United States
Department of
Agriculture

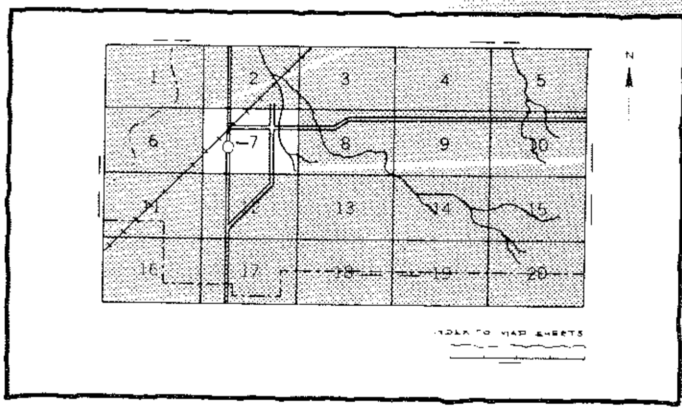
Soil
Conservation
Service

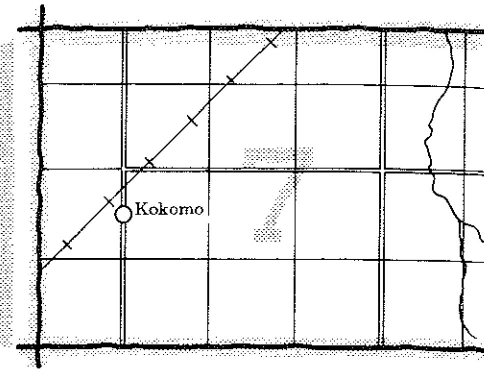
In cooperation with the
Ohio Department of Natural
Resources, Division of Lands
and Soil; and the Ohio
Agricultural Research and
Development Center

Soil Survey of Tuscarawas County, Ohio

HOW TO U

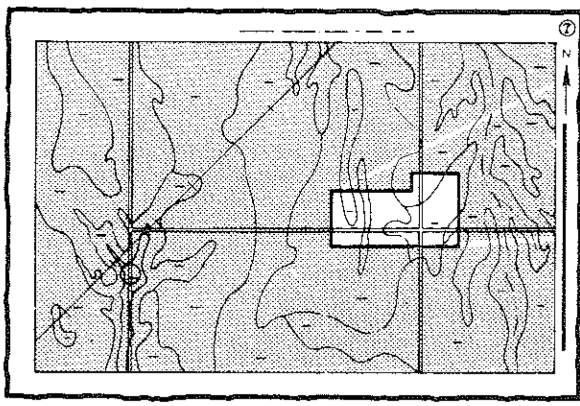
1. Locate your area of interest on the "Index to Map Sheets."

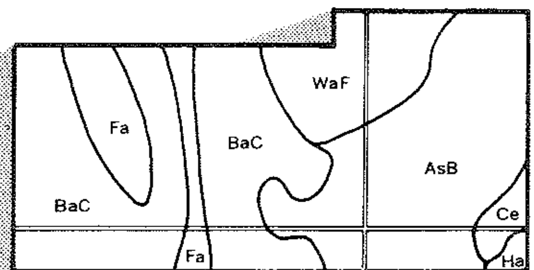




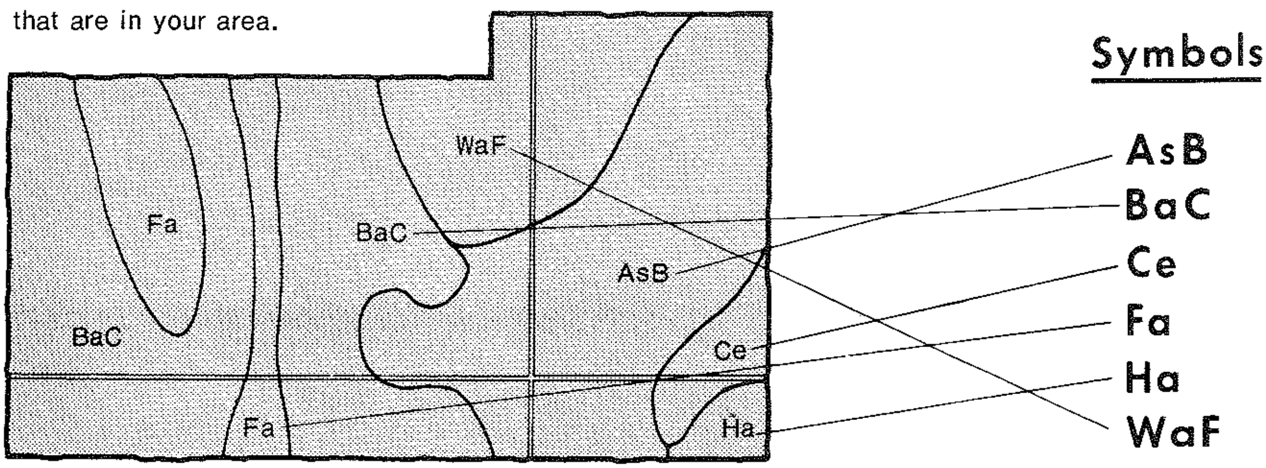
2. Note the number of the map sheet and turn to that sheet.

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



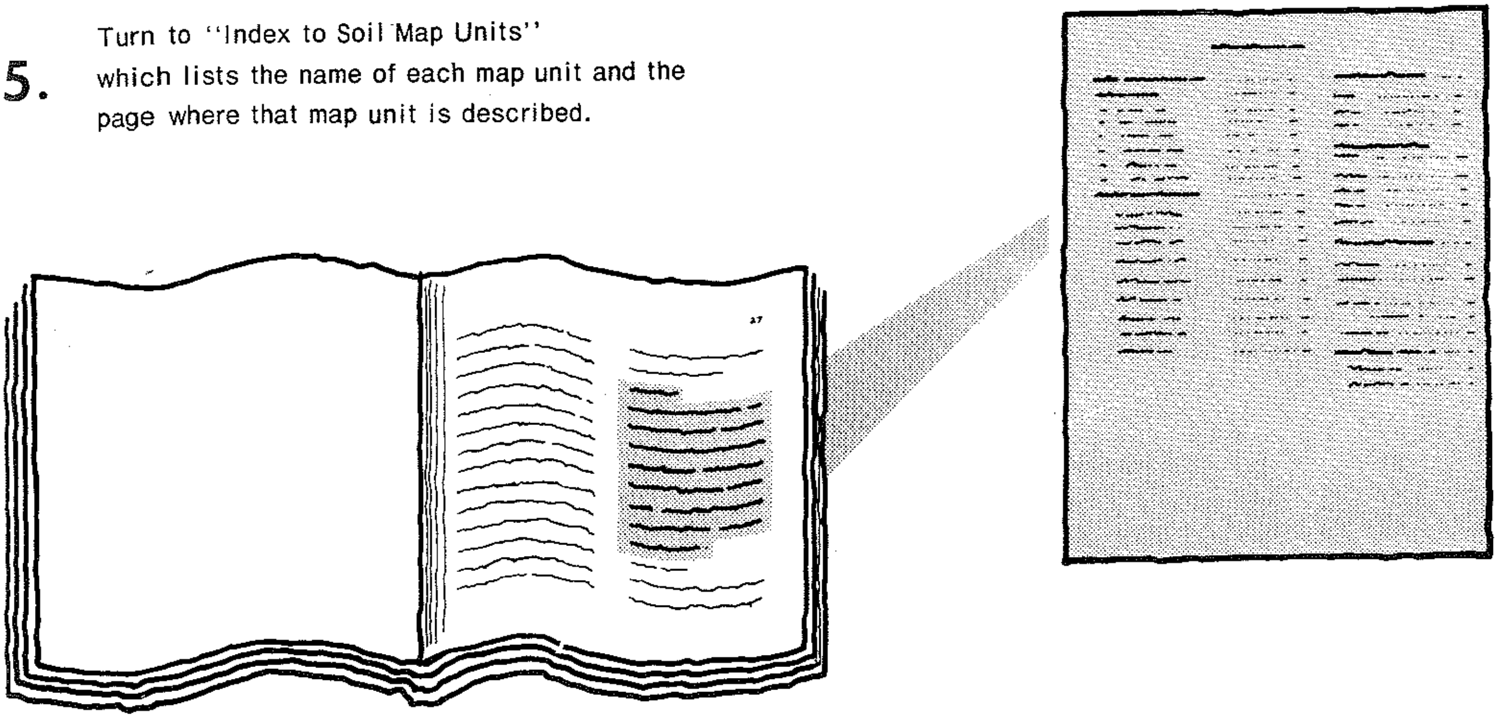


4. List the map unit symbols that are in your area.

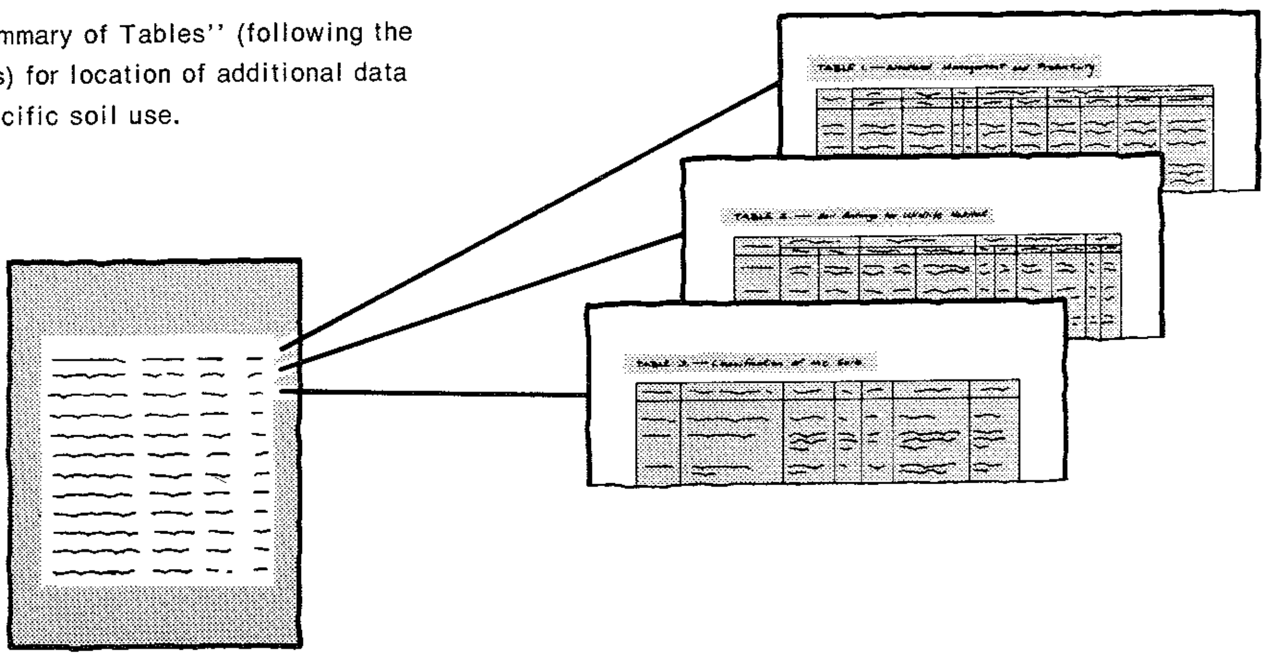


HIS SOIL SURVEY

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



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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Lands and Soil; and the Ohio Agricultural Research and Development Center. It was materially aided by funds provided by the Tuscarawas County Commissioners. It is part of the technical assistance furnished to the Tuscarawas Soil and Water Conservation District.

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

Cover: A small stream valley. Glenford, Fitchville, and Sebring soils are in the foreground. Westmoreland and Guernsey soils are on the hillsides in the background.

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Soil Series

Issued March 1986

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Summary of Tables

Foreword

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

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

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

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

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Soil Survey of
Tuscarawas County, Ohio

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

General Nature of the County

Tuscarawas County is in the east-central part of Ohio (fig. 1). It has a total area of about 364,160 acres, or 569 square miles. In 1980, the population was almost 85,000. New Philadelphia, near the center of the county, is the county seat.

Industry and farming are the major enterprises in the county; however, woodland is one of the dominant land uses. Other land uses include residential and recreational development. Industry is diversified and includes manufacturing of steel, chemicals, and vitrified clay products. Farm income is dominantly from dairy products, cash grain, and the sale of livestock. The major crops include corn, wheat, soybeans, oats, and hay, as well as vegetables and fruit.

Most of the soils on outwash terraces are well suited to farming and community development. If well managed, these soils are highly productive. Poor natural drainage is the major limitation affecting farming and community development on the soils on slack water terraces. If adequately drained, these soils can be highly productive. Erosion, slope, hillside slippage, high shrink-swell potential, moderate depth to bedrock, and slow permeability are the major limitations on strongly sloping to very steep soils.

This survey updates the soil survey of Tuscarawas County published in 1953 (*16*). It provides additional information and larger maps, which show the soils in greater detail.

Climate

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

Tuscarawas County is cold in winter but quite hot in summer. The winter precipitation, frequently in the form of snow, results in a good accumulation of soil moisture by spring and minimizes drought during the summer in most soils. Normal annual precipitation is adequate for all crops that are adapted to the temperature and length of the growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at New Philadelphia, Ohio, in the period 1960 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 18 degrees. The lowest temperature on record, which occurred at New Philadelphia on January 18, 1977, is 18 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred on July 4, 1966, is 99 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

Figure 1.—Location of Tuscarawas County in Ohio.

between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 22 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.50 inches at New Philadelphia on July 5, 1969. Thunderstorms occur on about 36 days each year, and most occur in summer.

The average seasonal snowfall is about 37 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 10 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 70 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in winter.

Settlement

The Tuscarawas River Valley was originally inhabited by a tribe of Delaware Indians (*8*). In 1772, a band of missionaries, led by David Zeisberger, arrived at the banks of the Tuscarawas River in Ohio. They laid out Schoenbrunn, the first settlement in the Northwest Territory attempted under civil government (*9*). They also built the first schoolhouse west of the Alleghenies. Schoenbrunn declined after the American Revolution. In 1798, Zeisberger laid out Goshen, which became a thriving Indian mission. It declined during the War of 1812 and was abandoned in 1824.

Fort Laurens, near Bolivar, was built during the American Revolution to guard against Indians allied with the British. It was the only fort in Ohio during the American Revolution. It was abandoned in 1779. The site is maintained as a state memorial.

Extensive settlement, in what is now Tuscarawas County, began in 1795, after the Treaty of Greenville. Tuscarawas County was formed from the Territory of Muskingum by an act of the state legislature in 1808. The population was about 1,000. Old Indian trails helped to open the county for settlement by pioneers from Pennsylvania, Virginia, and other Eastern States (*15*). Examples are the Muskingum Trail, along which the Ohio-Erie Canal was built, and the Moravian Trail, which provided a direct route from Pittsburgh.

In 1817, an experiment in communal living was undertaken at the village of Zoar by 300 Separatists from Wurttenburg, Germany. In 1898, the Society was dissolved, but many of the buildings have been restored and are open to visitors.

During the early 1820's, the Amish began to settle in Ohio. The Ohio Amish Community extends into Tuscarawas County in the Sugar Creek-Baltic area.

The Ohio-Erie Canal, built between 1825 and 1832, played an important part in the growth of the county. It linked Tuscarawas County with larger cities to the north. The once heavily traveled canal ran along the Tuscarawas River from Bolivar, at the northern end of the county, to Newcomerstown, at the southern end. Within 30 years, the population of the county more than doubled to about 30,000.

Farming

Farming in Tuscarawas County is oriented toward livestock. Dairy products accounted for 53 percent of the total farm income in 1979 (*4*). The sale of cattle accounted for 16 percent; poultry, 9 percent; corn, 8 percent; hogs, 3 percent; greenhouse and nursery plants, 3 percent; soybeans, 2 percent; and miscellaneous livestock, 2 percent. Sales from other enterprises accounted for 4 percent.

In 1979, farmland occupied 166,000 acres, or about 46 percent of the total acreage in the county (*7*). The county had 1,010 farms, which averaged 164 acres in size. Milk cows numbered 10,600; cattle and calves, 29,500; hogs, 8,100; and sheep, 3,000. The number of milk cows, cattle, and calves has remained constant over the past 10 years, whereas the number of sheep and hogs has decreased (*5*).

In 1979, about 25,200 acres of corn was harvested for grain and 4,200 acres was used for soybeans, 4,500 acres for wheat, 3,000 acres for oats, and 28,400 acres for hay. In the last 10 years, the acreage used for corn has increased by about 10,000 acres, soybeans by 2,900 acres, and hay by 5,200 acres. The recent trend is toward large farms used for crops, fewer acres used for small grain, and cropping the more sloping land by conservation tillage methods.

Geology

All of Tuscarawas County is unglaciated, except for a small area of Wisconsin drift in the northwest corner. The county is within the western part of the Allegheny Plateau.

Pottsville, Allegheny, and Conemaugh bedrock formations of the Pennsylvanian System are exposed in the county. The strata comprising these formations are sandstone, shale, coal, clay, limestone, and iron ore. The Pottsville Formation is confined to the northwestern two-thirds of the county. In Tuscarawas County only the upper half of it is above the present stream level. The Allegheny Formation crops out in every township. It is the most important among the exposed formations as a source of coal, clay, and shale. The Conemaugh Formation crops out in every township in the county, except for Wayne and Franklin Townships, in the northwestern part.

Sand and gravel outwash of the Wisconsin Age is confined chiefly to the valleys of the Tuscarawas River, Sandy Creek, and Sugar Creek.

Alluvial deposits are in the valleys of Conotton Creek, Beaverdam Creek, Stillwater Creek, and Little Stillwater Creek. The deposits are from the watersheds of these streams to the east and southeast. They are chiefly silt and clay. Similar deposits are in many valleys along the tributaries west of the Tuscarawas River. These tributaries include Buckhorn, Oldtown, and Stone Creeks and the South Fork of Sugar Creek.

Physiography, Relief, and Drainage

Most of Tuscarawas County is in the unglaciated part of the Allegheny Plateau, except for the northwest corner, which was glaciated during the Wisconsin Age. Most areas in the southern and eastern parts of the county are thoroughly dissected by drainageways that have cut deep valleys and left narrow ridgetops. In the western part of the county, the hills are not so steep as those of the dissected parts. The highest point in the county, about 1,340 feet above sea level, is in Auburn Township. The lowest point, about 795 feet, is at Newcomerstown.

Tuscarawas County is in the Muskingum Watershed Conservancy District. The Tuscarawas River and its tributaries drain the county. The Tuscarawas River enters the county near Bolivar, flows southeast to Zoarville, and then southwest through Dover and New Philadelphia. It leaves the county at Newcomerstown. Stillwater Creek drains the southeastern part of the county. It flows to the northwest and joins the Tuscarawas River near Midvale. Sugar Creek drains the northwestern part of the county. It flows to the southeast and joins the Tuscarawas River at Dover. Many smaller creeks and streams drain into these two tributaries or directly into the Tuscarawas River.

Recreation

Recreational activities in Tuscarawas County include hunting, fishing, swimming, camping, canoeing, boating, golf, tennis, hiking, horseback riding, and bicycling. Many of these activities are available in the Atwood Lake area, in the northeastern part of the county. Public recreation areas make up about 1 percent of the acreage in the county.

Numerous tourist attractions include the restored village at Schoenbrunn, the outdoor drama "Trumpet in the Land," the Warther Museum, Fort Laurens, Zoar Village, and the Sugar Creek-Amish Community. Most communities have parks and offer organized sports activities.

Water Supply

Most water for household and industrial use is obtained from wells drilled into bedrock formations and outwash of sand and gravel. Large aquifers are in the sand and gravel deposits. New Philadelphia and the larger cities are supplied by public water systems, which obtain water from deep wells in the sand and gravel deposits. Some parts of the county are supplied by water from streams. Most wells drilled into the bedrock formations yield 2 to 5 gallons per minute. Hillside springs and streams also provide water for livestock.

Although some areas used for special crops are irrigated, irrigation of field crops is not common in the county.

Urban Trends

One environmental factor that affects soil use in Tuscarawas County is the pressure of urban development, or the demand for areas that can be used as homesites or commercial and industrial sites. Most of the new urban development is on or near the outwash terraces adjacent to New Philadelphia and Dover. Wilkshire Hills, in the northern part of the county, occupies about 500 acres of former farmland. New houses are also built along roads near villages, but the urban development is not extensive.

Transportation Facilities

Tuscarawas County is well served by hard-surfaced, all-weather highways. Interstate 77 runs north and south through the county. U.S. Highway 36 runs northeast and southwest through the southern part. U.S. Highway 250 runs east and west through the east-central part of the county and north and south through the northwestern part.

State highways intersecting with these interstate and state highways provide access to all parts of the county. State Route 39 runs east and west through the center of the county. State Route 800 runs north and south through the eastern part. State Route 258 runs east and west and serves the southernmost part of the county. State Route 516, which runs northwest and southeast, and State Route 93, which runs north and south, are in the northwestern part of the county. State Route 416 runs north and south through the center of the county. State Route 212 runs southeast and northwest through the northeastern part. Most county roads are hard-surfaced, all-weather roads, and most township roads have improved surfaces.

Two railroad lines provide service. The New Philadelphia Municipal Airport provides charter and freight service but does not offer commercial passenger service.

Farm products are usually transported by truck to an elevator or market.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Westmoreland-Hazleton-Coshocton Association

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

This association consists of soils on ridgetops and hillsides. Most side slopes are long, and some have benches. Springs and seeps characterize many of the benches. Most areas are drained by small streams. Deep ravines are in some of the steeper areas. Slopes range from 8 to 60 percent.

This association makes up about 27 percent of the county. It is about 45 percent Westmoreland soils, 25 percent Hazleton soils, 10 percent Coshocton soils, and 20 percent soils of minor extent.

The strongly sloping to very steep Westmoreland soils are well drained and medium textured. They are on hillsides and ridgetops. Permeability and the available water capacity are moderate. The content of organic matter is moderate or moderately low.

The strongly sloping to very steep Hazleton soils are well drained, medium textured, and channery. They are on hillsides and ridgetops. In places boulders are on the surface. Permeability is rapid or moderately rapid. The available water capacity is low. The content of organic matter is moderately low.

The strongly sloping to steep Coshocton soils are medium textured and moderately well drained. They are on ridgetops and hillsides characterized by seeps and springs. In places stones are on the surface. Permeability is moderately slow or slow. The available water capacity is moderate or high. The content of organic matter is moderate.

The most extensive minor soils in this association are Guernsey soils, which have more clay in the subsoil than the major soils and are on ridgetops and hillsides; Bethesda soils, in areas that have been surface mined; and the somewhat poorly drained Orrville soils on narrow flood plains.

This association is used dominantly for woodland. Some areas are pastured, and some of the less sloping areas are used for corn and hay. The steeper soils are poorly suited or generally unsuited to pasture and cropland. The less sloping soils are moderately well suited or poorly suited to these uses. The steeper soils are well suited or moderately well suited to woodland. The slope and the hazard of erosion are the dominant limitations. Establishing trees is more difficult on the south-facing slopes.

The strongly sloping soils are moderately well suited to buildings and septic tank absorption fields. The moderately steep to very steep soils are poorly suited or generally unsuited to these uses. The Westmoreland soils are better suited to buildings and septic tank absorption fields than the Coshocton and Hazleton soils. The slope is the main limitation. The wetness, moderately slow and slow permeability, and moderate shrink-swell potential of the Coshocton soils and the poor filtering capacity and boulders in the Hazleton soils also are limitations affecting these uses.

2. Coshocton-Bethesda-Guernsey Association

Deep, nearly level to very steep, moderately well drained and well drained soils formed in residuum and colluvium derived from siltstone, shale, sandstone, and limestone and in material in surface mined areas; on uplands

This association consists of soils on ridgetops and hillsides. Spoil ridges and clifflike walls of exposed bedrock are distinctive features of the landscape. The walls of exposed bedrock are 50 to 100 feet high. They are the result of the latest excavation into the hillside.

Springs and seeps are in areas of the Coshocton and Guernsey soils. Slopes range from 0 to 70 percent.

This association makes up about 22 percent of the county. It is about 30 percent Coshocton soils, 30 percent Bethesda soils, 20 percent Guernsey soils, and 20 percent soils of minor extent.

The gently sloping to steep Coshocton soils are moderately well drained and medium textured. They are on ridgetops and hillsides. In places stones are on the surface. Permeability is moderately slow or slow. The available water capacity is moderate or high. The content of organic matter is moderate.

The nearly level to very steep, channery Bethesda soils are well drained and moderately fine textured. They are on spoil ridges and side slopes. Permeability is moderately slow. The available water capacity is low. The content of organic matter is very low. These soils are subject to hillside slippage.

The gently sloping to steep Guernsey soils are moderately well drained and medium textured. They are on ridgetops and hillsides. In places stones are on the surface. Permeability is moderately slow or slow. The available water capacity is moderate. The content of organic matter is moderate or moderately low. The shrink-swell potential is high. These soils are subject to hillside slippage.

The most extensive minor soils in this association are Morristown soils on spoil ridges, Glenford soils on slack water terraces along streams, and Rigley and Hazleton soils on hillsides and ridgetops. Morristown soils have been reclaimed. They have a higher lime content throughout than the major soils. Glenford soils have more silt in the upper part than the major soils, and Rigley soils have more sand in the subsoil. Hazleton soils have a higher content of coarse fragments in the subsoil than the Coshocton soils and a deeper root zone than the Bethesda soils.

This association is used for cropland, pasture, and woodland. Some areas that were strip mined have been left to natural reseeding. The Bethesda soils are generally unsuited to cultivated crops and are poorly suited or generally unsuited to hay and pasture. Though the slope and the irregular shape of some areas are limitations, the Coshocton and Guernsey soils are better suited to cropland than the Bethesda soils. They are well suited to woodland. The less sloping soils are well suited to pasture, but the steep soils are poorly suited.

The Coshocton and Guernsey soils are better suited to buildings and septic tank absorption fields than the Bethesda soils. Onsite investigations are needed to determine the suitability of specific areas of the Bethesda soils for these uses. Cutting and filling in the Bethesda soils and in the moderately steep and steep Guernsey soils increase the hazard of hillside slippage. The slope, seasonal wetness, the shrink-swell potential, and the slow or moderately slow permeability limit the use of the Coshocton and Guernsey soils as sites for buildings and septic tank absorption fields.

3. Berks-Coshocton-Westmoreland Association

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

This association consists of soils on ridgetops and side slopes dissected by drainageways. The ridgetops are generally long and narrow. Most of the side slopes are long, and some have benches. Slopes range from 8 to 70 percent.

This association makes up about 20 percent of the county. It is about 50 percent Berks soils, 15 percent Coshocton soils, 10 percent Westmoreland soils, and 25 percent soils of minor extent.

The moderately deep, strongly sloping to very steep, shaly Berks soils are medium textured and well drained. They are mainly on hillsides and, to a lesser extent, on ridgetops. Permeability is moderate or moderately rapid. The available water capacity is very low. The content of organic matter is moderate or moderately low.

The deep, strongly sloping to steep Coshocton soils are medium textured and moderately well drained. They are mainly on the lower part of side slopes and on some ridgetops. Springs and seeps are in areas of these soils. In places stones are on the surface. Permeability is moderately slow or slow. The available water capacity is moderate or high. The content of organic matter is moderate.

The deep, strongly sloping to very steep Westmoreland soils are medium textured and well drained. They are mainly on side slopes and, to a lesser extent, on ridgetops. Permeability and the available water capacity are moderate. The content of organic matter is moderate or moderately low.

The most extensive minor soils in this association are Bethesda soils, in areas that have been surface mined; Guernsey soils, which have more clay in the subsoil than the major soils and are on side slopes and ridgetops; and the somewhat poorly drained Orrville soils on narrow flood plains.

Most areas of this association are used for woodland. Some of the wider ridgetops and the lower parts of some side slopes are used for corn, small grain, hay, and pasture. The soils on the lower part of side slopes and on ridgetops are moderately well suited or poorly suited to cultivated crops and small grain and well suited or moderately well suited to hay and pasture. The major soils are moderately well suited or well suited to woodland. The slope, the hazard of erosion, and droughtiness are the major concerns of management. Establishing trees is more difficult on the Berks soils than on the other major soils because of droughtiness and the large amount of rock fragments.

The strongly sloping and moderately steep soils are moderately well suited or poorly suited to buildings and septic tank absorption fields. The steeper soils are generally unsuited. The main limitations are the moderate depth to bedrock in the Berks soils, the seasonal wetness and shrink-swell potential of the Coshocton soils, and the slope of all the major soils. The bedrock commonly is rippable.

4. Guernsey-Westmoreland-Berks Association

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

This association consists of soils on ridgetops and side slopes characterized by small intermittent drainageways and some springs, seeps, and slips. Slopes range from 3 to 40 percent.

This association makes up about 3 percent of the county. It is about 60 percent Guernsey soils, 15 percent Westmoreland soils, 10 percent Berks soils, and 15 percent soils of minor extent.

The deep Guernsey soils are moderately well drained and medium textured. They are on ridgetops and the upper part of side slopes. In places stones are on the surface. Permeability is moderately slow or slow, and the available water capacity is moderate. The content of organic matter is moderate or moderately low. The shrink-swell potential is high. These soils are subject to hillside slippage.

The deep Westmoreland soils are well drained and medium textured. They are on ridgetops and side slopes. Permeability and the available water capacity are moderate. The content of organic matter is moderate or moderately low.

The moderately deep, shaly Berks soils are well drained and medium textured. They are on ridgetops and the upper part of side slopes. Permeability is moderate or moderately rapid. The available water capacity is very low. The content of organic matter is moderate or moderately low.

The most extensive minor soils in this association are Keene soils, which are more silty in the upper part of the subsoil than the major soils and are on ridgetops, and the somewhat poorly drained Orrville soils on narrow flood plains.

This association is used for cropland, pasture, and woodland. Because of the deeper root zone and higher available water capacity, the Guernsey and Westmoreland soils are better suited to these uses than the Berks soils. The less sloping soils are well suited or moderately well suited to corn, small grain, hay, and pasture, and the steeper soils are poorly suited or generally unsuited to these uses. The major soils are well suited or moderately well suited to woodland. The slope, the hazard of erosion, and droughtiness are the major concerns of management. Establishing trees is more difficult on the Berks soils than on the other major soils because of droughtiness and the large amount of rock fragments.

The gently sloping and strongly sloping soils are moderately well suited to buildings and moderately well suited or poorly suited to septic tank absorption fields. The steeper soils are poorly suited or generally unsuited to these uses. The main limitations are the moderate depth to bedrock of the Berks soils; the seasonal wetness, moderately slow or slow permeability, and high shrink-swell potential of the Guernsey soils; and the slope of all the major soils. The Guernsey soils are also subject to hillside slippage.

5. Fitchville-Glenford-Orrville Association

Deep, nearly level to strongly sloping, somewhat poorly drained and moderately well drained soils formed in lacustrine sediments and alluvium; on slack water terraces and flood plains

This association is on valley floors. It consists of soils on slack water terraces and flood plains along perennial streams. Some short, steep slopes are between the slack water terraces and the flood plains. Slopes range from 0 to 15 percent.

This association makes up about 18 percent of the county. It is about 45 percent Fitchville soils, 15 percent Glenford soils, 15 percent Orrville soils, and 25 percent soils of minor extent.

The nearly level and gently sloping Fitchville soils are somewhat poorly drained and medium textured. They are on the flatter parts of the slack water terraces. Permeability is moderately slow, and the available water capacity is high. Organic matter content is moderate.

The gently sloping and strongly sloping Glenford soils are moderately well drained and medium textured. They are on the more sloping parts of the slack water terraces. Permeability is moderately slow, and the available water capacity is moderate or high. The content of organic matter is moderate.

The nearly level Orrville soils are somewhat poorly drained and medium textured. They are on flood plains along small perennial streams. Permeability is moderate. The available water capacity is moderate or high. The content of organic matter is moderate. These soils are occasionally flooded.

The most extensive minor soils in this association are the well drained Nolin and Tioga soils on the flood plains; the poorly drained Sebring and Canadice soils in the lowest positions on the slack water terraces; Coshocton soils, which formed in colluvium and residuum on the slope breaks to the uplands; and Caneadea soils, which have more clay in the subsoil than the major soils and are on the slack water terraces.

Most of this association is used for cropland. Some areas are used for pasture, and a few are used for woodland. Corn, soybeans, and small grain are the main crops. The soils are well suited or moderately well suited to corn and soybeans. They are well suited to hay, pasture, and woodland. Because of the hazard of flooding, the Orrville soils are not so well suited to small grain as the Fitchville and Glenford soils. The hazard of flooding on the Orrville soils, the wetness of the Fitchville and Orrville soils, and the hazard of erosion on the Glenford and Fitchville soils are the main limitations. The surface layer of these soils crusts after heavy rains.

