4/3) and common distinct gray (2.5Y 5/0) clay films on faces of peds; reddish brown (5YR 4/3) slickensides; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; many soft siltstone and shale fragments; 10 percent siltstone fragments; medium acid; clear wavy boundary.

BC2—56 to 68 inches; reddish brown (5YR 4/3) silty clay; weak coarse subangular blocky structure; firm; many distinct reddish brown (5YR 4/3) clay films and slickensides on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; many soft siltstone and shale fragments; 10 percent siltstone fragments; slightly acid; clear smooth boundary.

2C—68 to 80 inches; brown (7.5YR 5/4) channery silty clay loam; massive; firm; 35 percent siltstone fragments; slightly acid.

Range in Characteristics

Thickness of the solum: 40 to 80 inches
Depth to bedrock: More than 72 inches
Content of rock fragments: Ap horizon—5 to 15 percent; Bt horizon—5 to 35 percent; 2C horizon—10 to 45 percent

Ap horizon:
Color—hue of 10YR to 5YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam or silty clay loam

Bt horizon:
Color—hue of 2.5YR or 5YR in the upper part and

includes 10R in the lower part, value of 4 in the upper part and 3 or 4 in the lower part, and chroma of 3 to 6
Texture—silty clay loam, channery silty clay loam, silty clay, or channery silty clay

2C horizon:
Color—hue of 2.5YR to 2.5Y, value of 3 to 6, and chroma of 3 to 6
Texture—silty clay loam, channery silty clay loam, very channery silty clay loam, silty clay, channery silty clay, or very channery silty clay

Wellston Series

Depth class: Deep
Drainage class: Well drained
Permeability: Moderate
Parent material: Loess and residuum derived from sandstone
Landform: Hillslopes on uplands
Slope: 2 to 12 percent
Adjacent soils: Gilpin, Steinsburg, Westgate, Westmoreland, and Zanesville
Taxonomic class: Fine-silty, mixed, mesic Ultic Hapludalfs

Typical Pedon

Wellston silt loam, 2 to 6 percent slopes, about 1.25 miles southwest of Pennsville, in Penn Township, about 2,500 feet west and 2,200 feet south of the northeast corner of sec. 10, T. 9 N., R. 12 W.:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common medium and few fine roots; very strongly acid; abrupt smooth boundary.
BE—8 to 12 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common medium and few fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds, common distinct brown (10YR 4/3) organic coatings on vertical faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; very strongly acid; clear wavy boundary.
Bt—12 to 33 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; very strongly acid; gradual wavy boundary.
2BC—33 to 43 inches; yellowish brown (10YR 5/6) silt loam; moderate coarse subangular blocky structure; firm; few fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; common soft sandstone fragments; about 2 percent sandstone fragments; strongly acid; gradual wavy boundary.
2Cr1—43 to 50 inches; yellowish brown (10YR 5/6) weakly cemented sandstone that has brown (7.5YR 4/4) coatings on cleavage planes; few fine roots; clear wavy boundary.
2Cr2—50 to 55 inches; yellowish brown (10YR 5/6) weakly cemented sandstone bedrock.

Range in Characteristics

Thickness of the solum: 32 to 50 inches
Depth to bedrock: 40 to 60 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bt horizon—0 to 5 percent; 2BC or 2Bt horizon, where present—0 to 30 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silt loam or silty clay loam

Westgate Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate in loess and slow in residuum
Parent material: Loess and residuum derived from interbedded shale, limestone, and siltstone
Landform: Hillslopes on uplands
Slope: 2 to 12 percent
Adjacent soils: Aaron, Lowell, Wellston, Woodsfield, and Zanesville
Taxonomic class: Fine-silty, mixed, mesic Typic Hapludalfs

Typical Pedon

Westgate silt loam, 2 to 6 percent slopes, about 1.8 mile northeast of Deavertown, in York Township, about 2,565 feet west and 22 feet north of the southeast corner of sec. 19, T. 10 N., R. 13 W.:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; neutral; abrupt smooth boundary.
Bt1—8 to 15 inches; yellowish brown (10YR 5/6) silty clay loam; weak coarse subangular blocky structure; friable; few fine roots; common distinct dark yellowish

brown (10YR 4/4) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt2—15 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; many distinct pale brown (10YR 6/3) silt coatings on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; few siltstone fragments; strongly acid; clear smooth boundary.