The Glenford soils are moderately well suited to buildings and septic tank absorption fields, but the Fitchville soils are poorly suited and the Orrville soils are generally unsuited. The Fitchville and Glenford soils are better suited to dwellings without basements than to dwellings with basements. The seasonal wetness of all three soils, the moderately slow permeability of the Fitchville and Glenford soils, and the hazard of flooding of the Orrville soils are the main limitations.

6. Wheeling-Chili-Tioga Association

Deep, nearly level to strongly sloping, well drained soils formed in loamy material, glacial outwash, and alluvium; on outwash terraces and flood plains

This association is on broad flats in the wider valleys in the county. The outwash terraces occur as benches above the flood plains. Short, steep slopes and escarpments are between terrace levels and on the breaks between the outwash terraces and flood plains. Slopes range from 0 to 15 percent.

This association makes up about 10 percent of the county. It is about 20 percent Wheeling soils, 20 percent Chili soils, 10 percent Tioga soils, and 50 percent soils of minor extent.

The nearly level Wheeling soils are well drained and medium textured. They are on outwash terraces. Permeability is moderate in the subsoil and rapid in the substratum. The available water capacity is moderate. The content of organic matter also is moderate.

The nearly level to strongly sloping Chili soils are well drained and medium textured. They are on outwash terraces. Permeability is moderately rapid. The available water capacity is moderate or low. The content of organic matter is moderate or moderately low.

The nearly level Tioga soils are well drained and medium textured. They are in the highest positions on the flood plains and are occasionally flooded. Permeability is moderate or moderately rapid. The available water capacity is moderate. The content of organic matter also is moderate.

The most extensive minor soils in this association are the excessively drained Plainfield and Sparta soils; the somewhat poorly drained Weinbach and Orrville soils; Conotton soils, which have more rock fragments in the subsoil than the major soils; and Nolin soils, which have more clay and less sand in the subsoil. Plainfield, Sparta, and Conotton soils are on the stream and outwash terraces. Weinbach soils are on flats and in slight depressions on the outwash terraces. Orrville and Nolin soils are on the flood plains. Areas of Urban land are also in this association.

This is the most intensively cropped association in the county. Row crops are grown year after year. Small areas are used for pasture, woodland, and specialty crops, such as strawberries and melons. This association is well suited or moderately well suited to cropland and pasture. It is well suited to woodland. The Chili and Wheeling soils are well suited to planting early in spring. Because they are subject to flooding, the Tioga soils are better suited to the crops planted after the normal period of flooding than to the crops planted early in the spring. The droughtiness and hazard of erosion on the Chili soils and the hazard of flooding on the Tioga soils are the main limitations.

Some areas are used for urban development. The Chili and Wheeling soils are well suited or moderately well suited to buildings and septic tank absorption fields, but the Tioga soils are generally unsuited. The hazard of flooding on the Tioga soils and the slope of the Chili soils are the main limitations. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. This association is a source of sand and gravel.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Coshocton silt loam, 3 to 8 percent slopes, is one of several phases in the Coshocton series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Coshocton-Guernsey silt loams, 8 to 15 percent slopes, is an example.

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

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

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

BeB—Berks silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, well drained soil is on ridgetops in the uplands. Areas are long and narrow or oblong and are 5 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is yellowish brown, friable channery silt loam and very channery loam about 28 inches thick. Sandstone bedrock is at a depth of about 35 inches. In places the soil has more sand in the subsoil and is more than 40 inches deep.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils near the edges of ridgetops. A few seeps and springs are in these areas. Included soils make up about 15 percent of most mapped areas.

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

Most of the acreage is used as pasture or cropland. This soil is moderately well suited to corn and hay. It is well suited to the pasture. It is droughty and subject to erosion. If the soil is cultivated, plowed during seedbed preparation, or overgrazed, it has a moderate hazard of erosion. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops conserve moisture, reduce the runoff rate, and help to control erosion.

Some areas are wooded. This soil is moderately well suited to woodland. Seedling mortality is the main concern in managing woodland. It can be controlled by selecting drought-tolerant trees for planting.

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

The land capability classification is IIe. The woodland ordination symbol is 3f.

BkC—Berks shaly silt loam, 8 to 15 percent slopes. This moderately deep, strongly sloping, well drained soil is on ridgetops in the uplands. Slopes are convex or smooth. Most areas are long and narrow or oval and are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silt loam about 4 inches thick. The subsoil is yellowish brown, friable very shaly silt loam about 20 inches thick. Fractured shale bedrock is at a depth of about 24 inches. In some places the soil is less than 20 inches deep to bedrock, and in other places it is less than 20 inches deep to bedrock and has a lower content of coarse fragments in the subsoil.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils near the edges of ridgetops. A few seeps and springs are in these areas. These soils have more clay in the subsoil than the Berks soil. They make up about 15 percent of most mapped areas.

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

Most areas are used as pasture or cropland. This soil is poorly suited to corn and moderately well suited to hay. It is droughty and is subject to erosion. The hazard of erosion is severe if cultivated crops are grown. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops conserve moisture, reduce the runoff rate, and help to control erosion. The shale fragments in the surface layer hinder tillage.

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

Many areas are wooded. This soil is moderately well suited to trees. Seedling mortality is the main concern in managing woodland. It can be controlled by selecting drought-tolerant trees for planting.

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

This soil is poorly suited to septic tank absorption fields because of the slope and the moderate depth to bedrock. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. The filtering capacity can be improved by installing the fields in suitable fill material.

The land capability classification is IIIe. The woodland ordination symbol is 3f.

BkD—Berks shaly silt loam, 15 to 25 percent slopes. This moderately deep, moderately steep, well drained soil is on ridgetops and side slopes in the uplands. Areas are oval or long and narrow and are 5 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silt loam about 3 inches thick. The subsoil is yellowish brown, friable very shaly silt loam about 28 inches thick. Fractured olive siltstone bedrock is at a depth of about 31 inches.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils on slightly concave slopes. A few seeps and springs are in these areas. These soils have more clay in the subsoil than the Berks soil. They make up about 10 percent of most mapped areas.

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

Some areas are used as cropland or pasture. This soil is poorly suited to corn and moderately well suited to hay. It is droughty and is subject to erosion. The hazard of erosion is very severe if cultivated crops are grown. A permanent plant cover is the best means of helping to control erosion. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and cover crops conserve moisture, reduce the runoff rate, and help to control erosion. The moderately steep slope hinders the use of some farm machinery. The shale fragments in the surface layer hinder tillage.

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

Many areas are wooded. This soil is moderately well suited to woodland. Seedling mortality is the main concern in managing woodland. It can be controlled by selecting drought-tolerant trees for planting. The equipment limitation also is a concern, but mechanical tree planters and the mowers used to control plant competition can be operated on this soil. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

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

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

The land capability classification is IVe. The woodland ordination symbol is 3f on north aspects, 4f on south aspects.

BkE—Berks shaly silt loam, 25 to 40 percent slopes. This moderately deep, steep, well drained soil is on hillsides. Most areas are long and narrow or irregularly shaped and are 10 to 20 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silt loam about 3 inches thick. The subsoil is about 28 inches thick. It is yellowish brown and friable. The upper part is very shaly silt loam and very channery silt loam, and the lower part is extremely channery silt loam. Fractured olive siltstone bedrock is at a depth of about 31 inches. In some areas the soil is more than 40 inches deep to bedrock. In some places it has a lower content of coarse fragments in the subsoil, and in other places the fragments are dominantly sandstone.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils on slightly concave slopes. A few seeps, springs, and slips are in these areas. These soils have more clay in the subsoil than the Berks soil. They make up about 10 percent of most mapped areas.

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

Some areas are pastured. This soil is poorly suited to pasture and generally is unsuited to cultivated crops and small grain. Controlling erosion is the major concern of management. Also, the soil is droughty, and the slope hinders the use of equipment. If the pasture is plowed during seedbed preparation or overgrazed, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss.

Most areas are wooded. This soil is moderately well suited to woodland. Seedling mortality and the equipment limitation are the main concerns in managing woodland. Locating logging roads and skid trails on the contour facilitates the use of equipment. Selecting drought-tolerant trees for planting reduces the seedling mortality rate. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the steep slope and the bedrock at a depth of 20 to 40 inches. Cutting and filling increase the susceptibility of the included Guernsey soils to hillside slippage. Installing drains in the seepy areas helps to prevent this slippage.

The land capability classification is VIe. The woodland ordination symbol is 3f on north aspects, 4f on south aspects.

BkF—Berks shaly silt loam, 40 to 70 percent slopes. This moderately deep, very steep, well drained soil is on upland side slopes. Some areas are dissected by drainageways. Most areas are elongated and range from 20 to more than 300 acres in size.

Typically, the surface layer is dark grayish brown, friable shaly silt loam about 3 inches thick. The subsoil is yellowish brown, friable very channery silt loam about 28 inches thick. Fractured siltstone bedrock is at a depth of about 31 inches. In some areas the soil is more than 40 inches deep to bedrock.

Included with this soil in mapping are small areas of the deep, moderately well drained Guernsey soils on slightly concave slopes. A few seeps, springs, and slips are in these areas. These soils have more clay in the subsoil than the Berks soil. They make up about 10 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Berks soil. The available water capacity is very low. Runoff is very rapid. The subsoil is extremely acid or very strongly acid. The root zone generally is restricted by the moderate depth to bedrock.

This soil is generally unsuited to cultivated crops, hay, and pasture. The very steep slopes, the erosion hazard, and the very low available water capacity severely limit these uses.

Almost all areas are wooded. This soil is moderately well suited to woodland. Erosion, the equipment limitation, and seedling mortality are the main concerns of management. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Locating logging roads across the slope also facilitates the use of equipment. Selecting drought-tolerant trees for planting helps to control seedling mortality. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

Because of the slope, this soil generally is unsuited to building site development, septic tank absorption fields, and recreational development.

The land capability classification is VIIe. The woodland ordination symbol is 3f on north aspects, 4f on south aspects.

BnB—Bethesda channery clay loam, 0 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is on mine spoil ridges and benches and in concave, basin-shaped areas between spoil ridges. Areas of this map unit have been surface mined for coal. Ridge crests are commonly rounded and have smooth slopes. Rills and small gullies are on some ridges. Most basins are drained by a small waterway, but some do not have drainage outlets and contain intermittent pools of water. This soil is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are flat and 1 to 5 inches long. They are mainly shale, siltstone, and sandstone and smaller amounts of coal and carbonaceous shale. A few stones are at the surface and throughout the soil. Most areas are irregularly shaped and are 10 to 140 acres in size.

Typically, the surface layer is dark gray, firm channery clay loam about 9 inches thick. The substratum to a depth of about 60 inches is variegated dark gray, gray, and yellowish brown, firm very channery clay loam.

Included with this soil in mapping are barren areas where coal has been stockpiled. Also included are small ponded areas. Inclusions make up about 5 percent of most mapped areas.

Permeability is moderately slow in the Bethesda soil. The available water capacity is low. Runoff is medium. Unless the soil has been limed, the root zone is strongly acid to extremely acid. In the surface layer, the organic matter content is very low and tilth is poor. The depth of the root zone varies within short distance because of differences in the density of the material.

Some areas are used for grass-legume hay and small grain. This soil generally is unsuited to row crops and small grain and poorly suited to hay because it is a poor growing medium for roots. It is droughty and low in fertility. The surface layer is channery, has weak structure, and puddles and crusts easily. The hazard of erosion is very severe if cultivated crops are grown. A permanent plant cover is the best means of controlling erosion. Because of uneven grading and settling, a surface drainage system is needed in some areas.

This soil is poorly suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Restricted grazing during wet periods helps to prevent surface compaction. Soil tests are needed to determine specific nutrient needs. Ground cover and surface mulch reduce the runoff rate and the susceptibility to erosion and increase the rate of water intake.

Planted black locust and pines and some volunteer hardwoods are established in most areas. This soil is best suited to the trees that can tolerate the strongly acid to extremely acid, droughty, restricted root zone. Rock fragments throughout the soil interfere with the use of mechanical tree planters. Grasses and legumes provide ground cover during the establishment of trees.

This soil is used primarily for wildlife habitat. Wildlife habitat can be improved by establishing small ponds and a wider variety of plants. The wildlife plants that grow best on this soil are black locust, eastern white pine, red pine, red maple, sweetgum, Tatarian honeysuckle, and autumn-olive.

Once this soil has settled, it is moderately well suited to building site development and poorly suited to septic tank absorption fields. Onsite investigations are needed to determine the suitability for specific uses. Large stones and erosion are important considerations. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Enlarging septic tank absorption fields improves the filtering capacity. Blanketing sites for lawns with suitable soil material provides a more favorable root zone, increases the available water capacity, and covers small stones that would interfere with mowing.

The land capability classification is VIs. No woodland ordination symbol is assigned.

BnC—Bethesda channery clay loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on mine spoil side slopes and, to a lesser extent, on mine spoil benches and narrow ridgetops. These areas have been surface mined for coal. The soil is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are flat and 1 to 5 inches long. They are mainly shale, siltstone, and sandstone and small amounts of coal and carbonaceous shale. A few large stones are on the surface in most areas. Slopes are smooth. Small, shallow gullies and ponds, 1 to 3 acres in size, are in some areas. Most areas are oblong and 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, firm channery clay loam about 8 inches thick. The substratum to a depth of about 60 inches is firm very channery clay loam. The upper part is dark brown and dark grayish brown, and the lower part is dark brown.

Included with this soil in mapping are barren areas of soils that have a high content of sulfates. These areas are 1 to 5 acres in size. Included soils make up about 5 percent of most mapped areas.

Permeability is moderately slow in the Bethesda soil. The available water capacity is low. Runoff is very rapid. In the surface layer, the content of matter is very low and tilth is poor. The depth of the root zone varies within short distances because of differences in the density of the soil material. This zone is extremely acid to strongly acid unless the soil has been limed.

Some areas are used for grass-legume hay and small grain. This soil generally is unsuited to row crops and small grain. It is poorly suited to hay because the soil is a poor growing medium for roots. It is droughty and low in fertility. The surface layer is channery, has weak structure, and puddles and crusts easily. Erosion is a very severe hazard if cultivated crops are grown. Permanent plant cover is the best means of controlling erosion.

This soil is poorly suited to pasture. If the pasture is overgrazed or the soil is plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. Restricted grazing during wet periods helps to prevent surface compaction. Soil tests are needed to determine specific nutrient needs. Ground cover and surface mulch reduce the runoff rate and the susceptibility to erosion and increase the rate of water intake.

Most areas have been planted to black locust, or these trees have volunteered. This soil is best suited to the trees that can tolerate the strongly acid to extremely acid, droughty, restricted root zone. Rock fragments throughout the soil interfere with the use of mechanical tree planters. Grasses and legumes provide ground cover during the establishment of trees.

This soil is used primarily for wildlife habitat. Wildlife habitat can be improved by establishing small ponds and a wider variety of plants. The wildlife plants that grow best on this soil are black locust, eastern white pine, red pine, red maple, sweetgum, Tatarian honeysuckle, and autumn-olive.

Once this soil has settled, it is moderately well suited to building site development and poorly suited to septic tank absorption fields. Onsite investigations are needed to determine the suitability for specific uses. Large stones and erosion are important considerations. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the fields improves the filtering capacity. Blanketing sites for lawns with suitable soil material provides a more favorable root zone, increases the available water capacity, and covers small stones that would interfere with mowing.

The land capability classification is VIs. No woodland ordination symbol is assigned.

BnD—Bethesda channery clay loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on mine spoil side slopes and, to a lesser extent, on mine spoil benches and narrow ridgetops. These areas have been surface mined for coal (fig. 2). The soil is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are flat and 1 to 5 inches long. They are mainly shale, siltstone, and sandstone and smaller amounts of coal and carbonaceous shale. A few large stones are on the surface in most areas. Areas of water, 1 to 3 acres in size, are in some V-shaped valleys between spoil piles. Small gullies are in some areas. Most areas are irregularly shaped and are 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable channery clay loam about 5 inches thick. The substratum to a depth of about 60 inches is variegated brown, dark grayish brown, gray, and yellowish brown, firm channery clay loam and very channery clay loam.

Included with this soil in mapping are barren areas of soils that have a high content of sulfates. These areas are 1 to 5 acres in size. Also included are narrow strips of steep and very steep soils on side slopes. Included soils make up about 10 percent of most mapped areas.

Permeability is moderately slow in the Bethesda soil. The available water capacity is low. Runoff is very rapid.

Figure 2.—Bethesda channery clay loam, 15 to 25 percent slopes, in an area su·face mined for coal.

In the surface layer, the content of organic matter is very low and tilth is poor. The depth of the root zone varies within short distances because of differences in the density of the soil material. This zone is extremely acid to strongly acid.

Some areas are used for grass-legume hay and small grain. This soil generally is unsuited to row crops, small grain, and hay because of the moderately steep slope, droughtiness, and a very severe hazard of erosion.

This soil is poorly suited to pasture. The slope and the small stones in the surface layer interfere with the use of equipment. The soil is a poor growing medium for roots. The surface layer is channery, has weak structure, and puddles and crusts easily. A permanent plant cover is the best means of controlling erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. Restricted grazing during wet periods helps to prevent surface compaction. Ground cover and surface mulch reduce the runoff rate and susceptibility to erosion and increase the rate of water intake. Soil tests are needed to determine specific nutrient needs.

Most areas have been planted to black locust or have reseeded naturally to trees and briers. This soil is best suited to the trees that can tolerate the strongly acid to extremely acid, droughty, restricted root zone.

This soil is used primarily for wildlife habitat. Wildlife habitat can be improved by establishing small ponds and a wider variety of plants. The wildlife plants that grow best on this soil are black locust, eastern white pine, red pine, red maple, sweetgum, Tatarian honeysuckle, and autumn-olive.

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

The land capability classification is VIs. No woodland ordination symbol is assigned.

BnF—Bethesda channery clay loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is on mine spoil side slopes in areas that have been surface mined for coal, shale, or limestone. The soil is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are flat and 1 to 5 inches long. They are mainly shale, siltstone, and sandstone and smaller amounts of coal and carbonaceous shale. A few large stones are on the surface in most areas. Hillside slips are in most areas. Small, narrow areas of water are in V-shaped valleys between spoil piles and at the base of high walls. Areas range from 20 to 200 acres in size and are long and narrow.

Typically, the surface layer is dark grayish brown, friable channery clay loam about 6 inches thick. The substratum to a depth of about 60 inches is dark grayish brown, grayish brown, and gray. The upper part is firm very channery silt loam, very shaly silty clay loam, and extremely shaly silty clay loam. The lower part is the firm, extremely shaly analogs of clay loam, loam, and silt loam.

Included with this soil in mapping are small areas of gently sloping and sloping soils on ridgetops. These soils are not so susceptible to erosion as the Bethesda soil. Also included are some barren areas that have a high content of sulfates; vertical, high rock walls; and some narrow strips, on the lower part of slopes, that are in the flood pools of dams in the Muskingum Watershed Conservancy District and are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Bethesda soil. The available water capacity is low. Runoff is very rapid. In the surface layer, the content of organic matter is very low and tilth is poor. The depth of the root zone varies within short distances because of differences in the density of the soil material. This zone is extremely acid to strongly acid.

This soil generally is unsuited to row crops, small grain, hay, and pasture because of the steep and very steep slope, droughtiness, and a very severe hazard of erosion.

Most areas have been planted to black locust or have reseeded naturally to trees and briers. Some areas are bare or only sparsely vegetated. This soil is best suited to the trees that can tolerate the strongly acid to extremely acid, droughty, restricted root zone.

This soil is used primarily for wildlife habitat. Wildlife habitat can be improved by establishing a wider variety of plants. The wildlife plants that grow best on this soil are black locust, eastern white pine, red pine, red maple, sweetgum, Tatarian honeysuckle, and autumn-olive.

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

The land capability classification is VIIe. No woodland ordination symbol is assigned.

BtA—Bogart Variant loam, 0 to 3 percent slopes. This deep, nearly level, moderately well drained soil is on flats on terraces. Most areas are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, friable loam; the next part is yellowish brown, light yellowish brown, and pale brown, mottled, firm loam and gravelly sandy loam; and the lower part is yellowish brown, firm silty clay loam and silty clay that has mottles above a depth of 44 inches. The substratum to a depth of about 63 inches is yellowish brown, mottled, firm silty clay.

Included with this soil in mapping are small areas of the well drained Chili soils on slight rises and the somewhat poorly drained Fitchville soils near breaks to uplands. Also included are some areas of soils in the flood pools of dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the upper part of the Bogart Variant and slow or very slow in the substratum. The available water capacity is moderate or high. Runoff is slow. A seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to slightly acid. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, small grain, hay, and pasture. The surface layer can be worked within a fairly wide range of moisture content. This soil is well suited to no-till planting and other kinds of conservation tillage that leave crop residue on the surface. These practices increase the infiltration rate and help to control erosion. Natural drainage is generally adequate for crop production. Randomly spaced subsurface drains may be needed, however, in areas of the wetter included soils.

Some small areas are wooded. This soil is well suited to woodland. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is moderately well suited to buildings. Because of the seasonal wetness and the high clay content in the lower part of the profile, it is better suited to houses without basements than to houses with basements. Water moves laterally above the slowly permeable or very slowly permeable substratum. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action.

Because of the seasonal wetness and the slow or very slow permeability in the lower part of the profile, this soil is poorly suited to septic tank absorption fields. Perimeter drains can be used to reduce the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the slow or very slow permeability.

The land capability classification is I. The woodland ordination symbol is 1o.

BtB—Bogart Variant loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on terraces. Most areas are 5 to 25 acres in size.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is yellowish brown, mottled, friable and firm loam, sandy loam, and gravelly loam about 40 inches thick. The substratum to a depth of about 60 inches is yellowish brown, firm silty clay. In some areas the soil is eroded.

Included with this soil in mapping are small areas of the well drained Chili soils on slight rises and on slope breaks, and the somewhat poorly drained Fitchville soils in slight depressions. Also included are some areas of soils in the flood pools of dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the upper part of the Bogart Variant and slow or very slow in the substratum. The available water capacity is moderate or high. Runoff is medium. A seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to slightly acid. The root zone is deep.

Most areas are used for row crops, small grain, and hay. This soil is well suited to corn, soybeans, small grain, hay, and pasture. The erosion hazard is the main management concern. The surface layer can be worked within a fairly wide range of moisture content. No-till or other kinds of conservation tillage that leave crop residue on the surface help to control erosion and increase the infiltration rate. Grassed waterways help to control erosion where water concentrates and flows in natural channels. Natural drainage is generally adequate for crop production. Randomly spaced subsurface drains may be needed, however, in areas of the wetter included soils.

Some small areas are wooded. This soil is well suited to trees. Plant competition can be reduced by spraying, mowing, disking, or girdling.

This soil is moderately well suited to buildings. Because of the seasonal wetness and the high clay content in the lower part of the profile, it is better suited to houses without basements than to houses with basements. Water moves laterally above the slowly permeable or very slowly permeable substratum. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action. Removing as little vegetation as possible and establishing a temporary plant cover help to control erosion on construction sites.

Because of the seasonal wetness and the slow or very slow permeability in the lower part of the profile, this soil is poorly suited to septic tank absorption fields. Perimeter drains can be used to reduce the wetness. Enlarging the absorption area or installing a double absorption field system helps to overcome the slow or very slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 1o.

Ca—Canadice silty clay loam. This deep, nearly level, poorly drained soil is on slack water terraces. It is on broad flats and in depressions. It receives runoff from the adjacent soils and is subject to ponding. Most areas are oblong and are 10 to 80 acres in size.

Typically, the surface layer is dark brown, friable silty clay loam about 5 inches thick. The subsoil to a depth of about 60 inches is gray, firm silty clay. It is mottled below a depth of about 11 inches.

Included with this soil in mapping are small areas of Caneadea soils on slight rises. Also included are some areas of soils in the flood pools of dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is very slow in the Canadice soil. The available water capacity is moderate. Runoff is very slow or ponded. A seasonal high water table is near or above the surface during extended wet periods. In the surface layer, the content of organic matter is moderate or high and tilth is fair. The subsoil is strongly acid or medium acid in the upper part and slightly acid or neutral in the lower part. The root zone is restricted by the seasonal high water table and the high clay content in the subsoil.

Most areas are used for corn and hay. Some areas are pastured. This soil is poorly suited to corn, soybeans, hay, and pasture. Because of the ponding and the very slow permeability, managing this soil is very difficult. Surface drains and land leveling are more effective than subsurface drains in removing excess water. Good outlets for the subsurface drains are not available in most areas. The subsurface drains should be closely spaced for uniform drainage because movement of water into these drains is slow. Restricting tillage to a limited range in moisture content is important because the soil becomes compacted and cloddy if worked when wet and sticky. Overgrazing or grazing during wet periods, when the soil is soft and sticky, results in surface compaction, poor tilth, a decreased infiltration rate, and reduced plant growth. Proper stocking rates, proper plant selection, pasture rotation, and timely deferment of grazing help keep the pasture and the soil in good condition.

Some areas are wooded. This soil is poorly suited to trees. Ponding severely limits the use of planting and harvesting equipment. The trees can be logged during the drier parts of the year. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Because of the windthrow hazard, the trees left in the stand after harvest should be about the same height.

This soil is well suited to habitat for wetland wildlife. Because of the ponding and the very slow permeability, it is generally unsuitable as a site for buildings and septic tank absorption fields. Providing suitable base material helps to prevent the damage to local roads and streets caused by low strength. Installing drains and building the roads and streets on suitable fill material help to prevent the damage caused by ponding.

The land capability classification is IVw. The woodland ordination symbol is 4w.

CcA—Caneadea silty clay loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on slack water terraces. Most areas are oblong and are 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 9 inches thick. It is mottled in the lower part. The subsoil is about 47 inches thick. It is yellowish brown, mottled, and firm. It is silty clay in the upper part and silty clay loam in the lower part. The substratum to a depth of about 60 inches is yellowish brown, firm silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Canadice soils in depressions. Also included are some areas of soils in the flood pools of dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Caneadea soil. The available water capacity is moderate. Runoff is slow. A seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is fair. The subsoil is strongly acid to neutral. The root zone is deep.

Most areas are used for corn, small grain, and hay. Some areas are pastured. This soil is moderately well suited to these uses. The seasonal wetness is the major concern of management. Surface drains help to remove excess surface water. Subsurface drains are used to remove excess water from the subsoil. Restricting tillage to a limited range of moisture content is important because this soil becomes compacted and cloddy if worked when wet and sticky. Cover crops and a system of conservation tillage that leaves crop residue on the surface improve tilth, increase the water infiltration rate, and help to prevent surface crusting. Overgrazing or grazing during wet periods, when the soil is soft and sticky, results in surface compaction, poor tilth, a decreased infiltration rate, and reduced plant growth. Proper stocking rates, proper plant selection, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is moderately well suited to woodland. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. The windthrow hazard can be reduced by harvesting procedures that do not leave the remaining trees widely spaced.

Because of the seasonal wetness, the high shrink-swell potential, and the slow permeability, this soil is poorly suited to buildings and septic tank absorption fields. Landscaping building sites can help to drain excess surface water away from foundations. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep water away from basements. Designing walls that have pilasters and are reinforced with concrete, supporting walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields reduce the wetness. Enlarging the absorption area helps to overcome the restricted permeability.

Low strength, the high potential for frost action, and the high shrink-swell potential can result in damage to local roads and streets. Installing drains and providing suitable base material, however, help to prevent this damage.

The land capability classification is IIIw. The woodland ordination symbol is 3c.

CdB—Canfield silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on ground moraines. Most areas are elongated and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil extends to a depth of about 60 inches or more. The upper part is dark yellowish brown and yellowish brown, friable loam and clay loam. The lower part is a fragipan of multicolored, very firm and brittle loam, gravelly silt loam, and silt loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils in the flatter areas. A drainage system is needed if these soils are cropped. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Canfield soil and is slow in the fragipan. The root zone is mainly restricted to the 15- to 30-inch zone above the fragipan. The available water capacity of this zone is low. Runoff is medium. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The root zone is mainly strongly acid or very strongly acid.

Most areas are used for corn, small grain, and hay. This soil is well suited to these crops. Controlling erosion and maintaining the tilth are the main management concerns. The seasonal wetness delays planting in spring. Contour stripcropping, including meadow crops in the cropping sequence, and planting winter cover crops help to control erosion and maintain tilth. No-till planting or other kinds of conservation tillage that leave crop residue on the surface also help to control erosion. The surface layer crusts after hard rains. Shallow cultivation of intertilled crops, however, breaks up the crust. Randomly spaced subsurface drains are needed in the wetter included soils.

This soil is well suited to pasture. Because of the limited available water capacity, pasture plants grow better during the early part of the growing season than during the latter part. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help to keep the plants and the soil in good condition.

This soil is well suited to trees. Planting species that are tolerant of a root-restricting layer in the subsoil reduces the seedling mortality rate and the windthrow hazard. The windthrow hazard can be reduced by harvesting procedures that do not leave the remaining trees widely spaced. Selecting seedlings that have been transplanted once reduces the seedling mortality rate.

Because of the seasonal wetness, this soil is only moderately well suited to buildings. Water moves downslope along the top of the fragipan and can cause wetness in basements and around foundations and basement walls. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Diversions and drainage ditches help to divert runoff from the higher adjacent soils. Landscaping building sites can help to drain excess water away from foundations. Installing drains and providing suitable base material help to prevent the damage to local roads and streets caused by frost action.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the slowly permeable fragipan limit this use. Installing perimeter drains around septic tank absorption fields helps to lower the seasonal high water table. Increasing the size of the absorption area helps to overcome the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 1d.

CdC—Canfield silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on side slopes on ground moraines. Most areas are long and narrow and are 20 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish brown, friable loam, and the lower part is a fragipan of yellowish brown, mottled, very firm and brittle silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silt loam. In some areas the soil is eroded. In a few areas it is well drained.

Included with this soil in mapping are small areas of Coshocton soils on the upper part of slopes. These soils do not have a fragipan. They make up about 15 percent of most mapped areas.

Permeability is moderate above the fragipan in the Canfield soil and is slow in the fragipan. The root zone is mainly restricted to the 15- to 30-inch zone above the fragipan. The available water capacity in this zone is low. Runoff is rapid. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The root zone is mainly strongly acid or very strongly acid.

Many areas are used as cropland or pasture. This soil is moderately well suited to corn, soybeans, and small grain and is well suited to hay and pasture. The hazard of erosion and surface crusting are the main management concerns. No-till planting or other kinds of conservation tillage that leave crop residue on the surface, contour stripcropping, a cropping sequence that includes grasses and legumes, and grassed waterways help to prevent surface crusting, reduce the runoff rate, and help to control erosion. Shallow cultivation of intertilled crops also breaks up the crust. In the pastured areas, proper stocking rates, pasture rotation, timely deferment of grazing, and weed control help to keep the plants and the soil in good condition.

Some areas are wooded. This soil is well suited to trees. Planting species that are tolerant of a root-restricting layer in the subsoil reduces the seedling mortality rate and the windthrow hazard. The windthrow hazard can be reduced by harvesting procedures that do not leave the remaining trees widely spaced. Selecting seedlings that have been transplanted once reduces the seedling mortality rate.

Because of the seasonal wetness and the slope, this soil is only moderately well suited to buildings. Water moves downslope along the top of the fragipan and can cause wetness in basements and around foundations and basement walls. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. Diversions and surface drains help to divert runoff from the higher adjacent soils and help to control erosion. Buildings should be designed so that they conform to the natural shape of the land.

Installing drains and providing suitable base material help to prevent the damage to local roads and streets caused by frost action.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness, the slope, and the slowly permeable fragipan limit this use. Installing perimeter drains around the absorption fields helps to lower the seasonal high water table. Increasing the size of the absorption area helps to overcome the restricted permeability. Installing the distribution lines across the slope helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 1d.

CkB—Chili gravelly loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on slight rises on outwash terraces. Most areas are circular, oblong, or long and narrow and are 5 to 150 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 6 inches thick. The subsoil is about 52 inches thick. It is friable. The upper part is strong brown loam and gravelly loam, and the lower part is yellowish brown, dark brown, and brown gravelly sandy loam and gravelly loam. The substratum to a depth of about 60 inches is brown, loose very gravelly loamy sand.

Included with this soil in mapping are a few small areas of Wheeling soils on the flatter parts of the landscape. These soils have less gravel in the subsoil than the Chili soils. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Chili soil. The available water capacity is moderate or low. Runoff is medium. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid to slightly acid. The root zone is deep.

This soil is used mainly for corn and, to a lesser extent, for soybeans, small grain, hay, pasture, and specialty crops. It is well suited to these crops. Melons, strawberries, and other specialty crops are grown where water is available for irrigation. The soil dries early in spring. Because of the limited available water capacity, it is better suited to crops that mature early in the growing season than to crops that mature late in summer. Controlling erosion and conserving moisture are the major concerns of management. The hazard of erosion is moderate if the soil is cultivated or plowed during seedbed preparation or if the pastured areas are overgrazed. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, timely applications of lime and fertilizer are needed. The gravel in the surface layer interferes with tillage. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops help to prevent deterioration of tilth, reduce the runoff rate, and help to control erosion.

This soil is well suited to woodland. Drought-tolerant species should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited to building site development and septic tank absorption fields. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action.

The land capability classification is IIe. The woodland ordination symbol is 2o.

CkC—Chili gravelly loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on slope breaks and knolls on outwash terraces. Most areas are oblong and are 5 to 20 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 6 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown and brown, friable loam and firm gravelly clay loam, and the lower part is yellowish brown and dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose very gravelly loamy sand.

Included with this soil in mapping are small areas of Conotton soils on the upper part of slopes. These soils have more gravel in the subsoil than the Chili soil. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Chili soil. The available water capacity is moderate or low. Runoff is medium or rapid. In the surface layer, the content of organic matter is moderately low or moderate and tilth is good. The subsoil is strongly acid to slightly acid. The root zone is deep.

Most areas are used as cropland. Corn, small grain, and hay are the principal crops. This soil is moderately well suited to these crops. It is droughty during periods of below normal rainfall and dries early in spring. Because of the limited available water capacity, it is better suited to crops that mature early in the growing season than to crops that mature late in summer. Controlling erosion and conserving moisture are the major concerns of management. If the soil is cultivated, the hazard of erosion is severe. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, timely applications of lime and fertilizer are needed. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to prevent deterioration of tilth, conserve moisture, reduce the runoff rate, and help to control erosion.

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

This soil is well suited to woodland. Drought-tolerant species should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

Because of the slope, this soil is only moderately well suited to building site development and septic tank absorption fields. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of the effluent to the surface. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 2o.

CmA—Chili silt loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on flats on outwash terraces. Most areas are circular or oblong and are 10 to 200 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 51 inches thick. The upper part is brown, friable silt loam, loam, gravelly loam, and very gravelly coarse sandy loam. The lower part is brown and dark yellowish brown very gravelly loamy coarse sand, extremely gravelly coarse sandy loam, and extremely gravelly loamy coarse sand. The substratum to a depth of about 80 inches consists of various combinations of coarse sand and gravel.

Included with this soil in mapping are small areas of the excessively drained Sparta soils on very slight rises. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in the Chili soil. The available water capacity is moderate or low. Runoff is slow. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid to slightly acid. The root zone is deep.

Most areas are used for corn. Some areas are used for soybeans, small grain, or hay. This soil is well suited to these crops and to pasture and specialty crops. It dries early in spring and is well suited to irrigation. Because of the limited available water capacity, it is better suited to crops that mature early in the growing season than to crops that mature late in summer. The droughtiness is the main limitation. No-till planting or other kinds of conservation tillage that leave crop residue on the surface conserve moisture and increase the rate of water infiltration. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, timely applications of lime and fertilizer are needed. A surface crust forms after heavy rainfall, especially in tilled areas. Shallow cultivation of intertilled crops, however, breaks up the crust.

A few areas are wooded. This soil is well suited to woodland. Drought-tolerant species should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

This soil is well suited to building site development and septic tank absorption fields. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action.

The land capability classification is IIs. The woodland ordination symbol is 2o.

CnB—Chili-Urban land complex, undulating. This map unit consists of a deep, well drained Chili soil and areas of Urban land on outwash terraces. Slopes range from 0 to 8 percent. Areas are mainly irregularly shaped. Most are about 40 percent Chili gravelly loam and 40 percent Urban land. The Chili soil and Urban land occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Chili soil has a surface layer of dark brown, friable gravelly loam about 6 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown and brown, friable loam and firm gravelly clay loam. The lower part is yellowish brown and dark brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose very gravelly loamy sand. In places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

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

Included with this unit in mapping are a few small areas of the nearly level Wheeling soils and a few small areas of Conotton soils on the higher rises. Wheeling soils have less gravel in the subsoil than the Chili soil, and Conotton soils have more gravel in the subsoil. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 20 percent of most mapped areas.

Permeability is moderately rapid in the Chili soil. The available water capacity is moderate or low. Runoff is slow or medium. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid to slightly acid. The root zone is deep.

The Chili soil is used for parks, open areas, lawns, and gardens. It is well suited to grasses, flowers, vegetables, trees, and shrubs. Erosion is not a major problem, except where the soil is disturbed and left unprotected. Included spots that have been cut and filled are not well suited to lawns and gardens because tilth is poor in the exposed subsoil material. This material is sticky when wet and hard when dry.

The Chili soil is well suited to building site development and septic tank absorption fields (fig. 3). Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites. Safety precautions are needed to prevent the caving of cutbanks in excavated areas. Providing suitable base material helps to prevent the damage to local roads and streets from frost action.

The Chili soil is assigned to land capability classification IIe. Urban land is not assigned to a land capability classification. The Chili soil and Urban land are not assigned to a woodland ordination symbol.

CoA—Conotton gravelly loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on stream and outwash terraces. Most areas are oblong and are 10 to 75 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 9 inches thick. The subsoil is brown, friable

Figure 3.—An area of Chili-Urban land complex, undulating. The Chili soil is well suited to buildings.

gravelly sandy loam and very gravelly coarse sandy loam about 53 inches thick. The substratum to a depth of about 80 inches is yellowish brown, loose very gravelly loamy coarse sand.

Included with this soil in mapping are small areas of Chili soils in some of the lower landscape positions. These soils have less gravel in the subsoil than the Conotton soil. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is rapid in the Conotton soil. The available water capacity is low. Runoff is slow. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to neutral in the lower part. The root zone is deep.

This soil is used mainly for corn and, to a lesser extent, for soybeans, small grain, hay, and specialty crops, such as melons and strawberries. A few small areas are used for pasture. Because of droughtiness, the soil is only moderately well suited to these crops. The soil dries early in spring and is well suited to irrigation. Because of the low available water capacity, it is better suited to crops that mature early in the growing season than to crops that mature late in summer. No-till planting or other kinds of conservation tillage that leave crop residue on the surface conserve moisture and increase the rate of water infiltration. Plant nutrients are leached from this soil at a rapid rate. As a result, timely applications of lime and fertilizer are needed. The gravel in the surface layer interferes with tillage. Rotation grazing helps to maintain the grasses and legumes in pastured areas.

A few small areas are wooded. This soil is moderately well suited to trees. Seedling mortality can be controlled by selecting seedlings that have been transplanted once. Selecting species that are tolerant of droughtiness also reduces the seedling mortality rate.

This soil is well suited to buildings and is moderately well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. Providing suitable base material helps to prevent damage to local roads and streets caused by frost action. The caving of cutbanks is a hazard in excavations. Lawns dry up during periods of low rainfall in summer. As a result, new seedings should be mulched and watered.

The land capability classification is IIIs. The woodland ordination symbol is 3f.

CoB—Conotton gravelly loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on slight rises and low slope breaks on outwash and stream terraces. Most areas are long and narrow or oblong and are 10 to 60 acres in size.

Typically, the surface layer is dark brown, friable gravelly loam about 10 inches thick. The subsoil is about 40 inches thick. It is friable. The upper part is strong brown and yellowish brown gravelly loam, very gravelly sandy loam, and very gravelly coarse sandy loam, and the lower part is dark brown and brown very gravelly coarse sandy loam. The substratum to a depth of about 60 inches is yellowish brown and brown, loose very gravelly coarse sand.

Included with this soil in mapping are small areas of Chili soils on some of the flatter parts of the landscape. These soils have less gravel in the subsoil than the Conotton soil. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is rapid in the Conotton soil. The available water capacity is low. Runoff is slow or medium. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to neutral in the lower part. The root zone is deep.

Most areas are used for corn. A small acreage is used for soybeans, small grain, hay, and pasture. This soil is moderately well suited to these crops. It dries early in spring and is droughty. Because of the low available water capacity, it is better suited to crops that mature early in the growing season than to crops that mature late in summer. No-till planting or other kinds of conservation tillage that leave crop residue on the surface conserve moisture, increase the water infiltration rate, and help to control erosion. Plant nutrients are leached from this soil at a rapid rate. As a result, timely applications of lime and fertilizer are needed. The gravel in the surface layer interferes with tillage. Rotation grazing helps to maintain the grasses and legumes in pastured areas.

A few small areas are wooded. This soil is moderately well suited to trees. Seedling mortality can be controlled by selecting seedlings that have been transplanted once. Selecting species that are tolerant of droughtiness and the high content of coarse fragments in the subsoil also reduces the seedling mortality rate.

This soil is well suited to buildings and is moderately well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. The caving of cutbanks is a hazard in excavations. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action. Lawns dry up during periods of low rainfall in summer. As a result, new seedings should be mulched and watered. Removing as little vegetation as possible, mulching, and establishing a temporary plant cover help to control erosion on construction sites.

The land capability classification is IIIs. The woodland ordination symbol is 3f.

CoD—Conotton gravelly loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on slope breaks between terrace levels and in hummocky areas on stream and outwash terraces. Most areas are long and narrow and are 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable gravelly loam about 9 inches thick. The subsoil is about 31 inches thick. It is brown and friable. It is gravelly sandy loam in the upper part and very gravelly coarse sandy loam in the lower part. The substratum to a depth of about 60 inches is brown, loose very gravelly loamy sand.

Included with this soil in mapping are narrow bands of Chili soils on the lower part of slopes. These soils have less gravel in the subsoil than the Conotton soil. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is rapid in the Conotton soil. The available water capacity is low. Runoff is rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to neutral in the lower part. The root zone is deep.

Most areas are used for pasture and hay. This soil is generally unsuited to row crops and hay and poorly suited to pasture. The slope, the erosion hazard, and droughtiness are the major concerns of management. If the pasture is plowed during seedbed preparation or overgrazed, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. No-till seeding helps to control erosion and conserves moisture. Maintaining a good stand of grasses is very difficult because of the droughtiness and the moderately steep slope, which hinders the use of farm machinery.

Some areas are wooded. This soil is moderately well suited to trees. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Operating mechanical tree planters and the mowers used to control plant competition is difficult because of the moderately steep slope. Seedling mortality can be controlled by planting species that are tolerant of droughtiness and the high content of coarse fragments in the subsoil and selecting seedlings that have been transplanted once.

This soil is poorly suited to buildings. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. The caving of cutbanks is a hazard in excavations. This soil is a probable source of sand and gravel.

This soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies.

The land capability classification is VIIe. The woodland ordination symbol is 3f.

CpB—Coshocton silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on upland ridgetops and side slopes. Most areas are circular or elongated and are 10 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 40 inches thick. It is yellowish brown. The upper part is friable silt loam, and the lower part is mottled, firm silty clay loam and silt loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm channery silty clay loam. Brown shale bedrock is at a depth of about 60 inches. In some areas the subsoil contains more clay. In other areas it has a lower content of sand and coarse fragments in the upper part.

Included with this soil in mapping are small areas of Guernsey soils on slight rises. These soils have more clay in the subsoil than the Coshocton soil. Also included are a few seepy areas on the lower part of slopes and some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. The soils in the flood pools are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Coshocton soil. The available water capacity is moderate or high. Runoff is medium. A perched seasonal high water table is at a depth of 18 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. Unless the soil is limed, the subsoil is strongly acid or very strongly acid. The root zone is deep.

Most areas are used as cropland or pasture. Corn, small grain, and hay are the principal crops. This soil is well suited to a rotation of these crops and to pasture. Controlling erosion is the major concern of management. The hazard of erosion is moderate if the soil is cultivated or plowed during seedbed preparation or if the pastured areas are overgrazed. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Natural drainage generally is adequate, but subsurface drains are needed in the scattered seepy areas and in other wet areas. Restricted grazing during wet periods helps to keep the pasture in good condition.

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

This soil is moderately well suited to building site development. Removing as little vegetation as possible, mulching, and establishing temporary plant cover help to control erosion on construction sites. The seasonal wetness is a limitation on sites for dwellings, especially dwellings with basements. Also, the moderate shrink-swell potential of the subsoil is a limitation. Waterproofing basement walls and installing drains at the base of footings help to keep water away from basements. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Providing suitable base material, however, helps to prevent this damage.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is only moderately well suited to septic tank absorption fields. Installing perimeter drains reduces the wetness. Installing a double absorption field system and increasing the size of the field help to overcome the slow or moderately slow permeability.

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

CsC—Coshocton-Guernsey silt loams, 8 to 15 percent slopes. These deep, strongly sloping, moderately well drained soils are on hillsides and ridgetops. The landscape is fairly uniform. In some places, however, hillsides and ridgetops are concave, and in other places they are convex. A few landslips, seeps, and springs are in the areas. Most areas are circular or elongated and range from 20 to several hundred acres in size. They are 40 to 70 percent Coshocton silt loam and 20 to 40 percent Guernsey silt loam. The two soils occur as alternating, narrow bands so intricately mixed that mapping them separately is not practical.

Typically, the Coshocton soil has a surface layer of dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 35 inches thick. It is yellowish brown. The upper part is friable silt loam, and the lower part is mottled, friable and firm clay loam, silt loam, and channery loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm shaly silty clay loam. In some areas the soil is well drained.

Typically, the Guernsey soil has a surface layer of dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 37 inches thick. It is yellowish brown. The upper part is friable silt loam, and the lower part is mottled, firm silty clay loam and silty clay. The substratum to a depth of about 60 inches is olive brown, mottled, firm silty clay.

Included with these soils in mapping are small areas of the well drained Berks and Hazleton soils on the upper part of slopes. These included soils have a higher content of coarse fragments in the subsoil than the Coshocton and Guernsey soils. They make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Coshocton and Guernsey soils. The available water capacity is moderate or high in the Coshocton soil and is moderate in the Guernsey soil. Runoff is rapid on both soils. A perched seasonal high water table is in the lower part of the subsoil during extended wet periods. The content of organic matter is moderate in the surface layer of the Coshocton soil and moderately low in that of the Guernsey soil. Tilth is good in both soils. The subsoil of the Coshocton soil is strongly acid or very strongly acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. Both soils have a deep root zone.

Most areas are used for row crops, hay, and pasture (fig. 4). These soils are moderately well suited to corn and small grain and well suited to hay. Controlling erosion is the major concern of management. If the soils are cultivated, the hazard of erosion is severe. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops help to prevent excessive soil loss and surface crusting and reduce the runoff rate. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. Tilling when the soil is wet causes surface compaction and cloddiness.

These soils are well suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. No-till seeding also helps to control erosion. Springs provide livestock water in some pastured areas (fig. 5). Restricted grazing during wet periods helps to prevent surface compaction.

Some areas are wooded. These soils are well suited to trees. Plant competition can be reduced by spraying, mowing, or disking.

These soils are moderately well suited to building site development. The slope, the seasonal wetness, and the shrink-swell potential are limitations on sites for dwellings, especially dwellings with basements. Because of its lower shrink-swell potential, the Coshocton soil is better suited to buildings than the Guernsey soil. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations

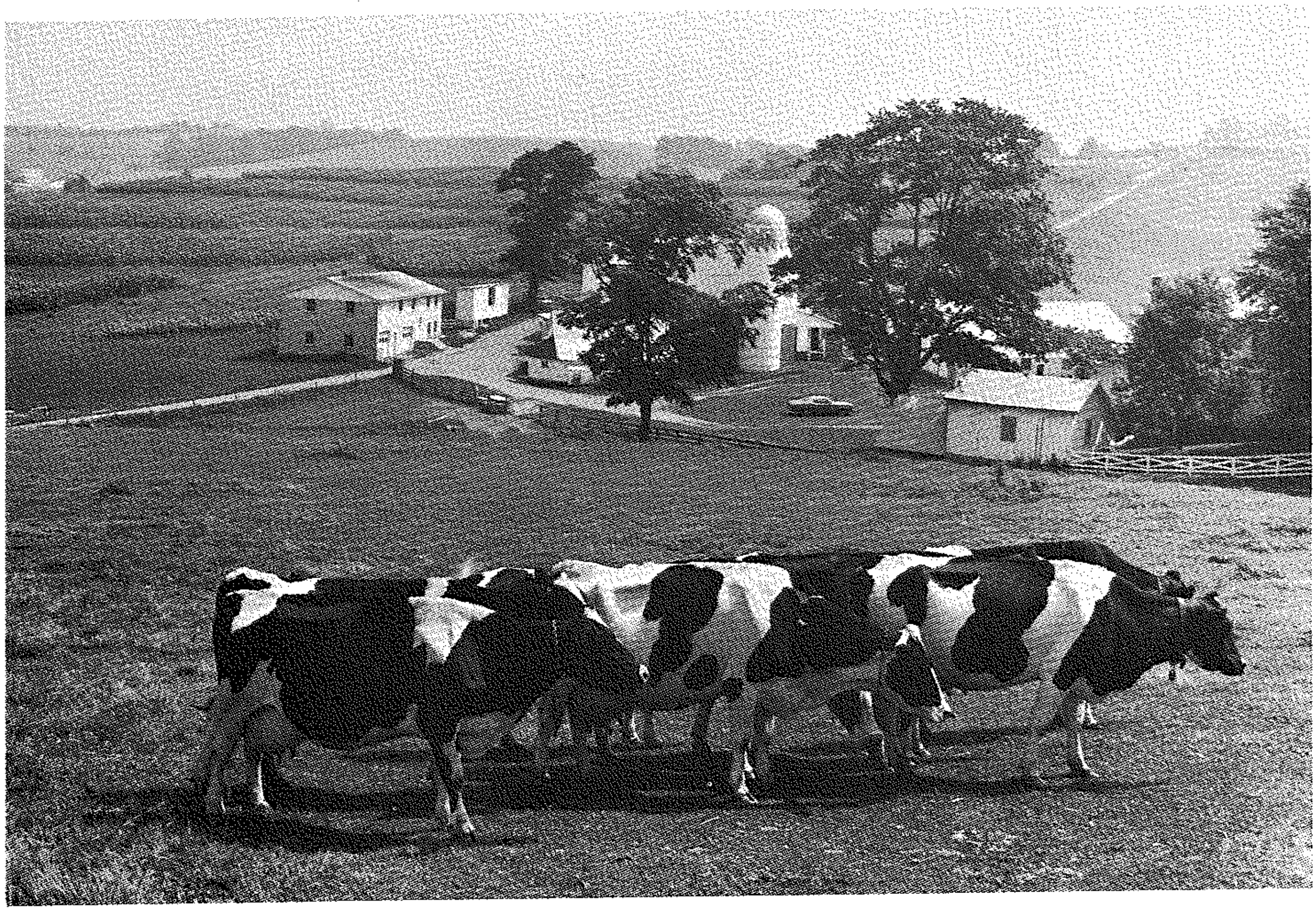

Figure 4.—Pasture in an area of Coshocton-Guernsey silt loams, 8 to 15 percent slopes.

with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces the hazard. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion.

The shrink-swell potential, the potential for frost action, and low strength can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

Because of the seasonal wetness, the slow or moderately slow permeability, and the slope, these soils are poorly suited to septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Perimeter drains reduce the wetness. Enlarging the field helps to overcome the slow or moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol is 2o.

CsD—Coshocton-Guernsey silt loams, 15 to 25 percent slopes. These deep, moderately steep, moderately well drained soils are on hillsides and ridgetops. The landscape is fairly uniform, but in places hillsides and ridgetops are concave. Most areas are circular or elongated and range from 20 to 200 acres in size. A few landslips, seeps, and springs are in the areas. Coshocton silt loam makes up 50 to 70 percent of most areas and Guernsey silt loam about 20 to 40 percent. The two soils occur as alternating, narrow bands so intricately mixed that mapping them separately is not practical.

Figure 5.—Spring-fed watering facility in an area of Coshocton-Guernsey silt loams, 8 to 15 percent slopes.

Typically, the Coshocton soil has a surface layer of dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, firm silty clay loam about 35 inches thick. It is mottled in the lower part. The substratum to a depth of 60 inches is olive brown and dark yellowish brown, mottled, firm shaly silty clay loam.

Typically, the Guernsey soil has a surface layer of brown, friable silt loam about 8 inches thick. The subsoil is about 51 inches thick. It is yellowish brown, mottled, firm silty clay loam, silty clay, clay, and channery clay. Black coal blossom is at a depth of about 59 inches.

Included with these soils in mapping are small areas of the well drained Hazleton soils on the convex parts of slopes. These included soils have a higher content of coarse fragments in the subsoil than the Coshocton and Guernsey soils. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 10 percent of most mapped areas.

Permeability is moderately slow or slow in the Coshocton and Guernsey soils. The available water capacity in the Coshocton soil is moderate or high and is moderate in the Guernsey soil. Runoff is very rapid on both soils. A perched seasonal high water table is in the lower part of the subsoil during extended wet periods.

The content of organic matter is moderate in the surface layer of the Coshocton soil and moderately low in that of the Guernsey soil. Tilth is good in both soils. The subsoil of the Coshocton soil is strongly acid or very strongly acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. Both soils have a deep root zone.

Many areas are used as pasture or cropland. These soils are poorly suited to corn, small grain, and hay. Controlling erosion is the major concern of management. If the soils are cultivated, the hazard of erosion is very severe. The surface layer crusts after hard rains. The cropping sequence should be dominated by meadow crops. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, and contour stripcropping maintain tilth, reduce the runoff rate, and help to prevent excessive soil loss.

These soils are moderately well suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, the hazard of erosion is very severe. No-till seeding helps to control erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. Restricted grazing during wet periods helps to prevent surface compaction. Springs provide livestock water in some pastured areas.

Some areas are used as woodland. These soils are well suited to trees. Locating logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Establishing water bars also helps to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun. Seedling mortality on south-facing slopes can be controlled by selecting seedlings that have been transplanted once.

These soils are poorly suited to building site development. The slope, seasonal wetness, and shrink-swell potential of both soils and the slippage hazard of the Guernsey soil are limitations on sites for dwellings. Because of a lower shrink-swell potential and a lower hazard of hillside slippage, the Coshocton soil is better suited to buildings than the Guernsey soil. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces the hazard. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion.

The shrink-swell potential, the potential for frost action, the slippage hazard, and low strength can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

Because of the seasonal wetness, the slow or moderately slow permeability, the slippage hazard, and the slope, these soils are generally unsuited to septic tank absorption fields.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

CsE—Coshocton-Guernsey silt loams, 25 to 40 percent slopes. These deep, steep, moderately well drained soils are on hillsides. Slopes are both concave and uniform. A few landslips, springs, and seeps are in the areas. Most areas are circular or elongated and range from 10 to 200 acres in size. Coshocton silt loam makes up 50 to 70 percent of most areas and Guernsey silt loam 20 to 40 percent. The two soils occur as alternating, narrow bands so intricately mixed that mapping them separately is not practical.

Typically, the Coshocton soil has a surface layer of dark brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. It is yellowish brown, dark brown, and brown, friable silt loam and firm silty clay loam and channery silty clay loam. It is mottled in the lower part. The substratum to a depth of about 60 inches is olive brown, mottled, firm shaly clay and shaly silty clay loam.

Typically, the Guernsey soil has a surface layer of dark grayish brown, friable silt loam about 5 inches thick. The subsoil is yellowish brown, firm silty clay about 51 inches thick. It is mottled in the lower part. Brown shale bedrock is at a depth of about 56 inches.

Included with these soils in mapping are small areas of the well drained Hazleton soils on the convex part of slopes. These soils have a higher content of coarse fragments in the subsoil than the Coshocton and Guernsey soils. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 10 percent of most mapped areas.

Permeability is moderately slow or slow in the Coshocton and Guernsey soils. The available water capacity in the Coshocton soil is moderate or high and moderate in the Guernsey soil. Runoff is very rapid on both soils. A perched seasonal high water table is in the lower part of the subsoil during extended wet periods. The content of organic matter is moderate in the surface layer of the Coshocton soil and moderately low in that of the Guernsey soil. Tilth is good in both soils. The subsoil of the Coshocton soil is strongly acid or very strongly acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. Both soils have a deep root zone.

Some areas are used for pasture. These soils are generally unsuited to row crops, small grain, and hay because of the steep slopes. They are poorly suited to permanent pasture. Pasture management is limited by the slope. Seeding by the no-till method helps to control erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and weed control are needed. Springs provide livestock water in some pastured areas.

Many areas are wooded. These soils are well suited to trees. Locating logging roads and skid trails across the slope facilitates the use of equipment and helps to control the erosion. Establishing water bars also helps to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun. Seedling mortality on south-facing slopes can be controlled by selecting seedlings that have been transplanted once.

These soils are generally unsuited to buildings and septic tank absorption fields. The steep slope, seasonal wetness, slow or moderately slow permeability, and shrink-swell potential of both soils and the slippage hazard of the Guernsey soil are management concerns. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces this hazard.

The land capability classification is VIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

CtC—Coshocton-Guernsey very stony silt loams, 8 to 15 percent slopes. These deep, strongly sloping, moderately well drained soils are on hillsides in the uplands. They generally are dissected by drainageways, and a few springs and seeps are in most areas. Stones cover about 0.1 to 3.0 percent of the surface. They are subrounded or angular and range from 10 inches to almost 4 feet across. They are about 5 to 30 feet apart. Areas are commonly circular or elongated and are 5 to 60 acres in size. Most areas are 50 to 70 percent Coshocton very stony silt loam and 30 to 40 percent Guernsey very stony silt loam. The two soils occur as alternating, narrow bands so intricately mixed that mapping them separately is not practical.

Typically, the Coshocton soil has a surface layer of dark grayish brown, friable very stony silt loam about 8 inches thick. The subsoil is yellowish brown, mottled, friable loam about 32 inches thick. The substratum is dark yellowish brown, mottled, friable shaly silty clay loam. Brown siltstone bedrock is at a depth of about 50 inches.

Typically, the Guernsey soil has a surface layer of dark grayish brown, friable very stony silt loam about 7 inches thick. The subsoil is about 38 inches thick. The upper part is light yellowish brown, friable silt loam. The lower part is yellowish brown, mottled, firm silty clay. The substratum is olive brown, mottled, firm silty clay. Brown siltstone bedrock is at a depth of about 54 inches.

Included with these soils in mapping are small areas of the well drained Berks and Hazleton soils on the upper part of the slopes. Also included are small areas of extremely stony soils directly below rock outcrops. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Coshocton and Guernsey soils. The available water capacity is moderate or high in the Coshocton soil and is moderate in the Guernsey soil. Runoff is rapid on both soils. A perched seasonal high water table is in the lower part of the subsoil during extended wet periods. The content of organic matter is moderate in the surface layer of the Coshocton soil and moderately low in that of the Guernsey soil. Tilth is good in both soils. The subsoil of the Coshocton soil is strongly acid or very strongly acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. Both soils have a deep root zone.

A few areas are used for pasture. These soils are poorly suited to hay and pasture. The stones on the surface hinder the application of fertilizer and mowing. If the stones are removed, these soils can be farmed. Erosion is a hazard if the soils are cultivated. Natural drainage generally is adequate, but subsurface drains are needed in scattered seepy areas. Springs provide livestock water in some areas. Restricted grazing during wet periods helps to prevent surface compaction.

Most areas are used as woodland. These soils are well suited to trees. The surface stones cause some difficulty in logging, planting tree seedlings by machine, and mowing or disking to control plant competition.

These soils are moderately well suited to building site development. The slope, the seasonal wetness, and the shrink-swell potential are limitations on sites for dwellings. Because of its lower shrink-swell potential, the Coshocton soil is better suited to buildings than the Guernsey soil. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Buildings should be designed to conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces the hazard. The stones should be removed prior to construction. Establishing and mowing lawns can be difficult unless the stones are removed. Erosion can be controlled by removing as little vegetation as possible, mulching, and establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion.

The shrink-swell potential, the potential for frost action, and low strength can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

Because of the seasonal wetness, the slow or moderately slow permeability, and the slope, these soils are poorly suited to septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Perimeter drains reduce the wetness. Enlarging the field helps to overcome the slow or moderately slow permeability.

The land capability classification is VIs. The woodland ordination symbol is 2x.

CtD—Coshocton-Guernsey very stony silt loams, 15 to 25 percent slopes. These deep, moderately steep, moderately well drained soils are on hillsides in the uplands. They generally are dissected by drainageways, and a few springs, seeps, and landslips are in most areas. Stones cover about 0.1 to 3.0 percent of the surface. They are subrounded or angular and range from 10 inches to almost 4 feet across. They are about 5 to 30 feet apart. Most areas are circular or long and narrow and range from 10 to 200 acres in size. They are 50 to 70 percent Coshocton very stony silt loam and 20 to 40 percent Guernsey very stony silt loam. The two soils occur as alternating, narrow bands so intricately mixed that mapping them separately is not practical.

Typically, the Coshocton soil has a surface layer of brown, friable very stony silt loam about 8 inches thick. The subsoil is about 34 inches thick. It is yellowish brown. The upper part is friable silt loam, and the lower part is mottled, firm silty clay loam. The substratum is yellowish brown, mottled, firm shaly silty clay. Brown siltstone bedrock is at a depth of about 60 inches.

Typically, the Guernsey soil has a surface layer of brown, friable very stony silt loam about 6 inches thick. The subsoil is yellowish brown, firm silty clay about 38 inches thick. It is mottled in the lower part. The substratum is grayish brown and yellowish brown, mottled, firm silty clay. Brown shale bedrock is at a depth of about 60 inches.

Included with these soils in mapping are small areas of the well drained Berks and Hazleton soils on the upper part of slopes. Also included are small areas of extremely stony or extremely bouldery soils directly below rock outcrops and some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. The soils in the flood pools are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Coshocton and Guernsey soils. The available water capacity is moderate or high in the Coshocton soil and is moderate in the Guernsey soil. Runoff is very rapid on both soils. A perched seasonal high water table is in the lower part of the subsoil during extended wet periods. The content of organic matter is moderate in the surface layer of the Coshocton soil and moderately low in that of the Guernsey soil. Tilth is good in both soils. The subsoil of the Coshocton soil is strongly acid or very strongly acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. Both soils have a deep root zone.

These soils are generally unsuited to row crops, small grain, and hay. They are poorly suited to pasture. The slope and stones on the surface hinder the application of fertilizer and mowing. If pasture is overgrazed or is plowed during seedbed preparation, the hazard of erosion is very severe. No-till seeding helps to control erosion. Springs provide livestock water in some areas.

Most areas are used as woodland. These soils are well suited to trees. The slope and the surface stones cause some difficulty in logging, in planting of tree seedlings by machine, and in mowing or disking to control plant competition. Locating logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Establishing water bars also helps to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun. Seedling mortality on south-facing slopes can be controlled by selecting seedlings that have been transplanted once.

These soils are poorly suited to building site development. The slope, seasonal wetness, and shrink-swell potential of both soils and the slippage hazard of the Guernsey soil are limitations on sites for dwellings. Because of a lower shrink-swell potential and a lower hazard of hillside slippage, the Coshocton soil is better suited to buildings than the Guernsey soil. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces the hazard. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The stones should be removed prior to construction. Establishing and mowing lawns can be difficult unless the stones are removed. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion.

The shrink-swell potential, the potential for frost action, the slippage hazard, and low strength can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

Because of the seasonal wetness, the slow or moderately slow permeability, the slippage hazard, and the slope, these soils are generally unsuited to septic tank absorption fields.

The land capability classification is VIs. The woodland ordination symbol is 2x on north aspects, 3x on south aspects.

EkA—Elkinsville silt loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on terraces. Most areas are circular or long and narrow and are 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is dark brown and dark yellowish brown, friable and firm silt loam and silty clay loam, and the lower part is dark yellowish brown, mottled, friable silt loam and loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam.

Included with this soil in mapping are small areas of Glenford and Chili soils. The moderately well drained Glenford soils are in the slightly lower landscape positions. Chili soils are in positions similar to those of the Elkinsville soil. They have more sand and gravel in the subsoil and substratum than the Elkinsville soil. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Elkinsville soil. The available water capacity is high or very high. Runoff is slow. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid or very strongly acid. The root zone is deep.