Bt3—24 to 34 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; few distinct pale brown (10YR 6/3) silt coatings on vertical faces of peds; few coarse fragments; strongly acid; gradual smooth boundary.

Bt4—34 to 40 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; very few fine roots; common distinct dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) clay films on faces of peds; common distinct pale brown (10YR 6/3) silt coatings on vertical faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; strongly acid; gradual smooth boundary.

2Bt5—40 to 52 inches; yellowish red (5YR 4/6) silty clay; moderate medium subangular blocky structure; very firm; few distinct reddish brown (5YR 4/4) clay films and slickensides on vertical faces of peds; neutral; gradual wavy boundary.

2BC—52 to 67 inches; dark reddish brown (2.5YR 3/4) silty clay; massive parting to weak medium subangular blocky structure; firm; reddish brown (5YR 3/4) slickensides on faces of peds; 10 percent soft shale fragments; mildly alkaline; gradual wavy boundary.

2C—67 to 78 inches; light olive brown (2.5YR 5/6) channery silty clay loam; common fine distinct yellowish red (5YR 4/6) and light brownish gray (10YR 6/2) mottles; massive; firm; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; 20 percent siltstone fragments; mildly alkaline; gradual wavy boundary.

2Cr—78 to 80 inches; dark reddish brown (2.5YR 3/4) weathered shale bedrock.

Range in Characteristics

Thickness of the solum: 40 to 72 inches

Depth to bedrock: 60 to 80 inches

Thickness of the loess mantle: 24 to 40 inches

Content of rock fragments: Ap horizon—0 to 5 percent; Bt horizon—0 to 5 percent; 2Bt horizon—0 to 15 percent; 2C horizon—0 to 30 percent

Ap horizon:

Color—hue of 10YR, value of 4 or 5, and chroma of 3 or 4

Texture—silt loam

Bt horizon:

Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6

Texture—silt loam or silty clay loam

2Bt horizon:

Color—hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 3 to 6

Texture—silty clay loam, silty clay, or clay

2C horizon:

Color—hue of 2.5Y to 2.5YR, value of 3 to 6, and chroma of 3 to 6

Texture—silty clay loam, channery silty clay loam, silty clay, or channery silty clay

Westmoreland Series

Depth class: Deep

Drainage class: Well drained

Permeability: Moderate

Parent material: Residuum and colluvium derived from interbedded siltstone and sandstone

Landform: Hillslopes on uplands

Slope: 12 to 70 percent

Adjacent soils: Aaron, Berks, and Guernsey

Taxonomic class: Fine-loamy, mixed, mesic Ultic Hapludalfs

Typical Pedon

Westmoreland silt loam, in an area of Westmoreland-Guernsey complex, 35 to 70 percent slopes, about 2.3 miles northwest of Ringgold, in Union Township, about 100 feet east and 1,000 feet north of the southwest corner of sec. 7, T. 8 N., R. 13 W.:

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; common fine and medium roots; 5 percent sandstone fragments; strongly acid; abrupt smooth boundary.

BA—3 to 7 inches; yellowish brown (10YR 5/4) silt loam; moderate medium granular structure; friable; few fine and medium roots; many distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; 5

percent sandstone fragments; strongly acid; clear smooth boundary.

Bt1—7 to 12 inches; yellowish brown (10YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; few fine and medium roots; common faint brown (7.5YR 5/4) clay films on faces of peds; 5 percent siltstone fragments; strongly acid; clear wavy boundary.

Bt2—12 to 19 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine and medium roots; common faint brown (7.5YR 5/4) clay films on faces of peds; few soft siltstone fragments; 5 percent siltstone fragments; strongly acid; clear wavy boundary.