Most areas are used as cropland or pasture. This soil is well suited to corn, soybeans, small grain, hay, and pasture. Row crops can be grown year after year if improved or intensive management is applied. The soil crusts after heavy rainfall, especially in tilled areas. Shallow cultivation of intertilled crops, however, breaks up the crust. Cover crops and a system of conservation tillage that leaves crop residue on the surface help to maintain tilth and prevent surface crusting. Controlled grazing during wet periods helps to prevent surface compaction.

Some areas are wooded. This soil is well suited to woodland. Plant competition can be controlled by cutting, spraying, or disking.

This soil is well suited to building site development and septic tank absorption fields. The moderate shrink-swell potential of the subsoil is a limitation on sites for dwellings. Backfilling around foundations with material that has a low shrink-swell potential helps to overcome this limitation. Low strength and the potential for frost action are limitations on sites for local roads and streets. Providing suitable base material, however, helps to prevent the road damage resulting from low strength and frost action.

The land capability classification is I. The woodland ordination symbol is 1o.

FcA—Fitchville silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on slack water terraces along streams. Most areas are long and narrow or circular and are 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is dark brown, gray, and yellowish brown, mottled, friable silt loam about 38 inches thick. The substratum to a depth of about 62 inches is grayish brown, mottled, friable silt loam.

Included with this soil in mapping are small areas of the poorly drained Sebring soils in depressions and small areas of Caneadea soils. Caneadea soils have more clay throughout than the Fitchville soil. They are in positions on the landscape similar to those of the Fitchville soil. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Fitchville soil. The available water capacity is high. Runoff is slow. A perched seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to neutral. The root zone is deep.

Most areas are used for corn, soybeans, small grain, hay, and pasture (fig. 6). If adequately drained, this soil is well suited to these crops and to pasture. Subsurface drains are used to remove excess water from the subsoil. Grassed waterways and open ditches move the runoff from adjacent soils on uplands to natural drainageways or to ditches. A surface crust forms after heavy rainfall. Shallow cultivation of intertilled crops, however, breaks up the crust. Restricted grazing during wet periods helps to prevent surface compaction in pastured areas. The forage species that can tolerate the wetness grow well.

This soil is well suited to woodland. The trees that can tolerate some wetness should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

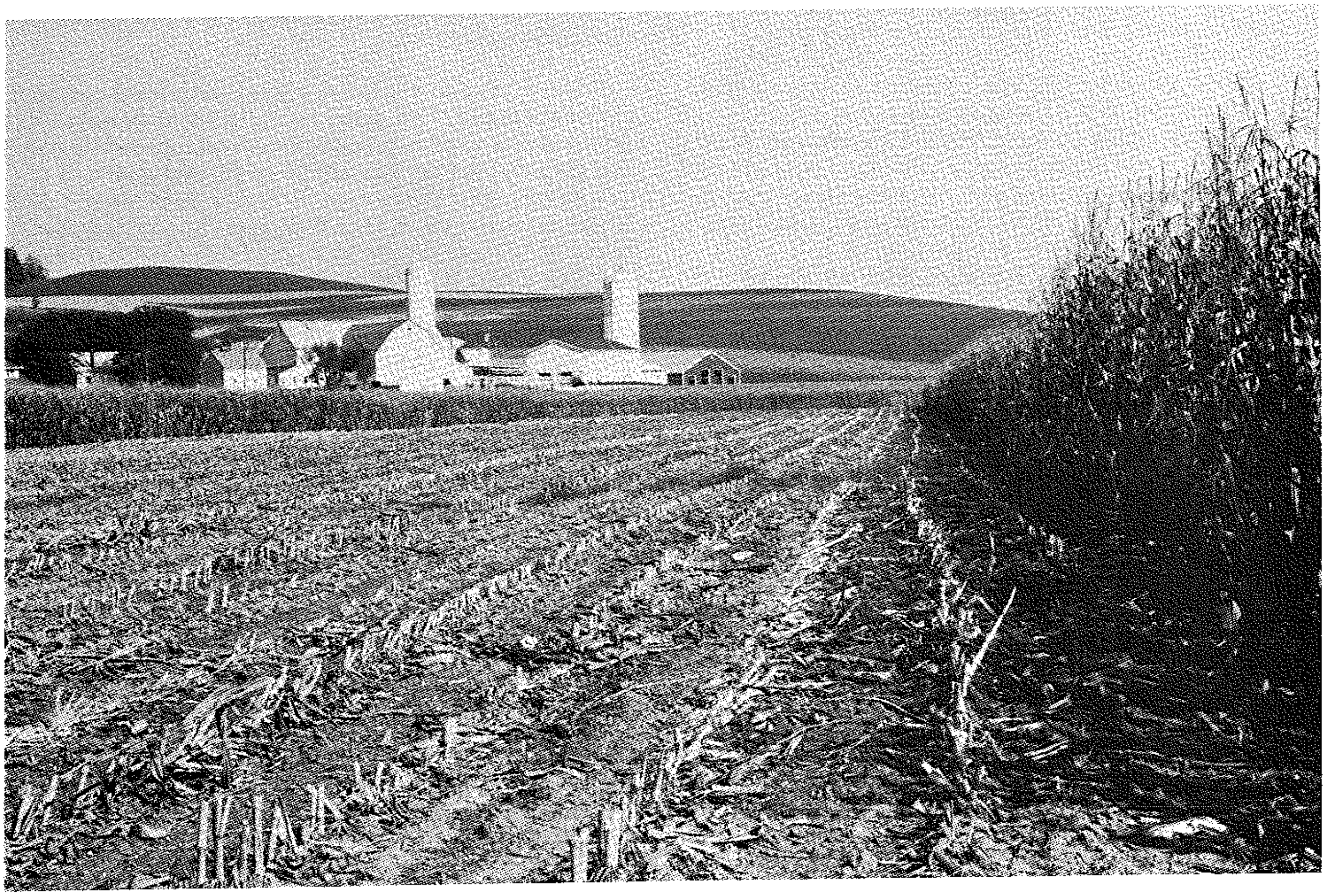

Figure 6.—A drained area of Fitchville silt loam, 0 to 3 percent slopes, used for corn.

This soil is poorly suited to building site development. The seasonal wetness is the main limitation. It can be reduced by surface and subsurface drains. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by designing walls that have pilasters and are reinforced with concrete, by supporting the wall with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material, however, help to prevent this damage.

Because of the seasonal wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains can reduce the wetness if drainage outlets are available. Enlarging the absorption area or installing a double absorption field system helps to overcome the moderately slow permeability.

The land capability classification is IIw. The woodland ordination symbol is 2o.

FcB—Fitchville silt loam, 3 to 8 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on slack water terraces along streams. Most areas are circular or long and narrow and are 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown, mottled, friable and firm silty clay loam and silt loam about 42 inches thick. The substratum to a depth of about 69 inches is yellowish brown, mottled, firm silt loam. In some eroded areas the surface layer has more clay.

Included with this soil in mapping are small areas of Sebring, Glenford, and Caneadea soils. The poorly drained Sebring soils are in depressions, the moderately well drained Glenford soils are on the more sloping parts of the landscape, and Caneadea soils are in positions on the landscape similar to those of the Fitchville soil. Also included are a few areas of soils in the flood pool of dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Fitchville soil. The available water capacity is high. Runoff is medium. A perched seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to neutral. The root zone is deep.

Most areas are used for row crops, small grain, hay, and pasture. If the drainage system is adequate and erosion is controlled, this soil is well suited to these crops and to pasture. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Subsurface drains are commonly used to improve drainage where outlets are available. Grassed waterways and open ditches move the runoff from the adjacent soils on uplands to natural drainageways or to ditches. A crust forms after heavy rainfall. Shallow cultivation of intertilled crops, however, breaks up the crust. Restricted grazing during wet periods helps to prevent surface compaction in pastured areas. The forage species that can tolerate the wetness grow well.

This soil is well suited to woodland. The trees that can tolerate some wetness grow well.

This soil is poorly suited to building site development. The seasonal wetness is the main limitation. It can be reduced by surface and subsurface drains. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material, however, help to prevent this damage.

Because of the seasonal wetness and the moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains can reduce the wetness if a drainage outlet is available. Enlarging the field or installing a double absorption field system helps to overcome the moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 2o.

FdA—Fitchville silt loam, clayey substratum, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is on lacustrine terraces. Most areas are long and narrow and are 30 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 11 inches thick. The subsoil is about 45 inches thick. It is yellowish brown and mottled. The upper part is friable silt loam, and the lower part is friable silt loam and firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay.

Included with this soil in mapping are small areas of the poorly drained Sebring soils in depressions. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Fitchville soil. The available water capacity is high. Runoff is slow. A perched seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to neutral. The root zone is deep. The shrink-swell potential is high in the substratum.

This soil is used for corn, soybeans, wheat, hay, and pasture. It is well suited to these crops and to pasture. The seasonal wetness is the main management concern. Surface and subsurface drains are used to remove excess water. The subsurface drains are more effective if placed above the slowly permeable, clayey substratum. Grassed waterways and open ditches move the runoff from adjacent soils on uplands to natural drainageways or to ditches. A surface crust forms after heavy rainfall. Shallow cultivation of intertilled crops, however, breaks up the crust. Restricted grazing during wet periods helps to prevent surface compaction in pastured areas. The forage species that can tolerate the wetness grow well.

This soil is well suited to woodland. The trees that can tolerate some wetness should be selected for planting. Spraying, mowing, or disking reduces plant competition.

This soil is poorly suited to building site development. The seasonal wetness is the main limitation. It can be reduced by surface and subsurface drains. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material, however, help to prevent this damage.

Because of the seasonal wetness and the slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains can reduce the wetness if drainage outlets are available. Enlarging the absorption area or installing a double absorption field system helps to overcome the slow permeability.

The land capability classification is IIw. The woodland ordination symbol is 2o.

FdB—Fitchville silt loam, clayey substratum, 3 to 8 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on slack water terraces. Most areas are long and narrow and are 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 11 inches thick. The subsoil is about 43 inches thick. It is yellowish brown and mottled. The upper part is friable silt loam, and the lower part is friable silt loam and firm silty clay loam. The substratum to a depth of about 65 inches is yellowish brown, firm silty clay.

Included with this soil in mapping are small areas of the poorly drained Sebring soils in depressions and small areas of the moderately well drained Glenford soils on the more sloping part of the landscape. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is slow in the Fitchville soil. The available water capacity is high. Runoff is medium. A perched seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to neutral. The root zone is deep. The shrink-swell potential is high in the substratum.

Most areas are used as cropland or pasture. This soil is well suited to corn, soybeans, wheat, hay, and pasture. Controlling erosion and reducing wetness are the major concerns of management. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Subsurface drains are used in areas where drainage outlets are available. Grassed waterways and open ditches move the runoff from the adjacent soils on uplands to natural drainageways or to ditches. A crust forms after heavy rainfall. Shallow cultivation of intertilled crops, however, breaks up the crust. Restricted grazing during wet periods helps to prevent surface compaction in pastured areas. The forage species that can tolerate the wetness grow well.

Some areas are wooded. This soil is well suited to woodland. The trees that can tolerate some wetness grow well. Spraying, mowing, or disking reduces plant competition.

This soil is poorly suited to building site development. The seasonal wetness is the main limitation. It can be reduced by surface and subsurface drains. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material, however, help to prevent this damage.

Because of the seasonal wetness and the slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains can reduce the wetness if a drainage outlet is available. Enlarging the absorption area or installing a double absorption field system helps to overcome the moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 2o.

FeB—Fitchville-Urban land complex, undulating. This map unit consists of a deep, somewhat poorly drained Fitchville soil and areas of Urban land on slack water terraces. Slopes are dominantly 0 to 5 percent, but they range from 0 to 8 percent. Areas commonly are irregularly shaped. Most are about 50 percent Fitchville silt loam and 30 percent Urban land. The Fitchville soil and Urban land occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Fitchville soil has a surface layer of dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 40 inches thick. It is yellowish brown and mottled. It is friable and firm silt loam in the upper part and friable silty clay loam in the lower part. The substratum to a depth of about 67 inches is yellowish brown, mottled, firm silt loam. In places the soil has been radically altered. Some low areas have been filled or leveled during construction, and small areas have been cut, built up, or smoothed.

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

Included with this unit in mapping are small areas of the poorly drained Sebring soils in shallow drainageways and depressions and small areas of the moderately well drained Glenford soils on slight rises. Included soils make up about 20 percent of most mapped areas.

Most areas are artificially drained through sewer systems, gutters, subsurface drains, and, to a lesser extent, surface ditches. Unless drained, the Fitchville soil has a perched seasonal high water table at a depth of 12 to 30 inches during extended wet periods. Permeability is moderately slow. The available water capacity is high. Runoff is slow or medium. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to neutral. The root zone is deep.

The Fitchville soil is used for parks, open areas, lawns, and gardens. It is well suited to grasses, flowers, vegetables, trees, and shrubs. Erosion is generally not a major problem unless the soil is disturbed and left unprotected or is used as a watercourse. Areas that have been cut or filled are poorly suited to lawns and gardens because tilth is poor in the exposed subsoil material. This material is sticky when wet and hard when dry.

The Fitchville soil is poorly suited to building site development. The seasonal wetness is the main limitation. Landscaping building sites can help to drain surface water away from foundations. Drains at the base of footings and other subsurface drains are used to remove excess water from around foundations and basement walls and to lower the seasonal high water table. Coating the exterior of the basement walls helps to keep basements dry. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material, however, help to prevent this damage.

Because of the seasonal wetness and the moderately slow permeability, the Fitchville soil is poorly suited to septic tank absorption fields. Perimeter drains can reduce the wetness if drainage outlets are available. Enlarging the absorption area or installing a double absorption field system helps to overcome the moderately slow permeability. Sanitary facilities should be connected to central sewers and treatment facilities wherever possible.

The Fitchville soil is assigned to land capability classification IIw. Urban land is not assigned a land capability classification. The Fitchville soil and Urban land are not assigned a woodland ordination symbol.

GfB—Glenford silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on slack water terraces along streams. It generally occurs as circular or elongated areas at the base of slope breaks to the uplands. It also occurs, however, as long and narrow areas on slope breaks between terrace levels. Most areas are 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper part is brown, friable silt loam; the next part is yellowish brown, mottled, friable silt loam; and the lower part is brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville soils in depressions. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Glenford soil. The available water capacity is moderate or high. Runoff is medium. A perched seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid or medium acid in the upper part and strongly acid to neutral in the lower part. The root zone is deep.

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

Some areas are wooded. This soil is well suited to woodland. Spraying, mowing, or disking help to control plant competition.

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

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

The land capability classification is IIe. The woodland ordination symbol is 1o.

GfC—Glenford silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on slack water terraces along streams. Most areas are long and narrow and are 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown and brown, friable silt loam about 42 inches thick. It is mottled below a depth of about 22 inches. The substratum to a depth of about 64 inches is yellowish brown, mottled, friable silt loam.

Included with this soil in mapping are long, narrow areas of soils that have slopes of 15 to 25 percent and are along drainageways. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 10 percent of most mapped areas.

Permeability is moderately slow in the Glenford soil. The available water capacity is moderate or high. Runoff is medium or rapid. A perched seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid or medium acid in the upper part and strongly acid to neutral in the lower part. The root zone is deep.

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

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

Some areas are wooded. This soil is well suited to woodland. Plant competition can be controlled by spraying, mowing, or disking.

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

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

The land capability classification is IIIe. The woodland ordination symbol is 1o.

GgB—Guernsey silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops in the uplands. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is dark yellowish brown, mottled, firm silty clay. The substratum is light olive gray, mottled, firm clay. Weathered shale bedrock is at a depth of about 60 inches.

Included with this soil in mapping are small areas of Coshocton, Westmoreland, and Berks soils on the edges of ridges. Coshocton soils have less clay in the subsoil than the Guernsey soil. Westmoreland and Berks soils are well drained. Also included are small areas of somewhat poorly drained soils on the flatter part of ridgetops. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in the Guernsey soil. The available water capacity is moderate. Runoff is medium. A perched seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to mildly alkaline in the lower part. The root zone is deep.

Most areas are used as cropland or pasture. This soil is well suited to corn, small grain, hay, and pasture. Controlling erosion and maintaining tilth are the major concerns of management. If the soil is cultivated or plowed during seedbed preparation or the pasture is overgrazed, the hazard of erosion is moderate. The surface layer crusts after hard rains. Shallow cultivation of intertilled crops, however, breaks up the crust. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour farming, and cover crops reduce the runoff rate, help to prevent excessive soil loss, and maintain tilth. Natural drainage generally is adequate, but subsurface drains are needed in scattered areas of the wetter included soils. Tilling when the soil is wet causes surface compaction and cloddiness. Restricted grazing during wet periods helps to prevent surface compaction and helps to keep the pasture in good condition.

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

This soil is moderately well suited to building site development. The seasonal wetness and the high shrink-swell potential are limitations on sites for dwellings, especially dwellings with basements. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. The shrink-swell potential, the potential for frost action, and low strength can result in damage to local roads and streets. Providing suitable base material and installing a drainage system, however, help to prevent this damage.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains reduce the wetness. Enlarging the field helps to overcome the slow or moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 2o.

GgC—Guernsey silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on ridgetops and benches. Most slopes are uneven because of differential soil movement on the slope. Most areas are long and narrow or circular and are 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is brown, firm silt loam. The lower part is dark yellowish brown, mottled, firm silty clay loam and silty clay. The substratum to a depth of about 60 inches is light olive gray, mottled, very firm silty clay.

Included with this soil in mapping are small, convex areas of the well drained Berks and Westmoreland soils on the higher part of ridges and Coshocton soils on the lower part of slopes. These soils contain less clay in the subsoil than the Guernsey soil. Also included are a few seepy areas on the lower part of slopes and on benches. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in the Guernsey soil. The available water capacity is moderate. Runoff is rapid. A perched seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to mildly alkaline in the lower part. The root zone is deep.

Many areas are used as pasture or cropland. Corn, small grain, and hay are the principal crops. This soil is moderately well suited to these crops. Controlling erosion is the major concern of management. If the soil is cultivated, the hazard of erosion is severe. The surface layer crusts after hard rains. Shallow cultivation of intertilled crops, however, breaks up the crust. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops maintain tilth, reduce the runoff rate, and help to prevent excessive soil loss. Natural drainage generally is adequate, but subsurface drains are needed in the scattered seepy areas. Tilling when the soil is wet causes surface compaction and cloddiness.

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

Some areas are used as woodland. This soil is well suited to trees. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to building site development. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. The slope, the seasonal wetness, and the high shrink-swell potential are limitations on sites for dwellings, especially dwellings with basements. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Cutting and filling increase the hazard of hillside slippage, but installing drains in seepy areas reduces the hazard.

The shrink-swell potential, the potential for frost action, and low strength can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

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

The land capability classification is IIIe. The woodland ordination symbol is 2o.

GgD—Guernsey silt loam, 15 to 25 percent slopes. This deep, strongly sloping, moderately well drained soil is on ridgetops and side slopes. Seeps, springs, and slips are common, and deep ravines are in some areas. Most areas are long and narrow and are 5 to 200 acres in size. Some areas on ridgetops are oblong.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, mottled, firm silty clay about 51 inches thick. Black coal blossom is at a depth of about 59 inches.

Included with this soil in mapping are small, convex areas of the well drained Berks and Westmoreland soils. These soils contain less clay in the subsoil than the Guernsey soil. Also included are some small areas of the well drained Upshur soils on the upper part of side slopes. These soils are redder in the subsoil than the Guernsey soils. Included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in the Guernsey soil. The available water capacity is moderate. Runoff is very rapid. A perched seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid in the upper part and strongly acid to mildly alkaline in the lower part. The root zone is deep.

Some areas are used as pasture or cropland. Corn, small grain, and hay are the principal crops. This soil is poorly suited to these crops. Controlling erosion is the major concern of management. If the soil is cultivated, the hazard of erosion is very severe. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops maintain tilth, reduce the runoff rate, and help to prevent excessive soil loss. Subsurface drains are needed in scattered seepy areas. Tilling when the soil is wet causes surface compaction and cloddiness.

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

Many areas are used as woodland. This soil is well suited to trees. Locating logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Establishing water bars also helps to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun. Seedling mortality on south-facing slopes can be controlled by selecting seedlings that have been transplanted once.

This soil is poorly suited to building site development. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. The slope, the seasonal wetness, the high shrink-swell potential, and the slippage hazard are limitations on sites for dwellings. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Cutting and filling increase the hazard of hillside slippage, but installing artificial drains in seepy areas reduces the hazard.

The shrink-swell potential, the potential for frost action, and low strength can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

Because of the seasonal wetness, the slow or moderately slow permeability, and the slope, this soil is generally unsuited to septic tank absorption fields.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

HeC—Hazleton channery loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops in the uplands. Most areas are long and narrow and are 10 to 40 acres in size.

Typically, the surface layer is brown, friable channery loam about 8 inches thick. The subsoil is about 40 inches thick. It is yellowish brown. The upper part is friable channery loam, and the lower part is channery and very channery sandy loam. Pale brown sandstone bedrock is at a depth of about 48 inches. In a few areas the depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are areas, generally less than 2 acres in size, of Westmoreland soils on the less sloping parts of the landscape. The subsoil of these soils has a higher content of clay and a lower content of sandstone fragments than that of the Hazleton soil. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is rapid or moderately rapid in the Hazleton soil. The available water capacity is low. Runoff is medium or rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The soil can be easily tilled throughout a wide range in moisture content. The subsoil is extremely acid to strongly acid. The root zone is deep.

Most areas are used as pasture or cropland. This soil is moderately well suited to corn, small grain, and hay. Controlling erosion and conserving moisture are the major concerns of management. If the soil is cultivated, the hazard of erosion is severe. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, timely applications of lime and fertilizer are needed. Some crop yields are reduced because of droughtiness. The sandstone fragments in the surface layer hinder tillage.

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

This soil is moderately well suited to woodland. Drought-tolerant trees should be selected for planting.

This soil is moderately well suited to building site development. Erosion can be controlled by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. The flat stone fragments in the subsoil can be easily excavated by heavy construction equipment. Buildings should be designed so that they conform to the natural slope of the land. Because the depth to bedrock is as shallow as 40 inches in some areas, the soil is better suited to dwellings without basements than to dwellings with basements. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action. Droughtiness is a limitation if the soil is used for lawns.

This soil is moderately well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. Providing suitable fill material helps to prevent the pollution of streams, lakes, and shallow wells that can result from the poor filtering capacity. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 3f.

HeD—Hazleton channery loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on side slopes and ridgetops in the uplands. Slopes are smooth and are characterized by some microrelief. Most areas are circular or long and narrow and are 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable channery loam about 5 inches thick. The subsoil is about 45 inches thick. It is yellowish brown. The upper part is friable channery sandy loam and very channery sandy loam, and the lower part is very friable very channery and extremely channery loamy coarse sand. Brown sandstone bedrock is at a depth of about 50 inches.

Included with this soil in mapping are narrow strips of the moderately well drained Guernsey soils. Seeps are common in these included areas. Also included are a few areas of soils in the flood pools of the dams in the Muskingum Water Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is rapid or moderately rapid in the Hazleton soil. The available water capacity is low. Runoff is rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is extremely acid to strongly acid. The root zone is deep.

Some areas are used as cropland. This soil is poorly suited to corn, small grain, and hay. Controlling erosion and conserving moisture are the major concerns of management. The slope also is a concern. If the soil is cultivated, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. Cultivated crops can be grown about once every 4 years. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. The moderately steep slope hinders the use of some farm machinery. Plant nutrients are leached from the soil at a moderately rapid rate. As a result, timely applications of lime and fertilizer are needed. Some crop yields are reduced because of droughtiness. The sandstone fragments in the surface layer hinder tillage.

Some areas are pastured. This soil is moderately well suited to pasture. In areas that are overgrazed or are plowed during seedbed preparation, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. No-till seeding also helps to control erosion. Timely applications of lime and fertilizer are needed.

Many areas are wooded. This soil is moderately well suited to woodland and to Christmas trees (fig. 7). Locating logging roads and skid trails on the contour facilitates the use of equipment. Mechanical tree planters and the mowers used to control plant competition can be operated on this soil. Because of the seedling mortality rate on south aspects, drought-tolerant trees should be selected for planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

Because of the slope, this soil is poorly suited to building site development. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Buildings should be designed so that they conform to the natural slope of the land. Because the depth to bedrock is as shallow as 40 inches in some areas, the soil is better suited to dwellings without basements than to dwellings with basements. Droughtiness is a limitation if the soil is used for lawns. Providing suitable base material helps to prevent the damage to local roads and streets caused by frost action.

This soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity may result in the pollution of streams, lakes, or shallow wells. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 3f on north aspects, 4f on south aspects.

HeE—Hazleton channery loam, 25 to 40 percent slopes. This deep, steep, well drained soil is on hillsides in the uplands. Most areas are long and narrow or oblong and are 10 to 400 acres in size.

Typically, the surface layer is very dark grayish brown, friable channery loam about 4 inches thick. The subsoil is about 36 inches thick. It is yellowish brown and friable. The upper part is channery loam and very channery sandy loam, and the lower part is very flaggy loamy

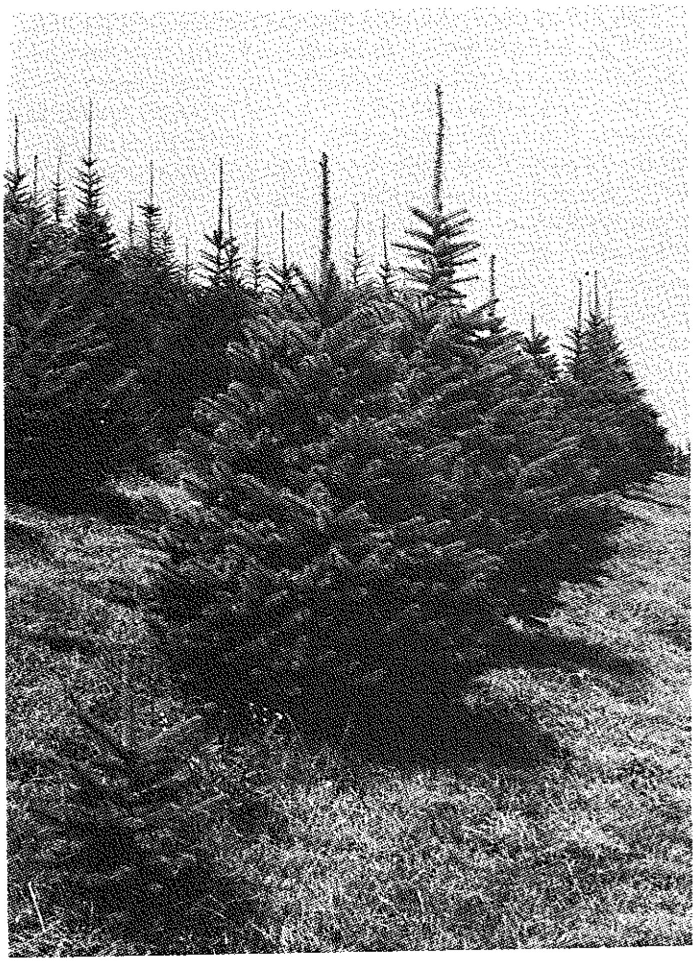

Figure 7.—Blue spruce Christmas trees in an area of Hazleton channery loam, 15 to 25 percent slopes.

coarse sand and extremely flaggy coarse sandy loam. The substratum is yellowish brown, friable extremely flaggy loamy coarse sand. Brown sandstone bedrock is at a depth of about 48 inches.

Included with this soil in mapping are small areas of the moderately well drained Guernsey soils on the concave parts of side slopes. A few seeps and slips are in these included areas. Also included are narrow strips of soils on the lower part of some hillsides that are in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is rapid or moderately rapid in the Hazleton soil. The available water capacity is low. Runoff is very rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is extremely acid to strongly acid. The root zone is deep.

This soil is generally unsuited to cultivated crops and hay. The steep slopes, the erosion hazard, and the low available water capacity severely limit these uses.

Some areas are pastured. This soil is poorly suited to pasture. The hazard of erosion, droughtiness, and the steep slope are the major concerns of management. If the pasture is plowed during seedbed preparation or overgrazed, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. No-till seeding also helps to control erosion.

Most areas are wooded. This soil is moderately well suited to woodland. Locating logging roads and skid trails on the contour facilitates the use of equipment. Operating mechanical tree planters and the mowers that are used to control plant competition is difficult because of the steep slope. Because of the seedling mortality rate on south aspects, drought-tolerant trees should be selected for planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields. Erosion can be controlled by building local roads on the contour and by seeding road cuts.

The land capability classification is VIe. The woodland ordination symbol is 3f on north aspects, 4f on south aspects.

HeF—Hazleton channery loam, 40 to 60 percent slopes. This deep, very steep, well drained soil is on hillsides in the uplands. In some areas it is dissected by deep drainageways. Most areas are long and narrow and are 5 to 250 acres in size.

Typically, the surface layer is very dark gray, friable channery loam about 6 inches thick. The subsoil is about 44 inches thick. It is yellowish brown and friable. The upper part is channery and very channery sandy loam, and the lower part is extremely channery sandy loam. The substratum is pale brown, friable extremely channery sandy loam. Hard sandstone bedrock is at a depth of about 55 inches. In some areas the soil has more sand throughout.

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

Permeability is rapid or moderately rapid in the Hazleton soil. The available water capacity is low. Runoff is very rapid. The subsoil is extremely acid to strongly acid. The root zone is deep.

This soil is generally unsuited to cultivated crops, hay, and pasture. The very steep slopes, the erosion hazard, and the low available water capacity severely limit these uses.

This soil is wooded. It is moderately well suited to woodland and to habitat for woodland wildlife. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Locating logging roads across the slope facilitates the use of equipment. Because of the seedling mortality rate on south aspects, drought-tolerant trees should be selected for planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the slope. Erosion can be controlled by building local roads on the contour and by seeding road cuts. On sites for trails, it can be controlled by laying out the trails on the contour, by establishing water bars and switchbacks, and by building steps.

The land capability classification is VIIe. The woodland ordination symbol is 3f on north aspects, 4f on south aspects.

HgF—Hazleton extremely bouldery loam, 25 to 60 percent slopes. This deep, steep and very steep, well drained soil is on side slopes in the uplands. Boulders cover 3 to 15 percent of the surface. They are mostly angular and 2 to 20 feet across. Most areas are long and narrow and are 10 to 100 acres in size.

Typically, the surface layer is dark gray, friable extremely bouldery loam about 6 inches thick. The subsoil is about 43 inches thick. It is yellowish brown and very friable. The upper part is channery sandy loam, and the lower part is very channery sandy loam. The substratum is pale brown, very friable very flaggy loamy coarse sand. Brown sandstone bedrock is at a depth of about 65 inches. In some areas the soil has sand throughout.

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

Permeability is rapid or moderately rapid in the Hazleton soil. The available water capacity is low. Runoff is very rapid. The subsoil is extremely acid to strongly acid. The root zone is deep.

Most areas are used as woodland. This soil is moderately well suited to woodland and to habitat for woodland wildlife. It is unsuited to most other uses because of the steep and very steep slopes and the surface boulders. The slopes and boulders seriously limit the use of logging and planting equipment. Logging roads and skid trails should be carefully laid out and should be protected from erosion by water bars.

Locating logging roads across the slope facilitates the use of equipment. Because of the seedling mortality rate on south aspects, drought-tolerant trees should be selected for planting. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the surface boulders and the steep and very steep slopes.

The land capability classification is VIIs. The woodland ordination symbol is 3x on north aspects, 4x on south aspects.

KeB—Keene silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on upland ridges and side slopes. Most areas are circular and are 40 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown and strong brown, mottled, friable silt loam and silty clay loam; and the lower part is brown, mottled, very firm silty clay. Grayish brown shale and gray sandstone bedrock is at a depth of about 46 inches. The silty mantle is more than 36 inches deep in some areas.

Included with this soil in mapping are small areas of Guernsey and Westmoreland soils on the upper part of slopes. Guernsey soils have more clay in the subsoil than the Keene soil. Westmoreland soils are well drained. Also included are a few seepy areas on the lower part of slopes and some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. The soils in the flood pools are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Keene soil. The available water capacity is moderate. Runoff is medium. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid or very strongly acid in the upper part and slightly acid to very strongly acid in the lower part. The root zone is deep.

Most areas are used as cropland. This soil is well suited to corn, soybeans, small grain, and hay. Erosion and surface crusting are the major concerns of management. No-till planting or other kinds of conservation tillage that leave crop residue on the surface, contour stripcropping, grassed waterways, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. The surface layer crusts after hard rains. Shallow cultivation of intertilled crops, however, breaks up the crust. Natural drainage generally is adequate, but subsurface drains are needed in the scattered seepy areas.

A very small acreage is pastured. This soil is well suited to pasture. Restricted grazing during wet periods helps to keep the pasture in good condition.

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

This soil is moderately well suited to building site development. The seasonal wetness is a limitation on sites for dwellings, especially dwellings with basements. Also, the moderate shrink-swell potential of the subsoil is a limitation. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Low strength and the potential for frost action can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is only moderately well suited to septic tank absorption fields. Installing perimeter drains reduces the wetness. Increasing the size of the absorption field helps to overcome the slow or moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 2o.

KeC—Keene silt loam, 8 to 15 percent slopes. This deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Most areas are circular or elongated and are 15 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable silt loam that is mottled below a depth of about 22 inches. The lower part is yellowish brown, mottled, firm silty clay loam. Grayish brown shale bedrock is at a depth of about 52 inches.

Included with this soil in mapping are small areas of Guernsey and Westmoreland soils on the upper part of slopes. Guernsey soils have more clay in the subsoil than the Keene soil. Westmoreland soils are well drained. Also included are a few seepy areas on the lower part of slopes. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow or slow in the Keene soil. The available water capacity is moderate. Runoff is rapid. A perched seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid or very strongly acid in the upper part and slightly acid to very strongly acid in the lower part. The root zone is deep.

Many areas are used as cropland or pasture. This soil is moderately well suited to corn, soybeans, and small grain and is well suited to hay and pasture. Erosion and surface crusting are the major concerns of management. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and a cropping sequence that includes small grain and hay help to prevent excessive soil loss and deterioration of tilth. Shallow cultivation of intertilled crops breaks up the surface crust. Natural drainage generally is adequate, but subsurface drains are needed in the scattered seepy areas. In the areas used as pasture, proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to control erosion.

Some areas are used as woodland. This soil is well suited to trees. Plant competition can be controlled by spraying, mowing, or disking.

This soil is moderately well suited to building site development. The seasonal wetness is a limitation on sites for dwellings, especially dwellings with basements. Also, the moderate shrink-swell potential of the subsoil and the slope are limitations. Buildings should be designed so that they conform to the natural slope of the land. The harmful effects of shrinking and swelling can be reduced by designing walls that have pilasters and are reinforced with concrete, by supporting the walls with a large spread footing, and by backfilling around foundations with material that has a low shrink-swell potential. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Low strength and the potential for frost action can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage. Erosion can be controlled on construction sites by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is only moderately well suited to septic tank absorption fields. Installing perimeter drains reduces the wetness. Increasing the size of the absorption field helps to overcome the slow or moderately slow permeability. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 2o.

Ln—Linwood mucky silt loam, ponded. This deep, nearly level, very poorly drained soil is in depressions in glacial outwash plains. It is frequently flooded and is subject to ponding. Slopes range from 0 to 3 percent. Most areas are long and narrow and are 8 to 20 acres in size.

Typically, the surface layer is dark gray, friable mucky silt loam about 5 inches thick. The next layer is black, firm muck about 18 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown and very dark gray, firm mucky silt loam and mucky sandy loam and dark gray, friable loamy fine sand.

Included with this soil in mapping are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding.

Permeability is moderately slow to moderately rapid in the organic layers and moderate in the loamy and sandy material. The available water capacity is very high. Runoff is very slow or ponded. A seasonal high water table is near or above the surface for long periods. In the surface layer, the content of organic matter is very high and tilth is good. The root zone is medium acid to neutral.

Most areas are used as habitat for wetland wildlife. They support cattails, reeds, and sedges. This soil is well suited to wetland wildlife habitat. It is generally unsuited to cultivated crops, hay, pasture, buildings, and septic tank absorption fields because of flooding and ponding. It is poorly suited to trees. The fluctuating water level limits the survival of many trees.

The land capability classification is Vw. The woodland ordination symbol is 5w.

Mc—Melvin silt loam, frequently flooded. This deep, nearly level, poorly drained soil is on flood plains along small streams. Slopes range from 0 to 3 percent. Most areas are long and narrow and are 20 to 190 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 12 inches thick. The subsoil is dark grayish brown and grayish brown, mottled, friable silt loam about 20 inches thick. The substratum to a depth of about 60 inches is grayish brown, friable silt loam.

Included with this soil in mapping are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding.

Permeability is moderate in the Melvin soil. The available water capacity is high or very high. Runoff is very slow. A seasonal high water table is near the surface during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is medium acid to neutral.

Many areas are used for pasture. Some areas are used as cropland. If drained, this soil is moderately well suited to corn and soybeans. It is generally unsuited to small grain. Undrained areas are too wet for the crops commonly grown in the county. Flooding and wetness are the main management concerns. They delay spring planting in most years. Flooding damages small grain. Surface and subsurface drains improve drainage. Outlets for the subsurface drains are not available in many areas, however, because of the low position on the landscape. Grasses and legumes that are tolerant of the seasonal wetness and flooding should be selected for seeding. The floodwater deposits sediment on hayland and pasture. Forage commonly becomes unsuitable for hay when covered with this sediment. Grazing when the soil is wet and soft causes surface compaction and poor tilth, damages plants, and hinders air and water movement in the soil.

Many areas are used as woodland. The soil is well suited to the trees adapted to wet sites. The species selected for planting should be tolerant of wetness and flooding. Selecting seedlings that have been transplanted once reduces the seedling mortality rate. Wetness severely limits the use of planting and logging equipment. This equipment can be used during the drier parts of the year.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields because of the wetness and the hazard of flooding. Providing fill material can elevate roads above normal flood levels.

The land capability classification is IIIw. The woodland ordination symbol is 1w.

MrB—Morristown loam, 0 to 8 percent slopes. This deep, well drained, nearly level and gently sloping soil is on mine spoil ridgetops and side slopes in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone and shale and smaller amounts of siltstone, sandstone, and coal. Slopes are smooth. Small shallow gullies are in some areas. A few stones are on the surface in some areas. Most areas are long and narrow or circular and are 5 to 100 acres in size.

Typically, the surface layer is yellowish brown, friable loam about 10 inches thick. The substratum extends to a depth of about 60 inches. It is firm. It is dark gray channery silty clay loam and channery clay loam in the upper part and very dark gray and dark gray very channery clay loam in the lower part.

Included with this soil in mapping are small areas of Bethesda soils and small areas of unreclaimed soils that have a surface layer of channery silty clay loam. Bethesda soils are more acid throughout than the Morristown soil. The thin, flat stone fragments in the unreclaimed soils interfere with tillage. Tilth is poor in these soils. Also included are small areas of soils that have a surface layer and substratum of very channery sandy loam or very channery loamy sand. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Morristown soil. The available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is slow or medium. Tilth is fair. The content of organic matter is very low. The substratum is mildly alkaline or moderately alkaline. The depth of the root zone varies.

Most of the acreage supports grasses and legumes for hay and pasture. Some areas are used for small grain. This soil is poorly suited to corn and moderately well suited to hay and pasture. Erosion is a hazard, and the soil is droughty. No-till management is well suited to this soil. A cropping sequence that includes grasses and legumes, incorporation of crop residue into the surface layer, cover crops, contour tillage, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and increase the rate of water intake. Because of uneven grading or settling, surface drains are needed in some areas.

This soil is best suited to the trees that can tolerate a high content of lime and droughty conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical tree planters can be used on this soil.

Once this soil has settled, it is moderately well suited to buildings and poorly suited to septic tank absorption fields. Onsite investigations are needed to determine the suitability for these uses. Erosion is a management concern. It can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover. Building local roads and streets on the contour and seeding road cuts also help to control erosion. The shrink-swell potential is a limitation on sites for dwellings. It can be overcome, however, by backfilling around foundations with material that has a low shrink-swell potential and by supporting the walls with a large spread footing. The moderately slow permeability is a limitation in septic tank absorption fields. Enlarging the absorption field improves the filtering capacity. If the soil is used for lawns, drought is a hazard during dry periods.

The land capability classification is IIIs. No woodland ordination symbol is assigned.

MrC—Morristown loam, 8 to 15 percent slopes. This deep, strongly sloping well drained soil is on mine spoil ridgetops and side slopes in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone and shale and smaller amounts of siltstone, sandstone, and coal. A few stones are on the surface. Small gullies and rills are in some areas. Most areas are elongated and are 20 to 150 acres in size.

Typically, the surface layer is yellowish brown, friable loam about 10 inches thick. The substratum to a depth of about 60 inches is dark gray, brown, and very dark gray, firm very channery silty clay loam and extremely channery clay loam. In some areas the soil is eroded.

Included with this soil in mapping are small areas of Bethesda soils and small areas of unreclaimed soils that have a surface layer of channery silty clay loam. Bethesda soils are more acid throughout than the Morristown soil. The thin, flat stone fragments in the unreclaimed soils interfere with tillage. Tilth is poor in these soils. Also included are small areas of soils that have a surface layer and substratum of very channery sandy loam or very channery loamy sand. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Morristown soil. The available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is rapid. Tilth is fair. The content of organic matter is very low. The substratum is mildly alkaline or moderately alkaline. The depth of the root zone varies.

Most of the acreage is used for grasses and legumes for hay and pasture. Some areas are used for small grain. This soil is poorly suited to corn and small grain. It is moderately well suited to pasture and hay. Erosion is a hazard, and the soil is droughty. A cropping sequence that includes grasses and legumes, incorporation of crop residue into the surface layer, contour stripcropping, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and increase the rate of water intake. Timely applications of lime and fertilizer are needed to maintain a good stand of the key forage plants. In the pastured areas, proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. No-till seeding also helps to control erosion.

This soil is best suited to the trees that can tolerate a high content of lime and droughty conditions. Grasses and legumes provide ground cover during the establishment of trees. Mechanical tree planters can be used on this soil.

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

The land capability classification is IVs. No woodland ordination symbol is assigned.

MrD—Morristown loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on mine spoil ridgetops and side slopes in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone and shale and small amounts of siltstone, sandstone, and coal. A few stones are on the surface and in the surface layer. In some areas the soil is dissected by deep gullies. Most areas are oblong and are 5 to 40 acres in size.

Typically, the surface layer is yellowish brown, friable loam about 6 inches thick. The substratum to a depth of about 60 inches is dark gray and gray, firm channery and very channery silty clay loam and clay loam. In some areas the soil is eroded.

Included with this soil in mapping are small areas of Bethesda soils and small areas of unreclaimed soils that have a surface layer of channery silty clay loam. Bethesda soils are more acid throughout than the Morristown soil. In the unreclaimed soils, tilth is poor and the thin, flat stone fragments interfere with tillage. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Morristown soil. The available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is very rapid. Tilth is fair. The content of organic matter is very low. The substratum is mildly alkaline or moderately alkaline. The depth of the root zone varies.

Most areas have been seeded to grasses. Some areas are used for pasture. This soil is generally unsuited to corn and small grain. It is poorly suited to hay and pasture. Erosion is a very severe hazard, and the soil is droughty. Slope hinders the use of some farm machinery. No-till seedings help to control erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and control erosion.

This soil is best suited to the trees that can tolerate a high content of lime and droughty conditions. Selecting species for planting that are tolerant of these conditions reduces the seedling mortality rate. Growth is generally slow. Erosion can be controllled by building logging roads and skid trails on the contour and by establishing water bars. Grasses and legumes provide ground cover during the establishment of trees.

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

The land capability classification is IVs. No woodland ordination symbol is assigned.

MrF—Morristown loam, 25 to 70 percent slopes. This deep, steep and very steep, well drained soil is on graded mine spoil side slopes in areas that have been surface mined for coal. It has been reclaimed by grading and by blanketing the surface with a layer of material removed from other soils. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. Most of the rock fragments are limestone and shale and smaller amounts of siltstone, sandstone, and coal. Small gullies are in some areas. A few stones are on the surface. Most areas are elongated and 10 to 100 acres in size.

Typically, the surface layer is yellowish brown, friable loam about 5 inches thick. The substratum to a depth of about 60 inches is dark gray and gray, firm channery and very channery silty clay loam and clay loam.

Included with this soil in mapping are small areas of Bethesda soils and small areas of unreclaimed soils that have a surface layer of channery clay loam or channery silty clay loam. Bethesda soils are more acid throughout than the Morristown soil. In the unreclaimed soils, tilth is poor and the thin, flat stone fragments interfere with tree planting. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Morristown soil. The available water capacity is low because the substratum has a high content of coarse fragments and is compact. Runoff is rapid. The content of organic matter is very low. The substratum is mildly alkaline or moderately alkaline. The depth of the root zone varies.

Most of the acreage supports grasses and legumes. This soil is generally unsuited to cultivated crops, hay, and pasture because of the steep and very steep slopes, the very severe erosion hazard, and droughtiness. A good ground cover increases the infiltration rate by slowing runoff.

This soil is best suited to the trees that can tolerate a high content of lime and droughty conditions. Selecting species for planting that are tolerant of these conditions reduces the seedling mortality rate. Growth is generally slow. Grasses and legumes provide ground cover during the establishment of trees. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars.

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

The land capability classification is VIIe. No woodland ordination symbol is assigned.

No—Nolin silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Narrow meander channels are in many areas. Slopes range from 0 to 3 percent. Most areas are long and narrow and are 10 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is brown and dark yellowish brown, friable silt loam about 35 inches thick. The substratum to a depth of about 60 inches is dark brown, friable silt loam and very friable sandy loam.

Included with this soil in mapping are some areas of the somewhat poorly drained Orrville soils in slight depressions. Also included are areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Nolin soil. The available water capacity is high. Runoff is slow. A seasonal high water table is at a depth of 36 to 72 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is medium acid to moderately alkaline.

Most areas are farmed. This soil is well suited to corn, soybeans, hay, and pasture. Winter grain crops are limited by the flooding. The soil is better suited to crops that can be planted after the normal period of flooding than to crops planted early in spring. The alkalinity of the soil in some areas reduces the availability of phosphorus in applied fertilizers. Applications of acid base fertilizers reduce the lime level. The surface layer crusts after hard rains. No-till planting or other kinds of conservation tillage that leave crop residue on the surface help to prevent excessive soil loss and surface crusting. Floodwater sometimes leaves sediment on hayland and pasture. Forage commonly is unsuitable for hay when covered with this sediment. Pasture rotation and restricted grazing during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to woodland. Tree seedlings can be damaged by floodwater. They can be easily established if competing vegetation is controlled by spraying, mowing, or disking.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding. It is well suited, however, to some kinds of recreational development. Local roads and streets can be constructed on fill material, above the expected high flood levels.

The land capability classification is IIw. The woodland ordination symbol is 1o.

Or—Orrville silt loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is in slight depressions in flood plains. Slopes range from 0 to 3 percent. Most areas are long and narrow and are 50 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is brown, grayish brown, and dark grayish brown, mottled, friable silt loam about 28 inches thick. The substratum to a depth of about 60 inches is gray and dark grayish brown, friable silt loam and loose sandy loam. It is mottled in the upper part.

Included with this soil in mapping are small areas of the well drained Tioga and Nolin soils on the slightly higher parts of the landscape and the poorly drained Melvin soils in depressions. Also included are areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are frequently flooded. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Orrville soil. The available water capacity is moderate or high. Runoff is slow. A seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid to slightly acid. The root zone is deep.

Most areas are used for corn, soybeans, and hay. Some irregularly shaped areas are used for pasture. If drained, this soil is well suited to these uses. Row crops can be grown year after year if the soil is adequately drained and if the flooding is controlled or the crops are planted after the normal period of flooding. Subsurface drains are used where drainage outlets are available. Grassed waterways are used to move runoff from the adjacent uplands to natural drainageways or ditches. A surface crust forms after periods of heavy rainfall, especially in tilled areas. Shallow cultivation of intertilled crops, however, breaks up the crust. Restricted grazing during wet periods helps to prevent surface compaction in the pastured areas. Because of the seasonal wetness and the potential for frost action, this soil is better suited to red clover and ladino clover than to alfalfa.

Some areas are used as woodland. These areas are mainly irregularly shaped or are dissected by old stream channels. This soil is well suited to woodland. The trees that are tolerant of some wetness should be selected for planting. Plant competition can be reduced by spraying, mowing, or disking.

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

The land capability classification is IIw. The woodland ordination symbol is 2o.

Pt—Pits, gravel. This map unit consists of surface mined areas from which sand and gravel have been removed for use in construction. The pits commonly are on outwash terraces and in areas of the Chili, Conotton, and Wheeling soils, which are underlain by glacial outwash. Most have a high wall on one or more sides. Areas are 10 to 60 acres in size. Actively mined pits are continually being enlarged.

The mined material consists of stratified layers of gravel and sand of varying thickness and orientation. The kind and grain size of the aggregates are relatively uniform within any one layer but commonly differ from layer to layer. Some layers contain appreciable amounts of silt and sand. Selectivity in mining commonly is feasible. Nearly all the large aggregates are rounded. In places carbonate cementation has formed a weakly bonded conglomerate.

Because of the nature of the mining operations, the soil material in spoil banks varies within short horizontal distances. It commonly has poor physical properties. Both the organic matter content and the available water capacity are very low. Most areas are easily eroded and are a source of siltation.

Many gravel pits that are no longer being mined can be smoothed and seeded to a plant cover, which helps to control erosion. The grasses and trees that tolerate the very low available water capacity and the unfavorable properties of the soil material should be selected for planting.

This map unit is not assigned to a land capability classification or a woodland ordination symbol.

Pu—Pits, quarry. This map unit consists of areas that have been surface mined for sandstone bedrock. The sandstone is used for molding forms. The quarries are on uplands, typically adjacent to areas of Coshocton, Hazleton, and Keene soils. Most range from 5 to 20 acres in size. Actively mined pits are continually being enlarged. Most have a high wall on one or more sides.

Before the sandstone is quarried, the overburden is generally removed and stockpiled. The material commonly has poor physical properties. The content of organic matter is very low. The available water capacity varies.

Areas that are no longer mined can be reclaimed and seeded to a plant cover, which reduces the risk of erosion. The grasses and trees that can withstand a fairly low available water capacity and unfavorable soil properties are needed for seeding and planting. Some areas can be developed for recreation uses or wildlife habitat.

This map unit is not assigned to a land capability classification or a woodland ordination symbol.

PwB—Plainfield loamy sand, 3 to 8 percent slopes. This deep, gently sloping, excessively drained soil is on glacial outwash and stream terraces. In some areas it is dissected by shallow drainage channels. Most areas are circular or elongated and are 10 to 40 acres in size.

Typically, the surface layer is dark brown, very friable loamy sand about 13 inches thick. The subsoil is yellowish brown, very friable sand about 21 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose sand.

Included with this soil in mapping are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding.

Permeability is rapid in the Plainfield soil. The available water capacity is low. Runoff is slow. In the surface layer, the content of organic matter is low. The subsoil is strongly acid to slightly acid. The root zone is deep.

This soil is used as cropland or pasture. Because of droughtiness and the wind erosion hazard, it is poorly suited to corn, soybeans, and small grain and is moderately well suited to hay and pasture. If irrigated, it is well suited to these crops and to specialty crops. If the soil is cultivated, wind erosion is a hazard during the period before the crops are large enough or dense enough to protect the soil. Winter cover crops and no-till planting or other kinds of conservation tillage that leave crop residue on the surface help to prevent excessive soil loss and conserve moisture. This soil is well suited to grazing early in spring. Because nutrients are rapidly leached, plants generally respond better to smaller but more frequent or more timely applications of fertilizer than to one large application.

This soil is moderately well suited to woodland. Seedling mortality is a severe limitation. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Drought-tolerant species should be selected for planting.

This soil is well suited to buildings and is moderately well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. The caving of cutbanks is a hazard in excavations. Lawns dry up during periods of low rainfall in summer. New seedings should be mulched and watered. Wind erosion is a hazard during construction. It can be controlled, however, by maintaining a vegetative cover on the site as much as possible during construction.

The land capability classification is IVs. The woodland ordination symbol is 3s.

RgC—Rigley sandy loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops and hillsides in the uplands. Areas generally are long and narrow or circular and are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 7 inches thick. The subsoil is brown and yellowish brown, very friable sandy loam about 42 inches thick. The substratum to a depth of about 60 inches is yellowish brown and strong brown, very friable sandy loam.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is medium or rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The soil can be easily tilled throughout a wide range in moisture content. The subsoil commonly is strongly acid. The root zone is deep.

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

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

Some areas are wooded. This soil is well suited to trees. Plant competition can be reduced by spraying, mowing, or disking.

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

The land capability classification is IIIe. The woodland ordination symbol is 2o.

RgD—Rigley sandy loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on ridgetops and hillsides in the uplands. Most areas are long and narrow or circular and are 5 to 90 acres in size.

Typically, the surface layer is dark brown, very friable sandy loam about 8 inches thick. The subsoil is about 42 inches thick. It is strong brown and very friable. It is dominantly sandy loam, but it is loamy sand directly above the substratum. The substratum to a depth of about 60 inches is light yellowish brown, very friable loamy sand.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The soil can be easily tilled throughout a wide range in moisture content. The subsoil commonly is strongly acid. The root zone is deep.

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

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

Many areas are wooded. This soil is well suited to woodland. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Locating logging roads and skid trails on the contour also facilitates the use of equipment. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south-facing slopes. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

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

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

RgE—Rigley sandy loam, 25 to 40 percent slopes. This deep, steep, well drained soil is on hillsides in the uplands. Most areas are long and narrow and are 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown and dark brown, friable sandy loam about 7 inches thick. The subsoil is yellowish brown, very friable sandy loam and loam about 36 inches thick. The substratum to a depth of about 60 inches is yellowish brown, very friable sandy loam. Some areas along ravines are very steep.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is very rapid. The subsoil commonly is strongly acid. The root zone is deep.

Some areas are pastured. This soil is poorly suited to pasture and generally is unsuited to cultivated crops and hay. The slope and the hazard of erosion are the major concerns of management. If the pasture is plowed during seedbed preparation or overgrazed, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and thus help to control erosion. No-till seeding also helps to control erosion. Maintaining a good stand of grasses and legumes is very difficult because the steep slope hinders the use of farm machinery.

Most areas are wooded. This soil is well suited to woodland and to habitat for woodland wildlife. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Locating logging roads and skid trails on the contour also facilitates the use of equipment. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate on south-facing slopes. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the slope. On sites for local roads and streets, erosion can be controlled by building on the contour and seeding road cuts.

The land capability classification is VIIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

RuA—Rush silt loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on outwash terraces. Most areas are elongated and range from 15 to 1,000 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 43 inches thick. The upper part is brown and yellowish brown, friable silt loam. The lower part is brown, friable loam, gravelly loam, and very gravelly clay loam. The substratum to a depth of about 68 inches is brown, loose very gravelly loamy sand. The silty material is more than 4 feet thick in some areas.

Included with this soil in mapping are small areas of Chili soils along drainageways. These soils have more gravel in the upper part than the Rush soil. Also included are some areas of soil in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the subsoil of the Rush soil and very rapid in the substratum. The available water capacity is high. Runoff is slow. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is commonly medium acid or strongly acid. The root zone is deep.

Most areas are used for corn, soybeans, small grain, and hay. A small acreage is used for strawberries and potatoes. This soil is well suited to these crops and to pasture. Row crops can be grown year after year if improved or intensive management is applied. The soil crusts after heavy rainfall, especially in tilled areas. Shallow cultivation of intertilled crops, however, breaks up the crust. Cover crops and a system of conservation tillage that leaves crop residue on the surface help to maintain tilth and prevent surface crusting.

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

This soil is well suited to building site development and septic tank absorption fields. The moderate shrink-swell potential of the subsoil is a limitation on sites for dwellings. Backfilling around foundations with material that has a low shrink-swell potential helps to overcome this limitation. Low strength and the potential for frost action are limitations on sites for local roads and streets. Providing suitable base material, however, helps to prevent the road damage resulting from low strength and frost action.

The land capability classification is I. The woodland ordination symbol is 1o.

Se—Sebring silt loam. This deep, nearly level, poorly drained soil is on slack water terraces along streams. It is on broad flats and in depressions. It receives runoff from adjacent soils and is subject to ponding. Most areas are circular or long and narrow. They are 15 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is light brownish gray and gray, mottled, friable silt loam about 36 inches thick. The substratum to a depth of about 63 inches is yellowish brown, mottled, friable silt loam.

Included with this soil in mapping are small areas of the poorly drained Canadice soils and the somewhat poorly drained Fitchville and Orrville soils. Canadice soils are in depressions. Their subsoil contains more clay than that of the Sebring soil. Fitchville soils are on slight rises and on toe slopes, and Orrville soils are on narrow flood plains. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Sebring soil. The available water capacity is high. Runoff is very slow or ponded. A seasonal high water table is near or above the surface during extended wet periods. In the surface layer, the content of organic matter is moderate or high and tilth is good. The subsoil is very strongly acid to slightly acid. The root zone is restricted by the seasonal high water table.

Most areas are used for corn, small grain, hay, or pasture. Drained areas are moderately well suited to these uses, and undrained areas are poorly suited. Wetness is the main management concern. Surface drains help to remove excess surface water. Subsurface drains are used in areas where drainage outlets are available. Grassed waterways, diversions, and open ditches move runoff from the adjacent uplands to natural drainageways or ditches (fig. 8). A surface crust forms after heavy rainfall. Shallow cultivation of intertilled crops, however, breaks up the crust. This soil is poorly suited to grazing early in spring. Restricted grazing during wet periods helps to prevent surface compaction. The water-tolerant forage species grow well.

This soil is well suited to woodland. The wetness limits the use of tree planting and harvesting equipment. The trees can be logged during the drier parts of the year. Selecting water-tolerant species for planting and selecting seedlings that have been transplanted once reduce the seedling mortality rate. Because of the windthrow hazard, the trees left in the stand after harvest should be about the same height and should not be widely spaced. Mowing, spraying, or disking helps to control plant competition.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the ponding and the moderately slow permeability. The ponding, low strength, and the potential for frost action can result in damage to local roads and streets. Providing suitable base material and installing a drainage system, however, help to prevent this damage. Building the roads and streets on suitable fill material helps to prevent the damage caused by ponding.

The land capability classification is IIIw. The woodland ordination symbol is 2w.

ShC3—Shinrock silty clay loam, 8 to 20 percent slopes, severely eroded. This deep, strongly sloping, moderately well drained soil is on dissected parts of former glacial lakebeds. Erosion has removed most of the original surface layer. Subsoil material that has a higher clay content has been mixed into the surface layer. Most areas are long and narrow and are 5 to 20 acres in size.

Figure 8.—Grassed waterway in an area of Sebring silt loam.

Typically, the surface layer is brown, firm silty clay loam about 5 inches thick. The subsoil is yellowish brown, mottled, firm silty clay about 28 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay and silty clay loam.

Included with this soil in mapping are narrow strips of soils that have slopes of 20 to 35 percent. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderately slow in the Shinrock soil. The available water capacity is moderate. Runoff is very rapid. A seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. In the surface layer, the content of organic matter is low and tilth is fair. The subsoil is medium acid to mildly alkaline. The root zone is mainly restricted to the moderately deep zone above the compact lakebed sediments.

Most areas are used for hay and pasture. This soil is moderately well suited to hay and pasture and poorly suited to corn, soybeans, and small grain. The erosion hazard is severe. This soil can be worked within a narrow range of moisture content. It crusts and puddles after hard rains. If plowed when wet and sticky, it is very cloddy. A system of conservation tillage that leaves crop residue on the surface, cover crops, and grassed waterways help to control runoff and erosion.

Incorporating crop residue or other organic matter into the surface layer improves tilth, increases the rate of water infiltration, and helps to prevent surface crusting. The high content of lime in the subsoil causes nutrient deficiency in some plants. Surface compaction, reduced growth, and increased runoff result from overgrazing or grazing during wet periods, when the soil is soft and sticky. Proper stocking rates, proper plant selection, pasture rotation, and timely deferment of grazing are needed.

A few areas are used as woodland. This soil is well suited to trees. The species selected for planting should be tolerant of a high clay content in the subsoil. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Because of the windthrow hazard, the trees left in the stand after harvest should be about the same height and should not be widely spaced.

This soil is moderately well suited to buildings. Erosion is a hazard during construction. It can be controlled by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover on construction sites. Buildings should be designed so that they conform to the natural slope of the land. Backfilling along basement walls with material that has a low shrink-swell potential helps to prevent the damage caused by shrinking and swelling. Installing drains at the base of footings and coating the exterior of basement walls help to keep basements dry. The caving of cutbanks is a hazard in excavations. Providing suitable base material and installing drains help to prevent the damage to local roads and streets caused by low strength and frost action.

This soil is poorly suited to septic tank absorption fields. The main limitations are wetness and the moderately slow permeability. Perimeter drains reduce the wetness. Enlarging the absorption area helps to overcome the restricted permeability. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 2c. !

SpA—Sparta loamy fine sand, 0 to 3 percent slopes. This deep, nearly level, excessively drained soil is on glacial outwash and stream terraces. In some areas it is dissected by shallow drainage channels. Most areas are oblong or circular and are 10 to 90 acres in size.

Typically, the surface layer is very dark grayish brown, friable loamy fine sand about 11 inches thick. The subsoil is dark brown, dark yellowish brown, and yellowish brown, friable and very friable loamy sand about 29 inches thick. The substratum to a depth of about 65 inches is yellowish brown and dark brown, loose sand.

Included with this soil in mapping are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding.

Permeability is rapid in the Sparta soil. The available water capacity is low. Runoff is slow. In the surface layer, the content of organic matter is moderately low. The subsoil is medium acid or slightly acid. The root zone is deep.

This soil is used mainly as cropland or pasture. Because of droughtiness and the wind erosion hazard, it is poorly suited to corn, soybeans, and small grain and is moderately well suited to hay and pasture. If irrigated, it is well suited to these crops and to specialty crops. If the soil is cultivated, wind erosion is a hazard during the period before crops are large enough or dense enough to protect the soil. No-till planting or other kinds of conservation tillage that leave crop residue on the surface and winter cover crops help to prevent excessive soil loss and conserve moisture. This soil is well suited to grazing early in spring. Because nutrients are rapidly leached, plants generally respond better to smaller but more frequent or more timely applications of fertilizer than to one large application.

This soil is moderately well suited to woodland. Seedling mortality is a severe limitation. It can be controlled by selecting seedlings that have been transplanted once or by mulching. Drought-tolerant species should be selected for planting.

This soil is well suited to buildings and moderately well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity may result in the pollution of ground water supplies. The caving of cutbanks is a hazard in excavations. Wind erosion is a hazard during construction. It can be controlled, however, by maintaining a vegetative cover on the site as much as possible during construction. Lawns dry up during periods of low rainfall in summer. New seedings should be mulched and watered.

The land capability classification is IVs. The woodland ordination symbol is 3s.

To—Tioga loam, occasionally flooded. This deep, well drained, nearly level soil is on flood plains. Slopes range frcm 0 to 3 percent. Most areas are long and narrow and are 300 to 800 acres in size.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is about 18 inches thick. The upper part is dark yellowish brown and yellowish brown, friable silt loam and loam, and the lower part is yellowish brown, very friable sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, very friable and loose loamy sand and sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Orrville soils in slight depressions and old meander channels. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in the Tioga soil. The available water capacity is moderate. Runoff is slow. A seasonal high water table is at a depth of 36 to 72 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid to slightly acid. The root zone is deep.

Most areas are used for corn, soybeans, hay, or pasture. This soil is well suited to these uses. It is better suited to the crops planted after the normal period of flooding than to the crops planted early in spring. Row crops can be grown year after year if the soil is intensively managed and if flooding is controlled or the crops are planted after the normal period of flooding. This soil is well suited to no-till planting and to other kinds of conservation tillage that leave a protective amount of crop residue on the surface. Floodwater sometimes leaves sediment on hay and pasture. Forage commonly is unsuitable for hay when covered with this sediment. Pasture rotation and restricted grazing during wet periods help to keep the pasture and the soil in good condition.

Some areas are used as woodland. This soil is well suited to trees. Plant competition can be reduced by spraying, mowing, or disking.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding. It is well suited, however, to some kinds of recreational development. Local roads and streets can be constructed on fill material, above the expected high flood levels. Safety precautions are needed to prevent the caving of cutbanks in excavations.

The land capability classification is IIw. The woodland ordination symbol is 2o.

Ua—Udorthents, hilly. These soils are in areas of cut and fill. They are mainly in construction areas along highways, in urban areas, and near dams in the Muskingum Watershed Conservancy District. In areas that have been cut, the remaining soil material is similar to the subsoil and substratum of adjacent soils. In fill or disposal areas, the characteristics of the soil material are more varied. This soil material generally is the subsoil and substratum of nearby soils. Slopes are dominantly 15 to 25 percent but range from 8 to 40 percent. Most areas are irregularly shaped and are 5 to 40 acres in size.