Bt3—19 to 37 inches; yellowish brown (0YR 5/6) channery silty clay loam; moderate fine and medium subangular blocky structure; firm; few fine and medium roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; few soft siltstone and shale fragments; 20 percent siltstone fragments; strongly acid; clear wavy boundary.

BC—37 to 46 inches; yellowish brown (10YR 5/4) channery silty clay loam; weak medium subangular blocky structure; firm; few medium roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common soft siltstone and shale fragments; 15 percent siltstone fragments; strongly acid; clear smooth boundary.

C—46 to 50 inches; yellowish brown (10YR 5/4) very channery silty clay loam; massive; firm; few faint brown (10YR 5/3) silt coatings on faces of peds; 50 percent siltstone fragments; strongly acid; clear wavy boundary.

R—50 to 55 inches; fractured olive (5Y 5/4) siltstone bedrock.

Range in Characteristics

Thickness of the solum: 25 to 46 inches
Depth to bedrock: 40 to 60 inches
Content of rock fragments: A or Ap horizon—5 to 15 percent; Bt horizon—5 to 30 percent; C horizon—45 to 90 percent

A or Ap horizon:
Color—hue of 10YR, value of 3 or 4, and chroma of 2 or 3
Texture—typically, silt loam, but loam in some pedons

Bt horizon:
Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6
Texture—loam, channery loam, silt loam, channery silt loam, silty clay loam, channery silty clay loam, clay loam, or channery clay loam

C horizon:
Color—hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 4 to 6
Texture—very channery silty clay loam, extremely channery silty clay loam, very channery clay loam, or extremely channery clay loam

Woodsfield Series

Depth class: Deep or very deep
Drainage class: Well drained
Permeability: Moderate in loess, slow in residuum
Parent material: Loess and residuum derived from shale
Landform: Hillslopes on uplands
Slope: 2 to 12 percent
Adjacent soils: Gilpin, Upshur, Westgate, and Zanesville
Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Woodsfield silt loam, 2 to 6 percent slopes, about 3.3 miles southeast of Deavertown, in Deerfield Township, about 2,660 feet east and 270 feet north of the southwest corner of sec. 8, T. 9 N., R. 12 W.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many coarse roots; medium acid; clear smooth boundary.

BE—7 to 12 inches; strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; many medium roots; many dark grayish brown (10YR 4/2) channel fillings; strongly acid; clear smooth boundary.

Bt1—12 to 17 inches; strong brown (7.5YR 4/6) silty clay loam; weak medium subangular blocky structure; friable; common medium roots; few faint brown (7.5YR 4/4) clay films on faces of peds; common dark grayish brown (10YR 4/2) channel fillings; strongly acid; clear smooth boundary.

2Bt2—17 to 24 inches; reddish brown (2.5YR 4/4) silty clay; weak medium subangular blocky structure; firm; few medium roots; few reddish brown (2.5YR 4/4) slickensides; many faint reddish brown (2.5YR 4/4) clay films on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; strongly acid; gradual smooth boundary.

2Bt3—24 to 31 inches; dark reddish brown (2.5YR 3/4) silty clay; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few medium roots; common dark reddish brown (2.5YR

3/4) slickensides; many faint dark reddish brown (2.5YR 3/4) clay films on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; medium acid; gradual smooth boundary.

2Bt4—31 to 39 inches; dark reddish brown (2.5YR 3/4) silty clay; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few medium roots; common red (2.5YR 5/6) slickensides; many faint dark reddish brown (2.5YR 3/4) clay films on faces of peds; slight effervescence; mildly alkaline; clear smooth boundary.

2BC—39 to 47 inches; dark reddish brown (2.5YR 3/4) silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; common fine flecks of light olive brown (2.5Y 5/6); few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; slight effervesence; mildly alkaline; clear smooth boundary.

2C—47 to 56 inches; variegated red (2.5YR 5/6), dark reddish brown (2.5YR 3/4), and light olive gray (5Y 6/2) silty clay loam; moderate medium angular blocky rock structure; firm; few distinct light gray (2.5Y 7/2) lime coatings in cleavages; strong effervesence; mildly alkaline; gradual wavy boundary.