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

Included with these soils in mapping are long, narrow escarpments of bedrock, which make up about 5 percent of most mapped areas.

The suitability of these soils as sites for buildings, roads, and sanitary facilities varies. Onsite investigation is needed to determine the suitability and limitations for specific uses. Maintaining vegetation on these soils helps to control erosion.

No land capability classification or woodland ordination symbol is assigned.

UpC—Upshur silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops and the upper part of side slopes in the uplands. Most areas are long and narrow and are 5 to 30 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 7 inches thick. The subsoil is red, reddish brown, weak red, and dark red, plastic and sticky silty clay about 41 inches thick. The substratum to a depth of about 64 inches is dark red, plastic and sticky silty clay. In some areas, the soil is eroded and the surface layer is a silty clay loam.

Included with this soil in mapping are small areas of Westmoreland soils. These soils are yellower throughout than the Upshur soil and contain less clay in the subsoil. They make up about 10 percent of most mapped areas.

Permeability is slow in the Upshur soil. The available water capacity is moderate. Runoff is rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The soil tends to dry out slowly. The subsoil is very strongly acid to slightly acid. The root zone is deep, but root growth is restricted somewhat by the clayey subsoil.

Most areas are used for pasture and hay. A few are used for corn and small grain. This soil is poorly suited to corn and small grain and moderately well suited to hay. If the soil is cultivated, the hazard of erosion is severe. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and surface crusting. Tilling when the soil is wet causes surface compaction.

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

Some areas are wooded. This soil is moderately well suited to woodland. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. The use of logging equipment is limited because the soil is soft and slippery when wet.

The trees can be logged during the drier parts of the year. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate. Selecting species for planting that are tolerant of the high clay content in the subsoil reduces the seedling mortality rate and the windthrow hazard.

This soil is moderately well suited to building site development. The shrink-swell potential is the main limitation. Designing walls that have pilasters and are reinforced with concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to prevent the damage to buildings caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land. Erosion can be controlled by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Cutting and filling increase the hazard of hillside slippage. Installing drains in areas where water collects, however, reduces the hazard. The shrink-swell potential and low strength can result in damage to local roads and streets. Providing suitable base material, however, helps to prevent this damage.

Because of the slow permeability and the slope, this soil is poorly suited to septic tank absorption fields. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Enlarging the field helps to overcome the slow permeability.

The land capability classification is IVe. The woodland ordination symbol is 3c.

WbA—Weinbach silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is in slightly depressional parts of broad flats on outwash terraces. Most areas are elongated or circular and are 15 to 150 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown, mottled, friable and firm silt loam and silty clay loam; the next part is a fragipan of yellowish brown and dark yellowish brown, mottled, very firm and brittle silt loam; and the lower part is yellowish brown, mottled, firm silt loam.

Included with this soil in mapping are small areas of Fitchville soils in drainageways and Rush and Wheeling soils in the slightly higher landscape positions. Fitchville soils do not have a fragipan. Rush and Wheeling soils are well drained. Also included are many areas of soils that have moderately rapidly permeable or rapidly permeable gravelly sandy loam or gravelly loamy sand in the lower part and some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. The soils in the flood pools are subject to flooding. Included soils make up about 20 percent of most mapped areas.

Permeability is moderate above the fragipan of the Weinbach soil and very slow in the fragipan. The root zone is mainly restricted to the part of the soil above the dense fragipan. The available water capacity of this zone is low. Runoff is slow. A perched seasonal high water table is at a depth of 12 to 36 inches during extended wet periods. In the surface layer, the content of organic matter is moderate and tilth is good. The root zone is strongly acid or very strongly acid.

This soil is mainly used for row crops and, to a lesser extent, for small grain, hay, and pasture. Drained areas are well suited to corn, soybeans, wheat, hay, and pasture. The seasonal wetness and the limited root zone are the main concerns of management. Surface and subsurface drains are used to remove excess water. The subsurface drains are more effective if placed above the very slowly permeable fragipan. Grassed waterways move the runoff from adjacent soils on uplands to natural drainageways or to ditches. A surface crust forms after heavy rainfall. Shallow cultivation of intertilled crops, however, breaks up the crust. Restricted grazing during wet periods helps to prevent surface compaction in pastured areas. The forage species that can tolerate the wetness should be selected for planting.

This soil is well suited to woodland. Selecting seedlings for planting that are tolerant of some seasonal wetness and of a root-restricting layer in the subsoil reduces the seedling mortality rate and the windthrow hazard. The windthrow hazard can be reduced by harvesting procedures that do not leave the remaining trees widely spaced. Seedling mortality can be controlled by selecting seedlings that have been transplanted once.

This soil is poorly suited to building site development. The seasonal wetness is the main limitation. It can be reduced by surface and subsurface drains. Landscaping building sites can help to drain surface water away from foundations. Waterproofing basement walls, installing drains at the base of footings, and installing sump pumps help to keep basements dry. The caving of cutbanks is a hazard in excavations. Low strength and the potential for frost action can result in damage to local roads and streets. Installing a drainage system and providing suitable base material, however, help to prevent this damage.

Because of the seasonal wetness and the very slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains can reduce the wetness if drainage outlets are available. Enlarging the absorption area helps to overcome the very slow permeability.

The land capability classification is IIw. The woodland ordination symbol is 2d.

WhC—Westmoreland silt loam, 8 to 15 percent slopes. This deep, well drained, strongly sloping soil is

Figure 9.—Apple orchard in an area of Westmoreland silt loam, 8 to 15 percent slopes.

on ridgetops in the uplands. Most areas are circular or elongated and are 5 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. It is yellowish brown and friable. The upper part is loam and channery loam, and the lower part is channery and extremely channery loam. The substratum is yellowish brown, friable extremely channery loam. Sandstone bedrock is at a depth of about 60 inches.

Included with soil in mapping are narrow strips of the moderately well drained Guernsey soils on the sides of ridges and small areas of the moderately deep Berks soils near the edges of ridgetops. Included soils make up about 15 percent of most mapped areas.

Permeability and the available water capacity are moderate in the Westmoreland soil. Runoff is medium or rapid. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is very strongly acid to medium acid. The root zone is deep.

Many areas are used as cropland or pasture. Corn, small grain, and hay are the principal crops. This soil is moderately well suited to corn and small grain and is well suited to hay. Areas where air drainage is good can be used for orchards (fig. 9). Controlling erosion is the main concern of management. If the soil is cultivated, the hazard of erosion is severe. The soil is well suited to no-till planting (fig. 10). A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and deterioration of tilth. Crusting of the surface layer restricts moisture penetration and air movement, especially in tilled areas. Shallow cultivation of intertilled crops, however, breaks up the crust.

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

Some areas are wooded. This soil is moderately well suited to woodland. Plant competition can be reduced by spraying, mowing, or disking.

This soil is moderately well suited to building site development. The slope and the depth to bedrock are limitations. Erosion can be controlled by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Buildings should be designed so that they conform to the natural slope of the land. Because the depth to bedrock is as shallow as 40 inches in some areas, the soil is better suited to dwellings without basements than to dwellings with basements. The potential for frost action and low strength can result in damage to local roads and streets. Providing suitable base material, however, helps to prevent this damage.

This soil is moderately well suited to septic tank absorption fields. The slope, the depth to bedrock, and the moderate permeability are limitations. Enlarging the field helps to overcome the moderate permeability. Providing suitable fill material helps to overcome the limited depth to bedrock. Laying out the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The land capability classification is IIIe. The woodland ordination symbol is 3o.

WhD—Westmoreland silt loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on ridgetops and hillsides in the uplands. Slopes are smooth and are characterized by some microrelief. Most areas are long and narrow or oblong and are 5 to 80 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 33 inches thick. It is friable. The upper part is yellowish brown and strong brown silt loam and channery loam, and the lower part is yellowish brown channery loam. The substratum is light yellowish brown, friable very channery sandy loam. Siltstone bedrock is at a depth of about 50 inches.

Included with this soil in mapping are the small areas of the moderately deep Berks soils and narrow strips of the moderately well drained Guernsey soils. The narrow strips typically are as much as 100 feet across the slope and 30 feet wide. Berks soils are on the upper part of slopes, and Guernsey soils are on the lower part. Seeps and springs are in areas of the Guernsey soils. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 10 percent of most mapped areas.

Permeability and the available water capacity are moderate in the Westmoreland soil. Runoff is rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid. The root zone is deep.

Most areas are used as cropland or pasture. This soil is poorly suited to corn and small grain and moderately well suited to hay. Commonly, a cultivated crop is included in the rotation about once every 4 years. If the soil is cultivated, the hazard of erosion is very severe. A permanent plant cover is the best means of controlling erosion. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and surface crusting. The moderately steep slope limits the use of some farm machinery.

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

Some areas are wooded. This soil is moderately well suited to woodland. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Mechanical tree planters and the mowers that control plant competition can be operated on this soil. Locating logging roads across the slope facilitates the use of equipment. Coves and north- and east-facing slopes are the best woodland sites. These

Figure 10.—No-till farming in an area of Westmoreland silt loam, 8 to 15 percent slopes.

sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and sun.

Mainly because of the slope, this soil is poorly suited to building site development. Land shaping is needed in some areas. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites. Building local roads and streets on the contour and seeding road cuts also help to control erosion. Because the depth to bedrock is as shallow as 40 inches in some areas, the soil is better suited to dwellings without basements than to dwellings with basements. The potential for frost action and low strength can result in damage to local roads and streets. Providing suitable base material, however, helps to prevent this damage.

Because of the slope and the moderate permeability, this soil is poorly suited to septic tank absorption fields. Laying out the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Enlarging the field helps to overcome the moderate permeability.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WhE—Westmoreland silt loam, 25 to 40 percent slopes. This deep, steep, well drained soil is on hillsides in the uplands. Most areas are long and narrow or oblong and are 15 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 34 inches thick. It is yellowish brown and friable. The upper part is silt loam and loam, and the lower part is channery silty clay loam and channery clay loam. The substratum is light yellowish brown, friable very channery loam. Sandstone bedrock is at a depth of about 50 inches.

Included with this soil in mapping are small areas of Hazleton soils and narrow strips of Guernsey soils. Hazleton soils are on the upper part of slopes. They have more rock fragments in the subsoil than the Westmoreland soil. The moderately well drained Guernsey soils are on hillsides characterized by seeps and springs. Also included are some areas of soils in flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability and the available water capacity are moderate in the Westmoreland soil. Runoff is very rapid. In the surface layer, the content of organic matter is moderately low and tilth is good. The subsoil is very strongly acid to medium acid. The root zone is deep.

Some areas are pastured. This soil generally is unsuited to cultivation because of the steep slopes and a severe hazard of erosion. It is poorly suited to pasture. Erosion is the major concern of management. A permanent plant cover is the best means of controlling erosion. If the pasture is plowed during seedbed preparation or overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. The slope limits the use of equipment.

Most areas are wooded. This soil is moderately well suited to woodland. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Operating mechanical tree planters and the mowers that control plant competition is very difficult because of the steep slope. Locating logging roads across the slope facilitates the use of equipment. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the steep slope. Cutting and filling increase the hazard of hillside slippage in the included areas of Guernsey soils. Installing subsurface drains in the seepy areas, however, reduces the hazard. On sites for local roads and streets, erosion can be controlled by building on the contour and seeding road cuts.

The land capability classification is VIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WhF—Westmoreland silt loam, 40 to 60 percent slopes. This deep, very steep, well drained soil is on hillsides in the uplands. Deep ravines are in some areas. Most areas are long and narrow or oblong and are 5 to 160 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 3 inches thick. The subsoil is about 37 inches thick. It is yellowish brown and friable. The upper part is channery silt loam, and the lower part is channery and very channery loam. The substratum is yellowish brown, friable very channery loam. Sandstone bedrock is at a depth of about 50 inches.

Included with this soil in mapping are small areas of Hazleton soils and narrow strips of Guernsey soils. Hazleton soils are on the upper part of slopes. They have more rock fragments in the subsoil than the Westmoreland soil. The moderately well drained Guernsey soils are on hillsides characterized by seeps and springs. Also included are some areas of soils in flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability and the available water capacity are moderate in the Westmoreland soil. Runoff is very rapid. The subsoil is very strongly acid to medium acid. The root zone is deep.

This soil is generally unsuited to cultivated crops, hay, and pasture. The very steep slope and the erosion hazard severely limit these uses.

Most areas are wooded. This soil is moderately well suited to woodland. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Locating logging roads across the slope facilitates the use of equipment. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

This soil generally is unsuited to building site development and septic tank absorption fields because of the very steep slope. Cutting and filling increase the hazard of hillside slippage in the included areas of Guernsey soils. Installing drains in the seepy areas, however, reduces the hazard. On sites for local roads and streets, erosion can be controlled by building on the contour and seeding road cuts.

The land capability classification is VIIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WnC—Westmoreland-Guernsey silt loams, 8 to 15 percent slopes. These deep, strongly sloping soils are on hillsides and ridgetops in the uplands. The Westmoreland soil is well drained, and the Guernsey soil is moderately well drained. In some areas slopes are uneven and are characterized by a microrelief of 1 to 2 feet. Seep spots are in some areas. Most areas are 50 to 70 percent Westmoreland silt loam and 20 to 30 percent Guernsey silt loam. The two soils occur as alternating, parallel bands that are associated with different bedrock strata. The area of the two soils are so intricately mixed or so small that mapping them separately is not practical.

Typically, the Westmoreland soil has a surface layer of dark brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. It is yellowish brown. The upper part is friable loam and channery loam, and the lower part is channery and very channery loam. The substratum is yellowish brown, friable very channery loam about 20 inches thick. Siltstone bedrock is at a depth of about 60 inches.

Typically, the Guernsey soil has a surface layer of brown, friable silt loam about 6 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable silt loam, and the lower part is dark yellowish brown, mottled, firm silty clay. The substratum is light olive gray, mottled, firm shaly clay.

Included with these soils in mapping are small areas of the moderately deep Berks soils on convex slopes and areas of Hazleton soils near the upper part of some side slopes. The subsoil of Hazleton soils has a lower content of clay and a higher content of sandstone fragments and sand than that of either the Westmoreland or Guernsey soil. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. The available water capacity is moderate in both soils. Runoff is medium or rapid on the Westmoreland soil and rapid on the Guernsey soil. The Guernsey soil has a perched seasonal high water table at a depth of 24 to 42 inches during extended wet periods. In the surface layer of both soils, the content of organic matter is moderate and tilth is good. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. The root zone is deep in both soils.

Most areas are used as cropland. Corn, small grain, and hay are the principal crops. These soils are moderately well suited to corn and small grain and are well suited to hay. Erosion is the major concern of management. It is a severe hazard if the soils are cultivated. The surface layer crusts after hard rains. A system of conservation tillage that leaves crop residue on the surface, grassed waterways, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and surface crusting. Scattered subsurface drains are needed in the seepy areas.

Many areas are pastured. These soils are well suited to pasture. If the pasture is overgrazed or is plowed during seedbed preparation, however, the hazard of erosion is severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss.

Some areas support trees. These soils are moderately well suited or well suited to woodland. Plant competition can be reduced by spraying, mowing, or disking.

These soils are moderately well suited to building site development. Because bedrock is as shallow as 40 inches in some areas, the Westmoreland soil is better suited to dwellings without basements than to dwellings with basements. The shrink-swell potential and the seasonal wetness of the Guernsey soil are limitations on sites for dwellings. Waterproofing basement walls and installing drains at the base of footings help to keep basements dry. Designing walls that have pilasters and are reinforced with concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil. Installing drains in these areas, however, reduces the hazard. Buildings should be designed so that they conform to the natural slope of the land. Erosion can be controlled by removing as little vegetation as possible, by mulching, or by establishing a temporary plant cover on construction sites.

Low strength and the potential for frost action in the Westmoreland and Guernsey soils and the shrink-swell potential of the Guernsey soil can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage. Erosion can be controlled by building the roads and streets on the contour and by seeding road cuts.

The Westmoreland soil is moderately well suited to septic tank absorption fields, and the Guernsey soil is poorly suited. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Providing suitable fill material helps to overcome the limited depth to bedrock in the Westmoreland soil. Perimeter drains reduce the wetness of the Guernsey soil. Enlarging the field helps to overcome the slow absorption of effluent in both soils.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Westmoreland soil is 3o, and that assigned to the Guernsey soil is 2o.

WnD—Westmoreland-Guernsey silt loams, 15 to 25 percent slopes. These deep, moderately steep soils are on ridges, knolls, and hillsides in the uplands. The Westmoreland soil is well drained, and the Guernsey soil is moderately well drained. Slopes are characterized by a microrelief of 1 to 2 feet. Seeps and slips are common. Most areas are long and narrow or oblong and are 10 to 20 acres in size. They are 50 to 75 percent Westmoreland silt loam and 20 to 30 percent Guernsey silt loam. The two soils occur as alternating, nearly horizontal bands that are associated with different bedrock strata. The areas of the two soils are so intricately mixed or so small that mapping them separately is not practical.

Typically, the Westmoreland soil has a surface layer of dark brown, friable silt loam about 9 inches thick. The subsoil is about 31 inches thick. It is yellowish brown and friable. The upper part is silty clay loam, channery silty clay loam, and channery silt loam, and the lower part is mottled channery clay loam. The substratum is brown, mottled, firm very channery clay loam. Siltstone bedrock is at a depth of about 60 inches.

Typically, the Guernsey soil has a surface layer of dark brown, friable silt loam about 8 inches thick. The subsoil is about 44 inches thick. It is mottled and firm. The upper part is brown clay loam and silty clay, and the lower part is yellowish brown silty clay loam and silty clay. The substratum is light olive brown, firm channery silty clay loam. Siltstone bedrock is at a depth of about 55 inches.

Included with these soils in mapping are small areas of the moderately deep Berks soils on the upper part of side slopes and areas of Hazleton soils near the upper part of some side slopes. The subsoil of Hazleton soils has a lower content of clay and a higher content of sandstone fragments and sand than that of either the Westmoreland or Guernsey soil. Also included, on toe slopes, are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. The soils in these areas are subject to flooding. Included soils make up 5 to 15 percent of most mapped areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. The available water capacity is moderate in both soils. Runoff is rapid on the Westmoreland soil and very rapid on the Guernsey soil. The Guernsey soil has a perched seasonal high water table at a depth of 24 to 42 inches during extended wet periods. In the surface layer of both soils, the content of organic matter is moderately low and tilth is good. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part.

Some areas are used for cultivated crops or hay. These soils are poorly suited to corn and small grain and are moderately well suited to hay. If the soils are cultivated, the hazard of erosion is very severe. The surface layer crusts after hard rains. A permanent plant cover is the best means of controlling erosion. A system of conservation tillage that leaves crop residue on the surface, contour stripcropping, and cover crops reduce the runoff rate and help to prevent excessive soil loss and surface crusting. The moderately steep slope hinders the use of some farm machinery. Scattered subsurface drains are needed in the seepy areas of the Guernsey soil.

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

Many areas are wooded. These soils are moderately well suited or well suited to woodland. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars. Mechanical tree planters and the mowers used to control plant competition can be operated on these soils. Selecting seedlings that have been transplanted once or mulching reduces the seedling mortality rate in areas of the Guernsey soil on south-facing slopes. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

These soils are poorly suited to building site development. The slope is the main limitation. The slippage hazard and the high shrink-swell potential of the Guernsey soil also limit this use. Because bedrock is as shallow as 40 inches in some areas, the Westmoreland soil is better suited to dwellings without basements than to dwellings with basements. Buildings should be designed so that they conform to the natural slope of the land. Waterproofing basement walls and installing drains at the base of footings help to keep water away from basements. Designing walls that have pilasters and are reinforced with concrete, supporting the walls with a large spread footing, and backfilling around foundations with material that has a low shrink-swell potential help to prevent the damage caused by shrinking and swelling. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil. Installing drains in the seepy areas, however, reduces the hazard. Erosion can be controlled by removing as little vegetation as possible, by mulching, and by establishing a temporary plant cover on construction sites.

Low strength and the potential for frost action in the Westmoreland and Guernsey soils and the shrink-swell potential of the Guernsey soil can result in damage to local roads and streets. Providing suitable base material and installing drains, however, help to prevent this damage. Building the roads and streets on the contour and seeding road cuts help to control erosion.

These soils are poorly suited to septic tank absorption fields. The slope and restricted permeability of both soils and the seasonal wetness of the Guernsey soil limit this use. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. Providing suitable fill material helps to overcome the limited depth to bedrock in the Westmoreland soil. Perimeter drains reduce the wetness of the Guernsey soil. Enlarging the field helps to overcome the slow absorption of effluent in both soils.

The land capability classification is IVe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WnE—Westmoreland-Guernsey silt loams, 25 to 40 percent slopes. These deep, steep soils are on hillsides in the uplands. The Westmoreland soil is well drained, and the Guernsey soil is moderately well drained. Slopes are characterized by a microrelief of 1 to 3 feet. Seeps and slips are common. Most areas are long and narrow to wide and are 20 to 120 acres in size. They are 50 to 70 percent Westmoreland silt loam and 20 to 30 percent Guernsey silt loam. The two soils occur as alternating, nearly horizontal bands across the slope. The areas of the two soils are so intricately mixed or so small that mapping them separately is not practical.

Typically, the Westmoreland soil has a surface layer of dark brown, friable silt loam about 9 inches thick. The subsoil is yellowish brown, friable loam and channery silt loam about 31 inches thick. The substratum is brown, friable very channery silt loam. Siltstone bedrock is at a depth of about 63 inches.

Typically, the Guernsey soil has a surface layer of dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown and grayish brown, mottled, firm silty clay. The substratum to a depth of about 60 inches is light gray, firm silty clay loam.

Included with these soils in mapping are small areas of the moderately deep Berks soils on the upper part of side slopes and areas of Hazleton soils near the upper part of some side slopes. The subsoil of Hazleton soils has a lower content of clay and a higher content of sandstone fragments and sand than that of either the Westmoreland or Guernsey soil. Also included, on toe slopes, are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. The soils in these areas are subject to flooding. Included soils make up 5 to 15 percent of most mapped areas.

Permeability is moderate in the Westmoreland soil and moderately slow or slow in the Guernsey soil. The available water capacity is moderate in both soils. Runoff is very rapid. The Guernsey soil has a perched seasonal high water table at a depth of 24 to 42 inches during extended wet periods. In the surface layer of both soils, the content of organic matter is moderately low and tilth is good. The subsoil of the Westmoreland soil is very strongly acid to medium acid. The Guernsey soil is medium acid to very strongly acid in the upper part of the subsoil and strongly acid to mildly alkaline in the lower part. The root zone is deep in both soils.

Some areas are pastured. These soils are generally unsuited to cultivation because of the steep slopes and a severe hazard of erosion. They are poorly suited to pasture. A permanent plant cover is the best means of controlling erosion. If the pasture is plowed during seedbed preparation or overgrazed, the hazard of erosion is very severe. Proper stocking rates and pasture rotation help to prevent overgrazing and excessive soil loss. No-till seeding also helps to prevent excessive soil loss. The slope limits the use of equipment.

Most areas are wooded. These soils are moderately well suited or well suited to woodland. Locating logging roads and skid trails across the slope facilitates the use of equipment and helps to control erosion. Establishing water bars also helps to control erosion. Coves and north- and east-facing slopes are the best woodland sites. These sites have cooler temperatures and less evapotranspiration because of less exposure to the prevailing wind and the sun.

These soils are generally unsuited to building site development and septic tank absorption fields. The steep slope is the main limitation. The seasonal wetness, slippage hazard, and high shrink-swell potential of the Guernsey soil and the restricted permeability of both soils also limit these uses. Cutting and filling increase the hazard of hillside slippage in areas of the Guernsey soil. Installing subsurface drains in the seepy areas reduces the hazard.

The land capability classification is VIe. The woodland ordination symbol is 2r on north aspects, 3r on south aspects.

WrA—Wheeling loam, 0 to 3 percent slopes. This deep, nearly level, well drained soil is on flats on outwash terraces. Most areas are long and narrow or oblong and are 10 to 200 acres in size.

Typically, the surface layer is dark brown, friable loam about 11 inches thick. The subsoil is about 39 inches thick. It is friable. The upper part is dark yellowish brown and yellowish brown silty clay loam, silt loam, and loam. The lower part is yellowish brown gravelly sandy loam. The substratum to a depth of about 70 inches is yellowish brown, loose very gravelly and extremely gravelly loamy sand.

Included with this soil in mapping are small areas of the excessively drained and droughty Sparta soils near slope breaks to uplands. Also included are some areas of soils in the flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 15 percent of most mapped areas.

Permeability is moderate in the subsoil of the Wheeling soil and rapid in the substratum. The available water capacity is moderate. Runoff is slow. In the surface layer, the content of organic matter is moderate and tilth is good. The subsoil is strongly acid or medium acid. The root zone is deep.

Most areas are used for corn, but some are used for soybeans, small grain, or hay. This soil is well suited to these crops and to pasture and specialty crops. Row crops can be grown year after year if improved or intensive management is applied. The soil is well suited to planting early in spring and to irrigation. Cover crops and no-till planting or other kinds of conservation tillage that leave crop residue on the surface help to maintain tilth and control erosion.

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

This soil is well suited to building site development and septic tank absorption fields. Low strength and the potential for frost action are limitations on sites for local roads and streets. Providing suitable base material, however, helps to prevent damage resulting from low strength and frost action.

The land capability classification is I. The woodland ordination symbol is 2o.

WsA—Wheeling-Urban land complex, nearly level. This map unit consists of a deep, well drained Wheeling soil and areas of Urban land on flats on outwash terraces. Slopes range from 0 to 3 percent. Areas are mainly irregularly shaped. Most are about 50 percent Wheeling loam and 30 percent Urban land. The Wheeling soil and Urban land occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Wheeling soil has a surface layer of dark brown, friable loam about 11 inches thick. The subsoil is about 39 inches thick. It is friable. The upper part is dark yellowish brown and yellowish brown silty clay loam, silt loam, and loam. The lower part is yellowish brown gravelly sandy loam. The substratum to a depth of about 70 inches is yellowish brown, loose very gravelly loamy sand. In places the soil has been radically altered. Some low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

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

Included with this unit in mapping are small areas of Chili and Sparta soils. Chili soils are near slope breaks to other terrace levels. They have more gravel in the subsoil than the Wheeling soil. The excessively drained Sparta soils are near slope breaks to uplands. Also included are some areas of soils in flood pools of the dams in the Muskingum Watershed Conservancy District. These soils are subject to flooding. Included soils make up about 20 percent of most mapped areas.

Permeability is moderate in the subsoil of the Wheeling soil and rapid in the substratum. The available water capacity is moderate. Runoff is slow. In the surface layer, the content or organic matter is moderate and tilth is good. The subsoil is strongly acid or medium acid. The root zone is deep.

The Wheeling soil is used for parks, open areas, lawns, and gardens. It is well suited to grasses, flowers, vegetables, trees, and shrubs. Erosion is not a major problem, except where the soil is disturbed and left unprotected. Included spots that have been cut and filled are not well suited to lawns and gardens because tilth is very poor in the exposed subsoil material. This material is sticky when wet and hard when dry.

The Wheeling soil is well suited to building site development and septic tank absorption fields. Low strength and the potential for frost action are limitations on sites for local roads and streets. Providing suitable base material, however, helps to prevent damage resulting from low strength and frost action.

The Wheeling soil is assigned to land capability classification I. Urban land is not assigned a land capability classification. The Wheeling soil and Urban land are not assigned a woodland ordination symbol.

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cropland, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for these uses. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to economically produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about prime farmland is available at the local office of the Soil Conservation Service or the Tuscarawas Soil and Water Conservation District.

About 59,920 acres in Tuscarawas County, or more than 16 percent of the total acreage, meets the requirements for prime farmland. This land is mainly in the Wheeling-Chili-Tioga and Fitchville-Glenford-Orrville associations, which are described under the heading "General Soil Map Units." Nearly 26,000 acres of the prime farmland consists of well drained and moderately well drained soils used for crops, mainly corn, soybeans, wheat, and hay. Nearly 33,980 acres consists of poorly drained or somewhat poorly drained soils, mainly in the Fitchville-Glenford-Orrville association. The poorly drained and somewhat poorly drained soils are considered prime farmland only in areas where a drainage system has been installed. Onsite investigation is needed to determine whether or not the wetness has been overcome.

In some parts of the county, the trend in land use has been a continuing loss of prime farmland to nonfarm uses. The loss of prime farmland to these uses puts pressure on marginal lands, which generally are more sloping and erodible, more droughty, less easily cultivated, and less productive.

The map units in Tuscarawas County that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The acreage and proportionate extent of each listed map unit are given in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. In table 5, the need for these measures is indicated in parentheses after the map unit name. Onsite evaluation is needed to determine whether this limitation has been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

Crops and Pasture

Steve Welker, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil in table 6.

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

In 1979, about 65,300 acres in Tuscarawas County was used for crops (*7*). Of this acreage, about 28,400 acres was used for hay; 25,200 acres, for corn; 4,500 acres, for wheat; 4,200 acres, for soybeans; and 3,000 acres, for oats. A small acreage was used for specialty crops.

The paragraphs that follow describe the main concerns in managing the cropland in the county. These concerns are erosion, soil drainage, droughtiness, surface compaction, and tilth.

Erosion is the major management problem on much of the cropland and some of the pasture in Tuscarawas county. It is a hazard where slopes are more than 2 percent. It is evidenced by gullies, rills, sedimentation of ditches and small drainageways, muddy runoff water, and clean small stones on the surface of the soil.

Erosion reduces soil productivity through the loss of at least part of the friable surface layer, which contains most of the plant nutrients and organic matter in the soil. As the surface layer is lost, subsoil material is incorporated into the plow layer by tillage. Future tillage of a surface layer that contains subsoil material is more difficult and energy intensive.

Water quality decreases when soil washes into streams. Fertilizers and pesticides are carried with the eroding soil material. Erosion is the major polluter of public waters.

Erosion is a major hazard on upland soils, such as the Coshocton, Westmoreland, Guernsey, and Keene soils. It is also a hazard on the gently sloping and strongly sloping Fitchville and Glenford soils on slack water terraces.

Erosion can be controlled by conservation practices. The practices used in Tuscarawas County include no-till planting or other kinds of conservation tillage that leave crop residue on the surface, cover crops, contour stripcropping, grassed waterways, diversions, rock chutes, sediment ponds, and drop structures (fig. 11). A variety of conservation practices are used in the county because of the extreme contrasts in topography and types of soils.

Erosion is not so serious on pasture as it is on cropland. In pastured areas, it can be controlled by reestablishment of vegetation, proper stocking rates, and rotational grazing. Erosion is a special problem in exercise lots for livestock. Tall fescue usually provides the best vegetative cover in these lots.

Streambank erosion is a serious hazard in the county. The Fitchville soils, on slack water terraces, and the Weinbach soils, on outwash terraces, are especially susceptible to streambank erosion. Because of the steep natural stream gradients in areas of these soils, the streambanks are undercut. The undercutting results in a large volume of soil loss. Streambank erosion can be controlled by placing riprap on the streambanks or by seeding the flatter banks to tall fescue. In pastured areas, fencing livestock out of the drainageway is very effective in controlling streambank erosion.

Soil drainage is a major management concern in some of the smaller valleys and in areas of springs or seeps on hillsides. According to the Conservation Needs Inventory, soil drainage was a limitation on 20,674 acres used for crops and pasture in 1967 (*10*).

Poor soil drainage restricts the oxygen supply to plant roots. Very little oxygen is available in soils saturated

Figure 11.—Contour stripcropping on Hazleton, Coshocton, and Guernsey soils.

with water. The wetness also restricts the use of farm machinery. Grazing wet soils results in soil compaction.

Maintaining good stands of alfalfa is difficult on poorly drained and somewhat poorly drained soils unless a drainage system is installed. Corn yields are greatly reduced in undrained areas of these soils.

Soil drainage can generally be improved by installing subsurface drains in the Sebring, Orrville, and Fitchville soils that are on flats along streams. Seeps and springs in the Coshocton and Guernsey soils on hillsides are commonly drained by subsurface drains. Surface and subsurface drains are used in areas of the Sebring, Caneadea, Fitchville, and Canadice soils on broad flats. Surface drainage can be improved by land leveling, by installing surface inlets that connect subsurface drains, and by digging or cleaning drainage ditches. Good outlets are needed for surface and subsurface drains. Where adequate outlets are not available, pumps can be used.

Many areas of bottom land in Tuscarawas County are flooded by backwater from dams. Locating and maintaining adequate drainage outlets are difficult because of siltation in areas flooded by backwater above the dams in the Muskingum Watershed Conservancy District. The streams most affected include Sugar Creek, north of State Route 39; Walnut Creek; and Conotton Creek. Areas which cannot be drained or which are flooded frequently can be used for late-planted soybeans, reed canarygrass, Garrison grass, or habitat for openland and wetland wildlife.

Droughtiness reduces crop yields, especially in dry years on soils that have a low or very low available water capacity, such as the Berks, Conotton, Plainfield, and Sparta soils. These soils are droughty because of a moderate depth to bedrock or a high content of sand, gravel, or rock fragments.

Practices which conserve moisture include no-till planting and other kinds of conservation tillage that leave crop residue on the surface. On many soils irrigation is needed during extended dry periods, particularly if specialty crops, such as strawberries, are grown. On most droughty soils, deep-rooted crops, such as alfalfa, grow better than other crops.

Soil compaction and tilth are increasing problems in the county. They affect the infiltration of water into the soil, ease of tillage, germination of seeds, and emergence of plants. Soils that have good tilth are aggregated and porous.

Removing crop residue, especially corn stover, and tilling, harvesting, and hauling compact wet soils and cause poor tilth. Soil compaction is more severe on the wetter soils, such as Canadice and Sebring soils. Compaction can be reduced and tilth can be improved by returning crop residue to the soil, by planting cover crops, by including grasses and legumes in the cropping sequence, and by tilling, harvesting, and grazing at optimum moisture conditions. Chisel plowing generally causes less compaction than moldboard plowing or disking.

Pasture is an important land use in the county. According to the Conservation Needs Inventory, about 62,444 acres in the county was pastured in 1967 (*10*). Commonly grown pasture plants are bluegrass, orchardgrass, and white clover.

Renovating pasture by no-till seeding of grasses and legumes increases forage production and helps to prevent excessive erosion. Most soils in the county are suitable for no-till seeding. Applications of lime and fertilizer commonly are needed. The kinds and amounts to be applied should be determined by soil tests. The number of grazing animals in a specific area should be determined by the carrying capacity of the pasture. Excessive erosion can result from overgrazing. It can be prevented by rotation grazing, applications of lime and fertilizer, and pasture renovation.

Management of reclaimed surface mined areas requires special practices. Soil limitations include a high content of rock fragments, a limited zone favorable for root development, droughtiness, a very low organic matter content, very low fertility, and the erosion hazard.

Bethesda and Morristown soils formed in strip mine spoil. About 31,670 acres of these soils was in the county in 1981. Only the 1,890 acres of Morristown soils has been reclaimed by grading and by blanketing the surface with a layer of material removed from natural soils. This acreage is increasing as more land is mined and reclaimed. The nearly level to strongly sloping Morristown soils are poorly suited to cultivated crops and are moderately well suited to hay and pasture. They are well suited to no-till planting or other kinds of conservation tillage that leave crop residue on the surface. Inclusion of grasses and legumes in the cropping sequence, incorporation of crop residue into the surface layer, cover crops, and contour tillage help to control erosion, conserve moisture, and increase the rate of water intake. Because of uneven grading or settling, surface drains are needed in some areas.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*13*). Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Approximately 46 percent of Tuscarawas County is wooded. The wooded acreage consists largely of privately owned stands and farm woodlots. The most extensive wooded areas are the eastern part of the county.

Most of the wooded areas support mixed hardwoods dominated by oak, cherry, and maple. They are areas of steep and very steep soils that formed in material weathered from the underlying limestone, siltstone, shale, and sandstone bedrock. Woodland is not a dominant land use on colluvial foot slopes and is only a minor land use on ridgetops. The ridgetops are used mostly for farming. The wooded acreage has increased in recent years, especially in areas where the soils are steep or very steep and formed in material weathered from the underlying bedrock. These areas are generally unsuited to crops and hay. Some large tracts that were used for hay and pasture are reverting to woodland.

In places the woodland shows the result of abuse and neglect. Heavy cutting without planning for future timber production has resulted in understocked stands of trees near maturity. High grading has continually removed the best trees and left diseased or damaged trees, which take up valuable growing space on soils that are excellent woodland sites. Low-value white elm and hollow beech, poorly formed black cherry, and maple now occupy thousands of acres where yellow-poplar, oak, black walnut, and sugar maple were once prevalent. Grazing has damaged or destroyed leaf litter and desirable seedlings, damaged roots, and packed the soil. Good management, in time, can restore this woodland to a higher level of production.

Soils differ greatly in productivity for woodland. The major limitations are moderately steep to very steep slopes, aspect, ponding, wetness, stoniness and boulders, a clayey subsoil, and a limited rooting depth. The factors that influence the growth of trees are almost the same as those influencing production of annual crops and pasture. The major difference is that tree roots use more of the soil depth, 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 properties to be considered in evaluating a soil for use as woodland are the percent of slope, the degree of past erosion, the acidity, and the fertility level.

Aspect is the direction in which the slope faces. North aspects are those slopes that have an azimuth of 355 to 95 degrees. South aspects have an azimuth of 96 to 354 degrees (*6*). Trees grow better on north and east aspects because of less exposure to the prevailing winds 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, a high evaporation by the prevailing winds, 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. Soil moisture increases as elevation decreases, partly because of downslope seepage. On the lower part of slopes the soil is generally deeper than on the upper part, the loss of soil moisture by evaporation is less, and the soil temperature is somewhat lower than on the upper part.

The slope is an important factor in woodland management. Steep and very steep slopes present serious equipment limitations. As the percent of slope increases, the rate of water infiltration decreases and the rate of runoff and the hazard of erosion increase. Erosion reduces the 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 and suitability of different kinds of trees. For example, black walnut trees grow better on Chili and Nolin soils than on other soils. These soils naturally have a lime content in the subsoil favorable for the growth of trees. The growth is slower on soils that are low in fertility.

Christmas trees are an important specialty crop in the county. Readily accessible markets, climate, and soils are influencing long-term expansion of this crop. Management and harvesting are difficult on steep and very steep soils. The strongly sloping or gently sloping, well drained and moderately well drained soils, such as the Westmoreland, Rigley, Coshocton, Keene, and Guernsey soils, are preferred for Christmas trees. Commonly planted species include the Scotch pine, white pine, blue spruce, and Fraser fir. Soils on outwash terraces, such as the Wheeling and Rush soils, are also well suited. The poorly drained soils, such as the Sebring and Canadice soils, are generally unsuited. Moving of live Christmas trees is difficult in areas of Plainfield and Sparta soils because these soils are sandy in the surface layer and in the upper part of the subsoil. Gravel and stones in Conotton, Chili, Coshocton, and Guernsey soils interfere with planting, digging, and moving of trees.

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 suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland 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 insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from a commercial nursery or from local offices of the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Forestry; or the Cooperative Extension Service.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

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

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

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

Paths and trails for hiking 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

Sally Griffith, soil conservationist, Soil Conservation Service, helped prepare this section.

Wildlife is an important natural resource in Tuscarawas County. The major wildlife species are deer, fox, squirrel, rabbit, raccoon, beaver, muskrat, grouse, mallard, and the wood duck. The numbers of wild turkey and quail increase if the habitat is well managed.

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 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 29,780 acres of unreclaimed strip mined land classified as Bethesda soils is used primarily for wildlife habitat. Habitat improvement on these soils is the major management concern. These soils are droughty, extremely acid, have poor tilth, contain many rock fragments, and have a limited zone favorable for root development. Wildlife habitat can be improved by establishing a wider variety of plants. The wildlife plants that grow best on these soils are black locust, eastern white pine, red pine, red maple, sweetgum, Tatarian honeysuckle, and autumn-olive.

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 deep, well drained soils, such as Tioga and Nolin soils.

Establishing farm ponds for ducks, muskrat, raccoon, and many other species is a popular conservation practice. The ponds will be underused by wildlife unless vegetation provides protection from predators. The suitability for ponds is site specific. The Coshocton, Canadice, Caneadea, and Keene soils are good sites for ponds.

Many areas of wet soils, such as the Canadice, Melvin, Sebring, and Linwood soils, are undrained. If well managed, excellent habitat for woodcock, raccoon, and other species can be developed. Some woody plants which 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 Soil Conservation Service.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor(*1*). A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are foxtail, goldenrod, smartweed, ragweed, and fescue.

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, maple, hawthorn, dogwood, hickory, blackberry, and black walnut. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub honeysuckle, autumn-olive, and crabapple.

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

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

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

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

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

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

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

Engineering

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

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

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

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

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

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

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "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.

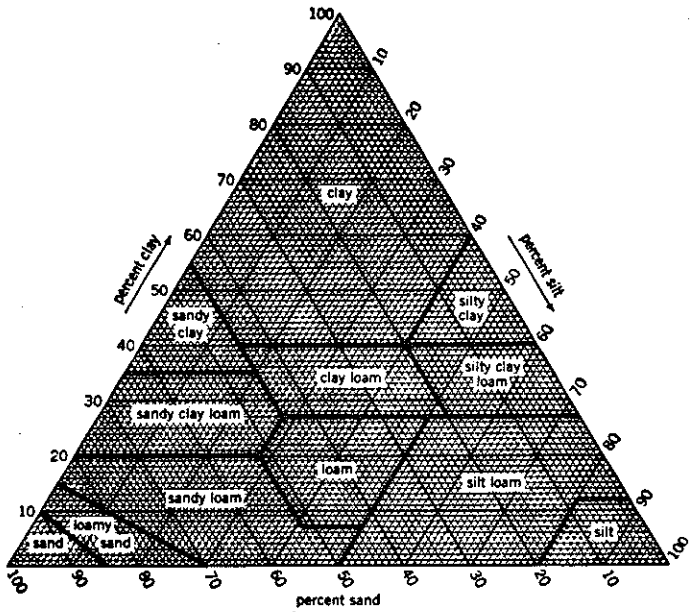

Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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. The AASHTO classification for soils tested is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to absorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and 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, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second letter is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Many of the soils in Tuscarawas County were sampled and laboratory data determined by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained on most samples include particle size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of the sampled soils and in evaluating their behavior under various land uses. Among these data, five of the profiles were selected as representative for the respective series and are described in this survey. These series and their laboratory identification numbers are: Chili (TU-16), Conotton (TU-17), Fitchville (TU-12), Guernsey (TU-18), and Hazleton (TU-13).

In addition to the Tuscarawas County data, laboratory data for many of the same soils are also available from nearby counties in eastern Ohio. Data from these counties and Tuscarawas County are on file at the Department of Agronomy, Ohio State University; the Ohio Department of Natural Resources, Division of Lands and Soil; and the Soil Conservation Service, State Office, Columbus, Ohio. Some of these data have been published in special studies of soils in nearby counties.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*14*). 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. Ten soil orders are recognized. The differences between orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*12*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*14*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Berks Series

The Berks series consists of moderately deep, well drained soils that formed in material weathered from shale and siltstone and from thin layers of fine grained sandstone. These soils are on uplands. Permeability is moderate or moderately rapid. Slopes range from 3 to 70 percent.

Berks soils are similar to Hazleton soils and commonly are adjacent to Coshocton and Westmoreland soils on hillsides and ridgetops. Coshocton and Westmoreland soils have an argillic horizon and have a lower content of coarse fragments in the subsoil than the Berks soils.

Coshocton, Hazleton, and Westmoreland soils are deep over bedrock. Coshocton soils are moderately well drained and have mottles of low chroma in the subsoil.

Typical pedon of Berks shaly silt loam, 25 to 40 percent slopes, about 2.5 miles south-southeast of Stone Creek; in an area of Jefferson Township 863 yards west and 88 yards north of the southeast corner of sec. 21, T. 7 N., R. 3 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) shaly silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common fine roots; about 30 percent coarse fragments; extremely acid; clear wavy boundary.

Bw1—3 to 8 inches; yellowish brown (10YR 5/4) very shaly silt loam; moderate medium subangular blocky structure; friable; common fine roots; about 50 percent coarse fragments; extremely acid; clear wavy boundary.

Bw2—8 to 13 inches; yellowish brown (10YR 5/4) very channery silt loam; moderate medium subangular blocky structure; friable; common fine roots; about 50 percent coarse fragments; very strongly acid; clear wavy boundary.

Bw3—13 to 18 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) extremely channery silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy silt coatings on faces of peds; about 75 percent coarse fragments; very strongly acid; clear wavy boundary.

Bw4—18 to 31 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) extremely channery silt loam; weak fine subangular blocky structure; friable; common roots in the upper part and few in the lower part; thin patchy silt coatings on faces of peds in the upper part; about 75 percent coarse fragments; very strongly acid; clear wavy boundary.

R—31 to 33 inches; olive (5Y 5/3) fractured siltstone bedrock.

The thickness of the solum ranges from 18 to 37 inches. The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments ranges from 10 to 35 percent in the A horizon and from 15 to 75 percent in individual subhorizons of the B horizon. The average content of coarse fragments in the control section is more than 35 percent. Where unlimed, the soils are very strongly acid or extremely acid throughout.

The B horizon has hue of 10YR, value of 5 or 6, and chroma of 4. It is the channery, very channery, extremely channery, shaly, very shaly, or extremely shaly analogs of silt loam or loam. Some pedons have a C horizon. The bedrock is commonly fractured shale, siltstone, or fine grained sandstone.

Bethesda Series

The Bethesda series consists of deep, well drained, moderately slowly permeable soils. These soils formed in a mixture of partly weathered fine-earth material and fragments of sandstone, siltstone, and shale in surface mined areas. Slopes range from 0 to 70 percent.

Bethesda soils are commonly adjacent to Berks, Coshocton, Guernsey, and Hazleton soils in unmined areas. The solum in the undisturbed Berks and Hazleton soils is thicker than that of the Bethesda soils. Coshocton and Guernsey soils are moderately well drained and have an argillic horizon.

Typical pedon of Bethesda channery clay loam, 25 to 70 percent slopes, about 1.5 miles southwest of Ragersville; in an area of Auburn Township 35 yards west and 555 yards south of the northeast corner of sec. 3, T. 7 N., R. 4 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) channery clay loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; many roots; about 30 percent coarse fragments; very strongly acid; abrupt smooth boundary.

C1—6 to 12 inches; dark grayish brown (10YR 4/2) very channery silt loam; massive; firm; common roots; about 45 percent coarse fragments; strongly acid; clear wavy boundary.

C2—12 to 20 inches; dark grayish brown (10YR 4/2) very shaly silty clay loam; massive; firm; about 45 percent coarse fragments; very strongly acid; clear wavy boundary.

C3—20 to 30 inches; dark grayish brown (10YR 4/2) extremely shaly silty clay loam; massive; firm; about 65 percent coarse fragments; very strongly acid; clear wavy boundary.

C4—30 to 36 inches; grayish brown (10YR 5/2) extremely shaly clay loam; massive; firm; about 70 percent coarse fragments; very strongly acid; clear wavy boundary.

C5—36 to 45 inches; gray (10YR 5/1) extremely shaly loam; massive; firm; about 75 percent coarse fragments; very strongly acid; clear wavy boundary.

C6—45 to 60 inches; dark grayish brown (10YR 4/2) extremely shaly silt loam; massive; firm; about 65 percent coarse fragments; extremely acid.

The soils range from strongly acid to extremely acid throughout, except where they have been limed. The coarse fragments are shale, sandstone, siltstone, and coal. They generally range from 2 millimeters to 25 centimeters in size, but some are stones and boulders. The content of coarse fragments ranges from 40 to 75 percent in the C horizon.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 3 to 5 and chroma of 0 to 4. It is dominantly channery clay loam, but the very channery, shaly, and very shaly analogs of clay loam are in some pedons. The C horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 4. It is the very shaly, extremely shaly, very channery, or extremely channery analogs of silty clay loam, clay loam, silt loam, or loam.

Bogart Variant

The Bogart Variant consists of deep, moderately well drained soils that formed in loamy glacial outwash and in the underlying lacustrine sediments. These soils are on terraces. Permeability is moderate in the glacial outwash and slow or very slow in the substratum. Slopes range from 0 to 8 percent.

Bogart Variant soils are commonly adjacent to Chili, Fitchville, Glenford, and Wheeling soils. The well drained Chili and Wheeling soils are in the slightly higher positions on the terraces. Fitchville and Glenford soils are on slack water terraces along streams. They have more silt and clay in the subsoil than the Bogart Variant.

Typical pedon of Bogart Variant loam, 0 to 3 percent slopes, about 1.25 miles southwest of New Cumberland; in an area of Warren Township 405 yards east and 282 yards south of the northwest corner of sec. 34, T. 15 N., R. 7 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; common roots; neutral; abrupt smooth boundary.

BE—8 to 15 inches; yellowish brown (10YR 5/4) loam; moderate fine subangular blocky structure; friable; common roots; thin silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—15 to 20 inches; yellowish brown (10YR 5/4) loam; common medium faint dark yellowish brown (10YR 4/4) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—20 to 24 inches; light yellowish brown (10YR 6/4) loam; common medium faint dark yellowish brown (10YR 4/4) and common medium distinct light gray (10YR 7/2) mottles; moderate coarse subangular blocky structure; firm; common roots; thin patchy light yellowish brown (10YR 6/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—24 to 32 inches; pale brown (10YR 6/3) gravelly sandy loam; common medium faint light brownish gray (10YR 6/2) mottles; moderate coarse subangular blocky structure; firm; common roots; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; about 20 percent coarse fragments; medium acid; clear wavy boundary.

Bt4—32 to 39 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2), light gray (10YR 7/1), and black (10YR 2/1) mottles; moderate coarse subangular blocky structure; firm; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; medium acid; clear wavy boundary.

2BC1—39 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 6/1) and common medium prominent reddish yellow (7.5YR 7/6) mottles; moderate medium subangular blocky structure; firm; medium acid; clear wavy boundary.

2BC2—44 to 52 inches; yellowish brown (10YR 5/4) silty clay; moderate medium subangular blocky structure; firm; continuous grayish brown (10YR 5/2) coatings on faces of peds; medium acid; clear wavy boundary.

2C—52 to 63 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm, sticky and plastic; continuous light brownish gray (2.5Y 6/2) coatings in seams; medium acid.

The thickness of the solum ranges from 30 to 55 inches. The content of coarse fragments is 0 to 2 percent in the Ap horizon and 0 to 20 percent in the Bt horizon.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is commonly loam, but it is silt loam in some pedons. It ranges from very strongly acid to neutral. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is loam or sandy loam and the gravelly analogs of these textures. It is very strongly acid to slightly acid. The 2BC horizon has hue of 10YR, value of 5, and chroma of 3 or 4. It is silty clay loam or silty clay. The 2C horizon is silty clay or silty clay loam and medium acid or slightly acid.

Canadice Series

The Canadice series consists of deep, poorly drained, very slowly permeable soils that formed in lacustrine deposits on slack water terraces. Slopes range from 0 to 3 percent.

Canadice soils are commonly adjacent to Caneadea, Fitchville, Glenford, Orrville, and Sebring soils. Fitchville, Glenford, Orrville, and Sebring soils have less clay in the subsoil than the Canadice soils. Caneadea, Fitchville, and Glenford soils are better drained than the Canadice soils and are in the slightly higher positions. Orrville soils are on flood plains. Sebring soils are in the same landscape positions as the Canadice soils.

Typical pedon of Canadice silty clay loam, about 2 miles south of Sugarcreek; in an area of Auburn Township 167 yards east and 212 yards south of the center of sec. 13, T. 8 N., R. 4 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many roots; few fine reddish brown (5YR 5/4) concretions; slightly acid; abrupt smooth boundary.

BAg—5 to 11 inches; gray (10YR 6/1) silty clay; moderate medium angular blocky structure; firm; common roots; few reddish brown (5YR 5/4) concretions; strongly acid; clear wavy boundary.

Btg1—11 to 17 inches; gray (10YR 6/1) silty clay; common medium prominent reddish brown (5YR 5/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; common roots; thin patchy light brownish gray (10YR 6/2) clay films and silt coatings on faces of peds; common black (10YR 2/1) concretions; strongly acid; clear wavy boundary.

Btg2—17 to 26 inches; gray (10YR 6/1) silty clay; common medium prominent yellowish red (5YR 5/6) mottles; moderate medium prismatic structure; firm; common roots; thin patchy light brownish gray (10YR 6/2) and gray (10YR 5/1) clay films and silt coatings on faces of peds; common black (10YR 2/1) concretions; strongly acid; clear wavy boundary.

Btg3—26 to 38 inches; gray (10YR 6/1) silty clay; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure; firm; few roots; thin patchy gray (10YR 6/1) clay films and silt coatings on faces of peds; common black (10YR 2/1) concretions; slightly acid; clear wavy boundary.

Btg4—38 to 44 inches; gray (10YR 6/1) silty clay; many medium distinct yellowish brown (10YR 5/4) and common medium prominent brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; firm; thin patchy gray (10YR 5/1) clay films and silt coatings on faces of peds; common very dark grayish brown (10YR 3/2) concretions; slightly acid; clear wavy boundary.

Btg5—44 to 54 inches; gray (10YR 6/1) silty clay; many medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; thin patchy gray (N 5/0) clay films and silt coatings on faces of peds; common very dark brown (10YR 2/2) concretions; slightly acid; clear wavy boundary.

BCg—54 to 60 inches; gray (10YR 6/1) silty clay; many medium distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; thin patchy gray (10YR 5/1) clay films and silt coatings on faces of peds; common very dark brown (10YR 2/2) concretions; slightly acid.

The Ap horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 2 or 3. It is very strongly acid to slightly acid unless it is limed. The Bt horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is silty clay or silty clay loam. It is strongly acid or medium acid in the upper part and slightly acid or neutral in the lower part.

Caneadea Series

The Caneadea series consists of deep, somewhat poorly drained, slowly permeable soils that formed in lacustrine deposits on slack water terraces. Slopes range from 0 to 3 percent.

Caneadea soils are commonly adjacent to Canadice, Fitchville, Glenford, Orrville, and Sebring soils. Fitchville, Glenford, Orrville, and Sebring soils have less clay in the subsoil than the Caneadea soils. Fitchville soils are in the same landscape position as the Caneadea soils. The moderately well drained Glenford soils are in the slightly higher positions. The poorly drained Canadice and Sebring soils are in depressions. Orrville soils are on flood plains.

Typical pedon of Caneadea silty clay loam, 0 to 3 percent slopes, about 2.5 miles east of Dennison; in an area of Union Township 600 yards west and 733 yards south of the northeast corner of sec. 19, T. 14 N., R. 7 W.

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; firm; common roots; specks of yellowish brown (10YR 5/6); neutral; clear smooth boundary.

Ap2—4 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; common medium distinct gray (10YR 6/1) and common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common roots; specks of yellowish brown (10YR 5/6); slightly acid; abrupt smooth boundary.

Bt1—9 to 16 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; common roots; thin patchy light brownish gray (10YR 6/2) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—16 to 32 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; few roots; medium continuous light brownish gray (10YR 6/2) clay films on faces of peds; common very dark brown (10YR 2/2) concretions; strongly acid; clear smooth boundary.

Bt3—32 to 38 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct gray (10YR 6/1) and few medium prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; medium continuous light brownish gray (10YR 6/2) clay films on faces of peds;

common very dark brown (10YR 2/2) concretions; neutral; clear smooth boundary.

Bt4—38 to 56 inches; yellowish brown (10YR 5/4) silty clay loam; few medium distinct gray (10YR 6/1) and common medium faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; medium continuous grayish brown (10YR 5/2) clay films on faces of peds; common very dark brown (10YR 2/2) concretions; neutral; clear wavy boundary.

C—56 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; firm; grayish brown (10YR 5/2) seams in vertical fissures; neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is strongly acid or very strongly acid except where it is limed. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay or silty clay loam. The C horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is silty clay loam or silty clay. It is stratified in some pedons.

Canfield Series

The Canfield series consists of deep, moderately well drained soils that formed in medium textured glacial till on ground moraines. These soils have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 3 to 15 percent.

Canfield soils are commonly adjacent to Bethesda, Coshocton, and Guernsey soils. Bethesda soils are in areas that were surface mined and have a higher content of coarse fragments throughout than the Canfield soils. Coshocton and Guernsey soils are in areas where the glacial till deposits are very thin or do not occur. They do not have a fragipan.

Typical pedon of Canfield silt loam, 3 to 8 percent slopes, about 3.75 miles northwest of Dundee; in an area of Wayne Township 377 yards west and 133 yards north of southeast corner of sec. 2, T. 10 N., R. 4 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many roots; few very dark brown (10YR 2/2) concretions; about 5 percent coarse fragments; neutral; abrupt smooth boundary.

BA—9 to 13 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; many roots; about 5 percent coarse fragments; slightly acid; clear wavy boundary.

Bt—13 to 17 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

Btx1—17 to 27 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; very firm; brittle; thin patchy clay films on faces of prisms; few very dark brown (10YR 2/2) concretions; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Btx2—27 to 40 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to weak medium platy; very firm; brittle; thin patchy clay films on faces of prisms; common very dark brown (10YR 2/2) concretions; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Btx3—40 to 43 inches; brown (7.5YR 4/4) gravelly silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; very firm; brittle; thin patchy clay films on faces of peds; about 20 percent coarse fragments; slightly acid; clear wavy boundary.

Btx4—43 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium prismatic structure parting to weak fine subangular blocky; very firm; brittle; thin very patchy clay films on faces of prisms; about 10 percent coarse fragments; slightly acid.

The thickness of the solum ranges from 50 to 80 inches, and the depth to the top of the fragipan ranges from 15 to 30 inches. The content of shale and crystalline fragments is 2 to 35 percent in the Bt and Btx horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. In uncultivated areas, the A horizon is 1 to 5 inches thick. The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, or clay loam and the gravelly analogs of these textures. It is strongly acid or very strongly acid. The Btx horizon has colors similar to those of the Bt horizon. It is loam, silt loam, or sandy loam and the shaly or gravelly analogs of these textures. It ranges from very strongly acid to neutral.

Chili Series

The Chili series consists of deep, well drained, moderately rapidly permeable soils on outwash terraces. These soils formed in loamy material and gravelly and sandy glacial outwash. Slopes range from 0 to 15 percent.

Chili soils are commonly adjacent to Bogart Variant, Conotton, Elkinsville, Glenford, and Wheeling soils. The moderately well drained Bogart Variant soils are in the slightly lower positions on outwash terraces. Bogart Variant, Elkinsville, and Glenford soils have more clay and silt in the substratum than the Chili soils. Elkinsville soils are on the slightly lower terrace levels, and Glenford soils are on the lacustrine terraces. Conotton and Wheeling soils are in positions on outwash terraces similar to those of the Chili soils. Conotton soils have a higher content of coarse fragments in the subsoil than the Chili soils. Wheeling soils have a lower base saturation in the substratum than the Chili soils.

Typical pedon of Chili silt loam, 0 to 3 percent slopes, about 2.5 miles north of Dover; in an area of Dover Township 1,408 yards east and 467 yards north of the southwest corner of sec. 2, T. 9 N., R. 2 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common roots; about 10 percent gravel; strongly acid; abrupt smooth boundary.

Bt1—10 to 16 inches; brown (7.5YR 5/4) silt loam; moderate medium granular structure; friable; common roots; about 5 percent gravel; medium acid; clear wavy boundary.

Bt2—16 to 22 inches; brown (7.5YR 5/4) loam; moderate medium subangular blocky structure; friable; few roots; about 5 percent gravel; thin patchy brown (7.5YR 5/4); clay films on faces of peds; medium acid; clear wavy boundary.

Bt3—22 to 28 inches; brown (7.5YR 5/4) gravelly loam; moderate medium subangular blocky structure; friable; about 20 percent gravel; thin patchy brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt4—28 to 33 inches; brown (7.5YR 4/4) very gravelly coarse sandy loam; weak medium subangular blocky structure; friable; about 45 percent gravel; thin patchy brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt5—33 to 39 inches; brown (7.5YR 4/4) very gravelly loamy coarse sand; weak medium subangular blocky structure; friable; about 50 percent gravel; thin patchy brown (7.5YR 4/4) clay films on faces of peds and on pebbles; strongly acid; clear wavy boundary.

Bt6—39 to 49 inches; brown (7.5YR 4/4) extremely gravelly coarse sandy loam; weak fine subangular blocky structure; friable; about 60 percent gravel; thin patchy brown (7.5YR 4/4) clay films on faces of peds and on pebbles; strongly acid; clear wavy boundary.

BCt1—49 to 55 inches; dark yellowish brown (10YR 4/4) extremely gravelly loamy coarse sand; weak fine subangular blocky structure; friable; about 60 percent gravel; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds and on pebbles; strongly acid; clear wavy boundary.

BCt2—55 to 61 inches; dark yellowish brown (10YR 4/4) extremely gravelly loamy coarse sand; weak medium subangular blocky structure; very friable; about 60 percent gravel; clay bridges between pebbles; strongly acid; clear wavy boundary.

C1—61 to 67 inches; yellowish brown (10YR 5/4) very gravelly coarse sand; weak medium subangular blocky structure; very friable; about 45 percent gravel; clay bridges between pebbles; medium acid; clear wavy boundary.

C2—67 to 72 inches; dark yellowish brown (10YR 4/4) extremely gravelly loamy coarse sand; weak fine subangular blocky structure; very friable; about 60 percent gravel; clay bridges between pebbles; medium acid; clear wavy boundary.

C3—72 to 80 inches; dark yellowish brown (10YR 4/4) very gravelly loamy coarse sand; weak fine subangular blocky structure; very friable; about 55 percent gravel; clay bridges between pebbles; strongly acid.

The thickness of the solum ranges from 40 to 80 inches. The content of coarse fragments commonly increases with increasing depth. It is 0 to 30 percent in the A horizon and in the upper part of the Bt horizon, 15 to 50 percent in the lower part of the Bt horizon, and 25 to 60 percent in the BC and C horizons.

The A horizon is gravelly loam or silt loam. It is very strongly acid to slightly acid unless it is limed. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 to 6. The upper part of the Bt horizon is sandy loam, silt loam, silty clay loam, clay loam, or sandy clay loam and the gravelly analogs of these textures. The lower part is the gravelly, very gravelly, or extremely gravelly analogs of coarse sandy loam, loamy coarse sand, sandy loam, loam, or sandy clay loam. The Bt horizon is strongly acid to slightly acid. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is the gravelly, very gravelly, or extremely gravelly analogs of loamy sand to coarse sand.

Conotton Series

The Conotton series consists of deep, well drained, rapidly permeable soils that formed in outwash deposits on stream and outwash terraces. Slopes range from 0 to 25 percent.

Conotton soils are commonly adjacent to Chili, Nolin, Orrville, Tioga, and Wheeling soils. Chili and Wheeling soils have less gravel in the subsoil than the Conotton soils. They are in positions on outwash terraces similar to those of the Conotton soils. Nolin, Orrville, and Tioga soils do not have an argillic horizon. They are on flood plains.

Typical pedon of Conotton gravelly loam, 0 to 3 percent slopes, about 1.25 miles west-southwest of Bolivar; in an area of Lawrence Township 1,857 yards west and 1,128 yards south of the northeast corner of sec. 2, T. 10 N., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) gravelly loam, brown (10YR 5/3) dry; weak medium granular structure; friable; common fine roots; about 20 percent gravel; medium acid; abrupt wavy boundary.

BA—9 to 12 inches; brown (7.5YR 5/4) gravelly sandy loam; moderate medium subangular blocky structure; friable; common fine roots; about 30 percent gravel; strongly acid; clear wavy boundary.

Bt1—12 to 17 inches; brown (7.5YR 4/4) very gravelly coarse sandy loam; moderate medium subangular blocky structure; friable; common fine roots; thin patchy clay films on faces of peds; about 35 percent gravel; strongly acid; clear wavy boundary.

Bt2—17 to 23 inches; brown (7.5YR 4/4) very gravelly coarse sandy loam; moderate medium subangular blocky structure; friable; common fine roots; thin patchy clay films on faces of peds and on pebbles; about 45 percent gravel; strongly acid; clear wavy boundary.

Bt3—23 to 48 inches; brown (7.5YR 5/4) very gravelly coarse sandy loam; weak medium subangular blocky structure; friable; few fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds and on pebbles; about 45 percent gravel; strongly acid in the upper part grading to slightly acid in the lower part; clear wavy boundary.

BC—48 to 62 inches; brown (10YR 5/3) very gravelly coarse sandy loam; weak medium subangular blocky structure; friable; thin very patchy clay films on pebbles about 45 percent gravel; slightly acid; clear wavy boundary.