2Cr—56 to 60 inches; light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) shale bedrock.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Depth to bedrock: 40 to 72 inches
Depth to carbonates: 31 to 60 inches
Thickness of the loess mantle: 14 to 26 inches
Content of rock fragments: Ap horizon—0 to 5 percent; Bt horizon—0 to 5 percent; 2Bt horizon—0 to 10 percent; 2C horizon—0 to 10 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam

Bt horizon:
Color—hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6
Texture—silt loam or silty clay loam

2Bt horizon:
Color—hue of 5YR, 2.5YR or 10R, value of 3 to 5, and chroma of 3 to 6
Texture—silty clay, clay, or silty clay loam

2C horizon:
Color—hue of 10R to 5Y or neutral, value of 3 to 6, and chroma of 0 to 6
Texture—silty clay loam, silty clay, or clay

Zanesville Series

Depth class: Deep and very deep
Drainage class: Moderately well drained
Permeability: Moderately slow or slow in the dense brittle layer
Parent material: Loess and residuum of sandstone and siltstone
Landform: Hillslopes on uplands
Slope: 2 to 12 percent
Adjacent soils: Gilpin, Wellston, Westgate, and Woodsfield
Taxonomic class: Fine-silty, mixed, mesic Typic Fragiudalfs

Typical Pedon

Zanesville silt loam, 2 to 6 percent slopes, about 0.25 mile south of Portersville, in Deerfield Township, about 520 feet north and 300 feet east of the southwest corner of sec. 19, T. 9 N., R. 13 W.:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; many medium and few fine roots; slightly acid; clear wavy boundary.

BE—5 to 10 inches; brown (10YR 5/3) silt loam; weak medium subangular blocky structure; friable; common fine roots; slightly acid; gradual wavy boundary.

Bt1—10 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; few distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; very strongly acid; clear wavy boundary.

Bt2—21 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common faint brown (10YR 5/3) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

Btx—26 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; strong coarse prismatic structure parting to moderate medium angular blocky; firm; slightly brittle; common fine roots; common faint dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) clay films on faces of peds; common faint brown (10YR 5/3) silt coatings on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; very strongly acid; clear smooth boundary.

2Bt—34 to 43 inches; yellowish brown (10YR 5/6) silty

clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; strong coarse prismatic structure parting to moderate medium angular blocky; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; 5 percent siltstone fragments; very strongly acid; gradual wavy boundary.

2BC—43 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; strong medium platy structure; firm; few fine roots; common distinct grayish brown (2.5Y 5/2) and dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (N 2/0) soft accumulations of iron oxide and manganese oxide; many soft siltstone fragments; 5 percent siltstone fragments; strongly acid; gradual wavy boundary.

2R—48 to 54 inches; fractured olive brown (2.5Y 4/4) siltstone bedrock.

Range in Characteristics

Thickness of the solum: 35 to 60 inches
Depth to bedrock: 40 to 72 inches
Depth to Btx horizon: 20 to 32 inches
Thickness of the loess mantle: 24 to 40 inches
Content of rock fragments: Ap horizon—0 to 2 percent; Bt horizon—0 to 2 percent; Btx horizon—0 to 10 percent; 2Bt horizon—5 to 15 percent

Ap horizon:
Color—hue of 10YR, value of 4 or 5, and chroma of 2 to 4
Texture—silt loam

Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6
Texture—silt loam, silty clay loam

Btx horizon:
Color—hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6
Texture—silty clay loam or clay loam

2Bt horizon:
Color—hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6
Texture—silty clay loam or clay loam

The Zanesville soils in this county do not have the well defined fragipan as defined in the range for the series. This difference, however, does not significantly affect the use or management of the soils.

Formation of the Soils

This section describes the major factors of soil formation. It tells how these factors have affected the soils of Morgan County and explains some of the processes of soil formation.

Factors of Soil Formation

Soils are the product of soil-forming processes acting on material deposited or accumulated by geologic forces. The major factors in soil formation are parent material, climate, relief, living organisms, and time.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on the parent material is modified by relief and by the length of time the parent material has been acted upon. The relative importance of each factor differs from place to place. In some places, one factor dominates and determines most of the soil properties, but normally the interaction of all five factors determines what kind of soil forms in any given place.

Parent Material

The soils of Morgan County formed in several kinds of parent material: residuum, colluvium, loess, a combination of these materials and lacustrine sediments, and alluvium.

Residuum from shale, sandstone, siltstone, and limestone bedrock is the most extensive parent material in the county. Limestone and shale residuum is fine textured. Lowell, Guernsey, and Upshur soils formed in this material and have a fine textured subsoil. Residuum weathered from siltstone and fine grained sandstone is medium textured. Gilpin and Westmoreland soils formed in this material and have a medium textured subsoil. Steinsburg soils formed in residuum weathered from medium or coarse grained sandstone and have a medium or coarse textured subsoil.

In some areas, the upper part of the subsoil formed in loess. This silty, windblown material is as much as 48 inches deep over residuum. Wellston, Westgate, Woodsfield, and Zanesville soils are examples of soils that are partly covered by loess.

Colluvium is weathered residuum and soil material that has been moved downslope. The soils on the middle and lower parts of long hillsides show the effects of colluvial action. These soils formed in both residuum and colluvium. They are deeper to bedrock and have rock fragments tilted at various angles. Downslope movement results from gravity, water action, animal activity, and frost action over long periods.

Mine spoils from surface mining for coal are a mixture of partly weathered fine earth and fragments of shale, siltstone, sandstone, and limestone that were piled up or graded in surface mining for coal. Bethesda, Barkcamp, and Morristown soils formed in mine spoils from surface mining for coal dominated by fragments of rock with some sand, silt, and clay. A few areas of Morristown soils have been reclaimed with 1 to 3 feet of stockpiled soil material.

Areas of lacustrine sediments or old alluvium are on terraces along Wolf Creek, Meigs Creek, Olive Green Creek, and tributaries of Federal Creek. Most of these soils are medium textured or fine textured in the subsoil. Glenford, Euclid, Licking, and Markland soils are on terraces.

Glacial outwash was deposited along the Muskingum River as meltwater as the last Wisconsinan glacier breached a divide in the northern part of Morgan County. The meltwater deposited coarse textured gravelly material at the higher terraces and silty material at the lower terraces. Conotton and Chavies soils formed in these materials.

Alluvium, or floodwater deposits, is the youngest parent material in the county. Alluvium is still accumulating as overflowing streams add fresh sediment. The sediment is from the surface layer of higher lying soils in the county. Nolin and Newark soils formed in alluvium.

A few areas of old alluvium covered by loess remain in deeply dissected, preglacial, valley fills. Omulga soils are medium textured in the subsoil and are at the higher elevations near Beverly.

Climate

The climate of Morgan County is so uniform as not to have contributed greatly to differences among the soils. It has favored both physical change and chemical weathering of parent materials and the activity of living organisms.

Rainfall has been adequate to leach carbonates in the parent material from the solum of most soils, for example, Conotton soils. Frequency of rainfall caused wetting and

drying cycles favorable to the translocation of clay minerals and the formation of soil structure, as in Guernsey and Woodsfield soils.

The range of temperature variations has favored both physical change and chemical weathering of the parent materials. Freezing and thawing aided the formation of soil structure. Warm temperatures in summer favored chemical reactions in the weathering of primary minerals.

Rainfall and temperature have been conducive to plant growth and the accumulation of organic matter in all soils. More information about the climate is available the section "General Nature of the County."

Relief

Relief, along with parent material, affects the natural drainage of soils. It influences the amount of runoff and the depth to the ground water table. Water that runs off sloping soils collects in depressions or is removed through the drainage system. Therefore, from an equal amount of rainfall, sloping soils receive less total water and the depressional soils more total water than flat, 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.

Relief can account for the formation of different soils from the same kind of parent material. For this reason, relief is commonly a dominant factor in differentiating soil series. Newark and Nolin soils, for example, both formed in alluvium. The well drained Nolin soils are in higher positions on flood plains. In Newark soils the seasonal high water table generally is not close to the surface. The somewhat poorly drained Newark soils are in lower positions on flood plains. In Nolin soils the water table generally is close to the surface during extended wet periods.

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 hardwood forest of oak, hickory, maple, yellow-poplar, and ash. Lowell, Guernsey, and other 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 and make it more permeable. Animals also mix the soil material and contribute organic matter. Worm channels, or wormcasts, are common in the surface layer of Elba, Lowell, and other well drained soils. Crawfish have made channels in Claysville, Newark, and other somewhat poorly drained soils.

Examples of human activities are cultivation, seeding, installing drainage systems, cutting and filling, surface mining, and liming and fertilizing. Liming and fertilizing affect soil chemistry.

Time

Time is needed for the other factors of soil formation to produce their affects. The age of a soil is indicated, to some extent, by the degree of soil development. If the parent material weathers slowly, the profile forms more slowly. In many areas, however, factors other than time have been responsible for most of the differences in the kind and distinctness of layers in the different soils.

Most soils in the county are old and have a strongly expressed profile. The youngest soils formed in spoils of surface mines for coal. They are Barkcamp, Bethesda, and Morristown soils. On flood plains, deposits of fresh sediment periodically interrupt soil formation. As a result, Nolin and Newark soils do not have a strongly expressed profile.

Processes of Soil Formation

Most soils in Morgan County have a strongly expressed profile. In most soils the processes of soil formation have distinctly changed the parent material. These are soils on uplands, including ridgetops, hillsides, benches, foot slopes, and terraces along the major streams. In contrast, the parent material on flood plains and in areas surface mined for coal is only slightly modified.

All the factors of soil formation combine in controlling the processes that form different layers in the soil. These processes are additions, removals, transfers, and transformations (*9*). Some processes result in differences among the surface layer, subsoil, and substratum.

In Morgan County the addition of organic matter to the surface layer has been a significant addition to the soils. A thin layer of organic matter accumulates under forest vegetation. If the soil is cleared and cultivated, organic matter is mixed with the underlying mineral material. However, in Elba, Upshur, and some other eroded soils, nearly all additions of organic matter have been removed.

The leaching of carbonates from calcareous parent materials has been a significant removal from the soils. It precedes many other chemical changes in the soil. Conotton soils formed in calcareous, gravelly glacial outwash deposited about 14,000 to 18,000 years ago along the Muskingum River. In those soils rainfall has leached calcium carbonates to lower horizons. Today, most soils on uplands do not have carbonates within 5 feet of the surface; thus, they are very strongly acid to

medium acid in the subsoil. Other minerals in the soils are subject to chemical weathering of leaching, but their resistance is higher and their removal is slower.

Seasonal wetting and drying of 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 particles are suspended in the percolating water moving through the surface layer. They are then deposited in the subsoil. This transfer of fine clay accounts for the common clay films on the faces of peds in the subsoil of most soils on uplands and terraces.

Following the removal of carbonates, alteration of such minerals as biotite and feldspar produces color changes and free iron oxides in the subsoil. If iron oxides are segregated by a fluctuating high water table, the result is gleying indicated by different shades of gray. Examples of gleying are the moderately well drained Guernsey and Licking soils and in somewhat poorly drained Euclid and Newark soils.

Transformations of mineral compounds occur in most soils. The results are apparent in the formation of layers not affected by rapid erosion or by accumulation of material at the surface. When the silicate minerals are weathered chemically, secondary 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.

Aeration sewage disposal system. Any system which utilizes the principal of oxidation in the decomposition of sewage by the introduction of air into the sewage or by surface absorption of air for a sufficient period of time to effect adequate treatment.

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 or miscellaneous areas 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, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock control. Configuration and relief of a landform 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.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

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.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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.

Cobble (or cobblestone). 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 or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

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. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.* These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated

through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, 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.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

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. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, 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. 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 of 6.6 to 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.

Outslope. The exposed area sloping away from a bench cut section in strip mining.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Perimeter drain. 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 or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains 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.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
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 generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of

alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

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 that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

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 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, considered collectively. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving because of differentia settling or sloughing on banks of fill material.

Upland. 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.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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 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.