C—62 to 80 inches; yellowish brown (10YR 5/4) very gravelly loamy coarse sand; single grained; loose; stratified with a few thin lenses of finer and coarser textured material; about 50 percent gravel; mildly alkaline.

The solum ranges from 40 to 80 inches in thickness. It is very strongly acid to medium acid in the upper part unless it is limed. It is strongly acid to neutral in the lower part. The C horizon is medium acid to mildly alkaline. The gravel content is 15 to 35 percent in the Ap and BA horizons and 35 to 65 percent in the Bt and C horizons.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3. The A horizon is dominantly gravelly loam but is gravelly sandy loam in some pedons. In undisturbed areas, it is 1 to 5 inches thick. Some pedons have an E horizon. The Bt horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. It is the very gravelly or extremely gravelly analogs of sandy loam, coarse sandy loam, or loam. Thin subhorizons of very gravelly or extremely gravelly sandy clay loam or clay loam are in some pedons. The weighted average clay content of the textural control section is 6 to 22 percent. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is stratified extremely gravelly sand to very gravelly loamy coarse sand.

Coshocton Series

The Coshocton series consists of deep, moderately well drained, moderately slowly permeable or slowly permeable soils on hillsides and ridgetops in the uplands. These soils formed in colluvium and residuum derived from siltstone, shale, and sandstone bedrock. They have a thin loess mantle in places. Slopes range from 3 to 40 percent.

Coshocton soils are similar to Keene and Westmoreland soils and are commonly adjacent to Guernsey, Hazleton, Keene, and Westmoreland soils on the hillsides and ridgetops. Guernsey soils have more clay in the subsoil than the Coshocton soils. Hazleton and Westmoreland soils are well drained. Hazleton soils have a higher content of sand and coarse fragments in the subsoil than the Coshocton soils. Keene soils have a lower content of sand and coarse fragments in the upper part of the subsoil than the Coshocton soils.

Typical pedon of Coshocton silt loam, in an area of Coshocton-Guernsey silt loams, 8 to 15 percent slopes, about 1.3 miles east of Sugar Creek; in an area of Sugarcreek Township 167 yards east and 202 yards south of the center of sec. 1, T. 8 N., R. 4 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; common roots; common yellowish brown (10YR 5/4) specks of soil material from the BA horizon; about 5 percent coarse fragments; neutral; abrupt smooth boundary.

BA—8 to 12 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common roots; about 5 percent coarse fragments; neutral; clear wavy boundary.

Bt1—12 to 19 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—19 to 25 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct gray (10YR 6/1) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish brown (10YR 5/8) clay films on faces of peds; continuous light yellowish brown (10YR 6/4) silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—25 to 32 inches; yellowish brown (10YR 5/4) channery loam; many medium distinct gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate coarse subangular blocky; firm; common roots; thin patchy light yellowish brown (10YR 6/4) clay films and continuous coatings on faces of peds; about 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bt4—32 to 37 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common roots; thin patchy pale brown (10YR 6/3) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

BC—37 to 43 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; thin very patchy yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

C1—43 to 50 inches; yellowish brown (10YR 5/4) shaly silty clay loam; common medium distinct gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium platy structure; firm; thin patchy light yellowish brown (2.5Y 6/4) clay films on faces of peds; about 15 percent coarse fragments; strongly acid; clear wavy boundary.

C2—50 to 60 inches; brown (10YR 5/3) shaly silty clay loam; common medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; about 15 percent coarse fragments; thin layers of silt loam; strongly acid.

The thickness of the solum ranges from 40 to 50 inches. The depth to bedrock ranges from 50 to 84 inches. Unless limed, the solum is strongly acid or very strongly acid. The C horizon is extremely acid to medium acid. The content of coarse fragments is 2 to 10 percent in the A horizon, 2 to 15 percent in the upper part of the B horizon, and 10 to 35 percent in the lower part.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is silt loam or very stony silt loam. The upper part of the Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam, silt loam, loam, or clay loam. The lower part of the Bt horizon is silty clay loam, clay loam, silt loam, or loam and the shaly or channery analogs of these textures. The BC horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is loam, silt loam, silty clay loam, or silty clay and the channery or shaly analogs of these textures. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is the shaly or channery analogs of silty clay loam or silty clay.

Elkinsville Series

The Elkinsville series consists of deep, well drained, moderately permeable soils on low terraces. These soils formed in alluvium. Slopes range from 0 to 3 percent.

Elkinsville soils are similar to Rush and Wheeling soils and are commonly adjacent to Fitchville, Glenford, and Tioga soils. The somewhat poorly drained Fitchville and moderately well drained Glenford soils are in the slightly lower landscape positions. Rush soils have a higher base saturation and more gravel and sand in the substratum than the Elkinsville soils. Tioga soils have more sand and less clay in the subsoil than the Elkinsville soils. They are on flood plains. Wheeling soils have more sand in the upper part than the Elkinsville soils.

Typical pedon of Elkinsville silt loam, 0 to 3 percent slopes, about 0.5 miles west of New Cumberland; in an area of Warren Township 577 yards west and 302 yards south of the northeast corner of sec. 35, T. 15 N., R. 7 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; common roots; neutral; abrupt smooth boundary.

Bt1—10 to 16 inches; dark brown (7.5YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—16 to 24 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; common roots; thin patchy clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—24 to 31 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; firm; common roots; thin patchy clay films on faces of peds; common very dark grayish brown (10YR 3/2) concretions; strongly acid; clear wavy boundary.

Bt4—31 to 44 inches; dark yellowish brown (10YR 4/4) silt loam; common medium faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; thin very patchy clay films on faces of peds; strongly acid; clear wavy boundary.

BC—44 to 52 inches; dark yellowish brown (10YR 4/4) loam; common medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; very strongly acid; clear wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium faint brown (10YR 5/3) mottles; massive; friable; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The content of coarse fragments is less than 2 percent in the solum.

The A horizon ranges from neutral to medium acid, depending upon local liming practices. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam and is strongly acid or very strongly acid. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4. It is silt loam, sandy loam, or loam and medium acid to very strongly acid.

Fitchville Series

The Fitchville series consists of deep, somewhat poorly drained soils that formed in lacustrine sediments on slack water terraces. Permeability is moderately slow or slow. Slopes range from 0 to 8 percent.

Fitchville soils are similar to Weinbach soils and are commonly adjacent to Elkinsville and Glenford soils. The well drained Elkinsville and moderately well drained Glenford soils are in the slightly higher landscape positions. Weinbach soils have a fragipan.

Typical pedon of Fitchville silt loam, 3 to 8 percent slopes, about 3.5 miles west of New Philadelphia; in an area of Dover Township 967 yards east and 947 yards north of the southwest corner of sec. 2, T. 8 N., R. 2 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; common black (10YR 2/1) and strong brown (7.5YR 5/6) concretions; slightly acid; abrupt smooth boundary.

Bt1—9 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; common medium prominent light gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films and continuous grayish brown (10YR 5/2) coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt2—19 to 33 inches; yellowish brown (10YR 5/4) silt loam; common medium prominent light gray (10YR 6/1) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium and coarse prismatic structure parting to weak medium subangular blocky; firm; common roots; thin patchy pale brown (10YR 6/3) clay films and continuous grayish brown (10YR 5/2) coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt3—33 to 41 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 5/1) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; common roots; thin patchy gray (10YR 5/1) clay films and continuous gray (10YR 5/1) coatings on faces of peds; common very dark grayish brown (10YR 3/2) concretions; very strongly acid; clear wavy boundary.

BC—41 to 51 inches; yellowish brown (10YR 5/4) silt loam; many medium prominent light gray (10YR 6/1) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; common roots; continuous gray (10YR 6/1) coatings on faces of peds; common black (10YR 2/1) concretions; strongly acid; clear wavy boundary.

C—51 to 69 inches; yellowish brown (10YR 5/4) silt loam; common medium prominent gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; massive; firm; common black (10YR 2/1) concretions; thin strata of loam; strongly acid.

The thickness of the solum ranges from 48 to 60 inches. The A and Bt horizons are very strongly acid to medium acid unless they are limed. The BC horizon is strongly acid to neutral, and the C horizon is slightly acid to strongly acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6. Less than 60 percent of the matrix has chroma of 2 or less. The Bt horizon is dominantly silt loam or silty clay loam, but it has thin subhorizons of loam in some pedons. It is slightly brittle in some pedons. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 4. It is dominantly silt loam, but in some pedons it has thin strata of loam and in others it is silty clay or clay.

Glenford Series

The Glenford series consists of deep, moderately well drained soils that formed in silty lacustrine deposits on slack water terraces along streams. Permeability is moderately slow. Slopes range from 3 to 15 percent.

Glenford soils are similar to Keene soils and are commonly adjacent to Elkinsville and Fitchville soils. The well drained Elkinsville soils are in the slightly higher positions on terraces along streams. The somewhat poorly drained Fitchville soils are in the slightly lower positions on the landscape. Keene soils have a higher content of coarse fragments in the lower part of the soil than the Glenford soils.

Typical pedon of Glenford silt loam, 8 to 15 percent slopes, in a meadow about 3 miles southwest of New Philadelphia; in an area of York Township 1,117 yards east and 247 yards north of the southwest corner of sec. 2, T. 8 N., R. 2 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common roots; neutral; abrupt smooth boundary.

BA—8 to 15 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common roots; few dark brown (10YR 4/3) krotovinas; medium acid; clear wavy boundary.

Bt1—15 to 22 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—22 to 29 inches; brown (10YR 5/3) silt loam; common medium faint light brownish gray (10YR 6/2) and few fine faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—29 to 36 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; friable; few roots; thin patchy brown (10YR 5/3) clay films on faces of peds; many gray (10YR 6/1) coatings on faces of peds; strongly acid; clear wavy boundary.

Bt4—36 to 43 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; friable; few roots; thin patchy gray (10YR 6/1) clay films and many gray (10YR 6/1) coatings on faces of peds; strongly acid; clear wavy boundary.

BC—43 to 50 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 6/1) mottles; weak coarse prismatic structure; friable; few roots; thin patchy gray (10YR 6/1) clay films on faces of peds; few black (10YR 2/1) coatings on faces of peds; medium acid; clear wavy boundary.

C—50 to 64 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light gray (10YR 7/1) and common medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; few black (10YR 2/1) coatings; thin strata of silty clay loam; medium acid.

The solum ranges from 30 to 60 inches in thickness. Unless limed, it is strongly acid or medium acid in the upper part and strongly acid to neutral in the lower part.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or silt loam. In some pedons it has a thin brittle layer in the middle or lower part. The C horizon has hue of 10YR, value of 5, and chroma of 3 or 4. It is silt loam, silty clay loam, or very fine sandy loam and is commonly stratified.

Guernsey Series

The Guernsey series consists of deep, moderately well drained, moderately slowly permeable or slowly permeable soils on hillsides and ridgetops in the uplands. These soils formed in residuum and colluvium derived from siltstone, shale, and thin strata of limestone. Slopes range from 3 to 40 percent.

Guernsey soils are similar to Upshur soils and are commonly adjacent to Berks, Coshocton, Hazleton, and Westmoreland soils on the hillsides and ridgetops. The adjacent soils have less clay in the subsoil than the Guernsey soils. Also, Berks and Hazleton soils have a higher content of coarse fragments in the subsoil. Berks, Hazleton, Upshur, and Westmoreland soils are well drained. Upshur soils have a redder hue in the subsoil than the Guernsey soils.

Typical pedon of Guernsey silt loam, in an area of Coshocton-Guernsey silt loams, 15 to 25 percent slopes, about 4.5 miles northeast of Sugarcreek; in an area of Sugarcreek Township 2,090 yards east and 303 yards south of the northwest corner of sec. 3, T. 9 N., R. 3 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; few specks of yellowish brown (10YR 5/6) soil material from the Bt1 horizon; about 2 percent coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—8 to 11 inches; yellowish brown (10YR 5/6) silty clay loam; common medium faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—11 to 16 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—16 to 21 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; common fine roots; thin patchy yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—21 to 29 inches; yellowish brown (10YR 5/4) silty clay; commmon medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; common fine roots; thin patchy light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/4) clay films on faces of peds; common very dark grayish brown (10YR 3/2) coatings (manganese oxide) on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt5—29 to 37 inches; yellowish brown (10YR 5/4) channery clay; many medium distinct dark brown (7.5YR 3/2) and many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; about 30 percent coarse fragments; mildly alkaline; clear wavy boundary.

Bt6—37 to 44 inches; yellowish brown (10YR 5/4) clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; common very dark grayish brown (10YR 3/2) coatings (manganese oxide) on faces of peds; about 10 percent coarse fragments; mildly alkaline; clear wavy boundary.

Bt7—44 to 51 inches; yellowish brown (10YR 5/4) channery clay; many medium distinct strong brown (7.5YR 5/6) and common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; thin patchy brown (10YR 5/3) clay films on faces of peds; common very dark grayish brown (10YR 3/2) coatings (manganese oxide) on faces of peds; about 20 percent coarse fragments; mildly alkaline; clear wavy boundary.

Bt8—51 to 59 inches; yellowish brown (10YR 5/4) clay; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) clay films on faces of peds; common very dark grayish brown (10YR 3/2) coatings (manganese oxide) on faces of peds; about 2 percent coarse fragments; mildly alkaline; clear wavy boundary.

2Cr—59 to 65 inches; black (10YR 2/1) coal blossom; massive.

The thickness of the solum ranges from 44 to 60 inches. The depth to bedrock ranges from 50 to 80 inches. The content of coarse fragments is 0 to 10 percent in the A horizon and 0 to 20 percent in the Bt horizon. Within individual subhorizons of the Bt horizon, it is as much as 35 percent. The A horizon and the upper part of the Bt horizon are medium acid to very strongly acid unless they are limed. The lower part of the Bt horizon is strongly acid to mildly alkaline. Coal seams are in some pedons.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is silt loam or very stony loam. The upper part of the Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is silt loam, silty clay loam, or silty clay. The lower part has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam, silty clay, or clay and the shaly or channery analogs of these textures. Some pedons have a C horizon.

Hazleton Series

The Hazleton series consists of deep, well drained, moderately rapidly permeable or rapidly permeable soils on ridgetops and hillsides in the uplands. These soils formed in colluvium and residuum derived from sandstone. Slopes range from 8 to 60 percent.

Hazleton soils are similar to Berks and Rigley soils and are commonly adjacent to Berks, Coshocton, Guernsey, and Westmoreland soils on the ridgetops and hillsides. Berks soils are moderately deep over bedrock. Their subsoil contains more silt and clay and less sand than that of the Hazleton soils. Coshocton, Guernsey, Rigley, and Westmoreland soils have an argillic horizon. Their subsoil has a lower content of coarse fragments than that of the Hazleton soils. Coshocton and Guernsey soils are moderately well drained.

Typical pedon of Hazleton channery loam, 25 to 40 percent slopes, about 1.5 miles south of Stone Creek; in an area of Jefferson Township 725 yards south and 43 yards west of the northeast corner of sec. 23, T. 7 N., R. 3 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) channery loam; grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; about 20 percent coarse fragments; extremely acid; abrupt smooth boundary.

Bw1—4 to 10 inches; yellowish brown (10YR 5/4) channery loam; weak fine subangular blocky structure; friable; many fine roots; about 25 percent coarse fragments; extremely acid; clear wavy boundary.

Bw2—10 to 17 inches; yellowish brown (10YR 5/4) channery loam; weak fine subangular blocky structure; friable; common fine roots; thin very patchy yellowish brown (10YR 5/4) silt coatings on faces of peds; about 30 percent coarse fragments; very strongly acid; clear wavy boundary.

Bw3—17 to 25 inches; yellowish brown (10YR 5/4) very channery sandy loam; weak medium subangular blocky structure; friable; common roots; thin very patchy strong brown (7.5YR 5/6) silt coatings on faces of peds; about 45 percent coarse fragments; very strongly acid; clear wavy boundary.

BC1—25 to 33 inches; yellowish brown (10YR 5/4) very flaggy loamy coarse sand; weak medium subangular blocky structure; friable; few fine roots; thin very patchy strong brown (7.5YR 5/4) silt coatings on faces of peds; about 55 percent coarse fragments; very strongly acid; clear wavy boundary.

BC2—33 to 40 inches; yellowish brown (10YR 5/4) extremely flaggy coarse sandy loam; weak medium subangular blocky structure; friable; thin very patchy strong brown (7.5YR 5/4) silt coatings on faces of peds; about 60 percent coarse fragments; very strongly acid; clear wavy boundary.

C—40 to 48 inches; yellowish brown (10YR 5/4) extremely flaggy loamy coarse sand; weak medium subangular blocky structure; friable; about 60 percent coarse fragments; very strongly acid; clear wavy boundary.

R—48 to 53 inches; brown (10YR 5/3) sandstone bedrock.

The thickness of the solum ranges from 40 to 50 inches. The depth to bedrock ranges from 40 to more than 60 inches. The content of coarse fragments generally increases with increasing depth. It is 15 to 25 percent in the A horizon and 15 to 70 percent in the B horizon. By weighted average, it is more than 35 percent in the textural control section.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. It is channery loam or extremely bouldery loam. It is extremely acid to strongly acid unless it is limed. Some pedons have an E horizon. The Bw horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is the channery, very channery, extremely channery, flaggy, very flaggy, or extremely flaggy analogs of loam or sandy loam. The Bw horizon is extremely acid to strongly acid. The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is very channery, extremely channery, very flaggy, or extremely flaggy sandy loam to loamy coarse sand.

Keene Series

The Keene series consists of deep, moderately well drained, moderately slowly permeable or slowly permeable soils on upland ridges and side slopes. These soils formed in a thin mantle of loess and in the underlying material weathered from siltstone and shale. Slopes range from 3 to 15 percent.

Keene soils are similar to Coshocton and Glenford soils and are commonly adjacent to Coshocton, Guernsey, and Hazleton soils on the side slopes and narrower ridgetops. Coshocton and Hazleton soils have a higher content of sand and coarse fragments in the upper part than the Keene soils. Hazleton soils are well drained. Glenford soils formed in lacustrine sediments on slack water terraces. Guernsey soils have more clay in the subsoil than the Keene soils.

Typical pedon of Keene silt loam, 3 to 8 percent slopes, about 1 mile northwest of Dundee; in an area of Wayne Township 555 yards north and 1,453 yards west of the southeast corner of sec. 4, T. 10 N., R. 4 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

BE—7 to 13 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; few black (10YR 2/1) concretions; common dark yellowish brown (10YR 4/4) coatings; strongly acid; clear wavy boundary.

Bt1—13 to 20 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; common black (10YR 2/1) concretions; strongly acid; clear wavy boundary.

Bt2—20 to 25 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/6) and common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films on faces of peds; few dark brown (7.5YR 4/4) concretions; strongly acid; clear wavy boundary.

Bt3—25 to 32 inches; strong brown (7.5YR 5/6) silt loam; common medium prominent gray (10YR 6/1) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy clay films on faces of peds; few very dark grayish brown (10YR 3/2) concretions; about 2 percent fragments; strongly acid; clear wavy boundary.

2Bt4—32 to 40 inches; strong brown (7.5YR 5/6) silty clay loam; common medium prominent gray (10YR 6/1) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy gray (10YR 6/1) clay films on faces of peds; common black (10YR 2/1) concretions; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

2BC—40 to 46 inches; brown (10YR 4/3) silty clay; common medium faint yellowish brown (10YR 5/4 and 5/6) mottles; weak medium subangular blocky structure; very firm, sticky; common very dark gray (10YR 3/1) concretions; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

2Cr—46 to 62 inches; grayish brown (10YR 5/2) shale bedrock.

3R—62 to 65 inches; gray sandstone bedrock.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock ranges from 40 to 84 inches. Unless limed, the upper part of the solum is strongly acid or very strongly acid. The lower part is slightly acid to very strongly acid. The content of coarse fragments, mainly siltstone, is 0 to 5 percent in the upper part of the solum and 5 to 30 percent in the lower part.

The Ap horizon has hue of 10YR, value or 4 or 5, and chroma of 2 or 3. Some pedons have both A and E horizons. The Bt horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 6. It is silty clay or silty clay loam. The clay content of the textural control section is 28 to 35 percent. Some pedons have a C horizon.

Linwood Series

The Linwood series consists of deep, very poorly drained, organic soils in depressions on glacial outwash plains. These soils formed in organic deposits that have recent alluvium in the surface layer. They are underlain by loamy and sandy material. Permeability is moderately slow to moderately rapid in the organic layer and moderate in the loamy and sandy material. Slopes range from 0 to 3 percent.

Linwood soils are commonly adjacent to Chili and Wheeling soils on outwash plains and to Nolin soils on flood plains. The adjacent soils formed in mineral material.

Typical pedon of Linwood mucky silt loam, ponded, about 1.5 miles south of Bolivar; in an area of Lawrence Township 933 yards north and 1,320 yards east of the southwest corner of sec. 1, T. 10 N., R. 2 W.

A—0 to 5 inches; dark gray (10YR 4/1) mucky silt loam, gray (10YR 5/1) dry; moderate medium and fine granular structure; friable; common roots; medium acid; clear wavy boundary.

Oa1—5 to 10 inches; black (N 2/0), broken face and rubbed, sapric material; about 20 percent fiber, less than 5 percent rubbed; moderate medium angular blocky structure; firm; common roots; medium acid; clear wavy boundary.

Oa2—10 to 15 inches; black (N 2/0), broken face and rubbed, sapric material; about 30 percent fiber, less than 5 percent rubbed; few fine distinct red (2.5YR 4/6) mottles; moderate coarse prismatic structure; firm; common roots; slightly acid; clear wavy boundary.

Oa3—15 to 23 inches; black (N 2/0), broken face and rubbed, sapric material; about 20 percent fiber; less than 5 percent rubbed; massive; firm; neutral; clear wavy boundary.

2Cg1—23 to 41 inches; very dark grayish brown (10YR 3/2) mucky silt loam; massive; firm; about 15 percent organic material; neutral; clear wavy boundary.

2Cg2—41 to 51 inches; very dark gray (10YR 3/1) mucky sandy loam; massive; firm; neutral; clear wavy boundary.

2Cg3—51 to 60 inches; dark gray (10YR 4/1) loamy fine sand; massive; friable; medium acid.

The depth to mineral material is 20 to 50 inches. The soils range from medium acid to neutral throughout.

The A horizon has hue of 2.5Y or 10YR, value of 3 or 4, and chroma of 1 or 2. The part of the surface tier below the A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 and chroma of 0 to 2. The subsurface tier has hue of 2.5Y or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. Thin layers of hemic material are in some pedons. The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It ranges from mucky sandy loam to silty clay loam.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils that formed in silty alluvium on flood plains. Slopes range from 0 to 3 percent.

Melvin soils are similar to Orrville soils and are commonly adjacent to Fitchville and Glenford soils on terraces along streams. Fitchville, Glenford, and Orrville soils are better drained than the Melvin soils and do not have dominantly gray colors in the subsoil. Also, Fitchville and Glenford soils have an argillic horizon.

Typical pedon of Melvin silt loam, frequently flooded, about 3 miles south of Dundee; in an area of Sugar Creek Township 308 yards north and 483 yards east of the southwest corner of sec. 11, T. 9 N., R. 4 W.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

Bg1—12 to 18 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; friable; common roots; thin patchy gray (10YR 5/1) coatings on faces of peds; slightly acid; clear wavy boundary.

Bg2—18 to 26 inches; grayish brown (2.5Y 5/2) silt loam; common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; common roots; thin patchy gray (10YR 5/1) coatings on faces of peds; slightly acid; clear wavy boundary.

Bg3—26 to 32 inches; grayish brown (2.5Y 5/2) silt loam; few fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; common black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; clear wavy boundary.

Cg—32 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common black (10YR 2/1) concretions (iron and manganese oxides); slightly acid.

The solum ranges from 20 to 40 inches in thickness. It ranges from neutral to medium acid throughout. The content of coarse fragments is 0 to 5 percent to a depth of 30 inches and 0 to 20 percent below that depth.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The B horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is silt loam or silty clay loam. The C horizon has colors and textures similar to those of the B horizon. It is neutral or slightly acid.

Morristown Series

The Morristown series consists of deep, well drained, moderately slowly permeable soils in surface mined areas. These soils formed in a mixture of calcareous, partly weathered fine-earth material and fragments of limestone, shale, and some sandstone and siltstone. Slopes range from 0 to 70 percent.

Morristown soils are commonly adjacent to Coshocton, Guernsey, Hazleton, and Westmoreland soils in unmined areas. The solum in the undisturbed adjacent soils is thicker than that of the Morristown soils. Coshocton, Guernsey, and Westmoreland soils have an argillic horizon. Coshocton and Guernsey soils are moderately well drained.

Typical pedon of Morristown loam, 8 to 15 percent slopes, about 2.25 miles northeast of Ragersville; in an area of Auburn Township 335 yards west and 228 yards north of the southeast corner of sec. 15, T. 8 N., R. 3 W.

Ap—0 to 10 inches; yellowish brown (10YR 5/6) loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; many roots; about 15 percent coarse fragments; slightly acid; abrupt smooth boundary.

C1—10 to 20 inches; dark gray (10YR 4/1) very channery silty clay loam; massive; firm; common roots; about 50 percent coarse fragments; slight effervescence; moderately alkaline; clear wavy boundary.

C2—20 to 24 inches; variegated dark gray (10YR 4/1) and brown (10YR 5/3) very channery silty clay loam; massive; firm; few roots; about 50 percent coarse fragments; slight effervescence; moderately alkaline; clear wavy boundary.

C3—24 to 30 inches; variegated dark gray (10YR 4/1) and brown (10YR 5/3) extremely channery clay loam; massive; firm; about 60 percent coarse fragments; slight effervescence; moderately alkaline; clear wavy boundary.

C4—30 to 42 inches; dark gray (N 4/0) extremely channery clay loam; massive; firm; about 70 percent coarse fragments; slight effervescence; moderately alkaline; clear wavy boundary.

C5—42 to 60 inches; very dark gray (N 3/0) extremely channery clay loam; massive; firm; about 60 percent coarse fragments; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is slightly acid to moderately alkaline. The C horizon has hue of 7.5YR to 5Y or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 8. It is the channery, very channery, or extremely channery analogs of loam, clay loam, silty clay loam, or silt loam. The average content of coarse fragments in this horizon is 35 to 70 percent. The C horizon is mildly alkaline or moderately alkaline.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils that formed in alluvium on flood plains. Slopes range from 0 to 3 percent.

These soils have calcium carbonate in the upper part of the solum that is not definitive for the Nolin series. This difference, however, does not alter the usefulness or behavior of the soils.

Nolin soils are commonly adjacent to Chili, Orrville, and Wheeling soils. The adjacent soils have more sand in the subsoil than the Nolin soils. Chili and Wheeling soils have an argillic horizon. They are on the higher benches along streams. The somewhat poorly drained Orrville soils are in slight depressions on flood plains.

Typical pedon of Nolin silt loam, occasionally flooded, about 2 miles southeast of Zoar; in an area of Sandy Township 1,265 yards east and 493 yards north of the southwest corner of sec. 3, T. 10 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; weak medium granular structure; friable; common fine roots; common brown (10YR 5/3) silt coatings on faces of peds; strong effervescence; moderately alkaline; abrupt smooth boundary.

Bw1—9 to 18 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common fine roots; common brown (10YR 5/3) silt coatings on faces of peds; strong effervescence; moderately alkaline; clear wavy boundary.

Bw2—18 to 27 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; strong effervescence; moderately alkaline; clear wavy boundary.

Bw3—27 to 33 inches; brown (10YR 5/3) silt loam; weak medium subangular blocky structure; friable; slight effervescence; mildly alkaline; clear wavy boundary.

BC—33 to 44 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

C1—44 to 50 inches; dark brown (7.5YR 4/4) silt loam; massive; friable; neutral; clear wavy boundary.

C2—50 to 60 inches; dark brown (7.5YR 4/4) sandy loam; massive; very friable; neutral.

The solum ranges from 40 to 60 inches in thickness. It ranges from medium acid to moderately alkaline. The content of coarse fragments is 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. The B horizon is silt loam or silty clay loam. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam, sandy loam, or silt loam.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils that formed in alluvium on flood plains. Slopes range from 0 to 3 percent.

Orrville soils are similar to Melvin soils and are commonly adjacent to the well drained Nolin and Tioga soils in the slightly higher positions on the flood plains. Melvin soils are poorly drained and have dominantly gray colors in the subsoil.

Typical pedon of Orrville silt loam, occasionally flooded, about 2.5 miles east-southeast of Gilmore; in an area of Perry Township 123 yards west and 448 yards north of the southeast corner of sec. 4, T. 5 N., R. 1 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many roots; medium acid; abrupt smooth boundary.

Bw—8 to 13 inches; brown (10YR 5/3) silt loam; many medium distinct yellowish brown (10YR 5/6) and common medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.

Bg1—13 to 21 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.

Bg2—21 to 30 inches; grayish brown (10YR 5/2) silt loam; many medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few roots; many reddish brown (5YR 5/4) stains along root channels; common black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; clear wavy boundary.

BCg—30 to 36 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct reddish brown (5YR 5/4) mottles along root channels; weak medium subangular blocky structure; friable; common black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; clear wavy boundary.

Cg1—36 to 42 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct reddish brown (5YR 5/4) mottles along root channels; massive; friable; few black (10YR 2/1) concretions (iron and manganese oxides); slightly acid; clear wavy boundary.

Cg2—42 to 50 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; about 5 percent coarse fragments; medium acid; clear wavy boundary.

Cg3—50 to 60 inches; gray (5Y 5/1) sandy loam; massive; loose; about 5 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 24 to 50 inches. The content of coarse fragments is 0 to 15 percent in the B horizon. Unless it is limed, the solum is strongly acid to slightly acid. The C horizon ranges from neutral to strongly acid.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4. It is silt loam or loam. The C horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 to 4. It is dominantly silt loam, loam, or sandy loam, but it has thin strata of silty clay loam or loamy sand in some pedons.

Plainfield Series

The Plainfield series consists of deep, excessively drained, rapidly permeable soils on glacial outwash and stream terraces. These soils formed in sandy outwash deposits. Slopes range from 3 to 8 percent.

Plainfield soils are similar to Sparta soils and are commonly adjacent to Chili, Conotton, Sparta, and Wheeling soils. The adjacent soils are in positions on the landscape similar to those of the Plainfield soils. Chili, Conotton, and Wheeling soils have more clay in the subsoil and more gravel in the substratum than the Plainfield soils. Sparta soils have a mollic epipedon.

Typical pedon of Plainfield loamy sand, 3 to 8 percent slopes, about 2 miles east of Bolivar; in an area of Sandy Township 133 yards east and 50 yards south of the northwest corner of sec. 5, T. 10 N., R. 1 W.

Ap—0 to 13 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; many roots; slightly acid; abrupt smooth boundary.

Bw1—13 to 22 inches; yellowish brown (10YR 5/4) sand; moderate fine granular structure; very friable; many roots; slightly acid; clear wavy boundary.

Bw2—22 to 28 inches; yellowish brown (10YR 5/6) sand; weak fine granular structure; very friable; common roots; slightly acid; clear wavy boundary.

Bw3—28 to 34 inches; yellowish brown (10YR 5/4) sand; weak fine granular structure; very friable; few roots; slightly acid; clear wavy boundary.

C1—34 to 48 inches; yellowish brown (10YR 5/4) sand; single grained; loose; few roots in the upper part; few dark yellowish brown (10YR 4/4) bands; slightly acid; clear wavy boundary.

C2—48 to 60 inches; yellowish brown (10YR 5/4) sand; single grained; loose; one-half inch thick dark yellowish brown (10YR 4/4) band in the lower part; medium acid; clear wavy boundary.

The thickness of the solum ranges from 18 to 34 inches. The soils are strongly acid to slightly acid throughout.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6.

Rigley Series

The Rigley series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in residuum and colluvium derived from sandstone bedrock. Slopes range from 8 to 40 percent.

Rigley soils are similar to Hazleton and Westmoreland soils and are commonly adjacent to Coshocton, Guernsey, Hazleton, and Westmoreland soils on hillsides and ridgetops. Coshocton, Guernsey, and Westmoreland soils contain more clay and less sand in the subsoil than the Rigley soils. Coshocton and Guernsey soils are moderately well drained and have mottles of low chroma in the subsoil. Hazleton soils have a cambic horizon and have a higher content of sandstone fragments throughout than the Rigley soils.

Typical pedon of Rigley sandy loam, 15 to 25 percent slopes, about 4.5 miles south of Baltic; in an area of Bucks Township 17 yards south and 273 yards east of the center of sec. 25, T. 7 N., R. 4 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) sandy loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; many roots; about 10 percent coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—8 to 14 inches; strong brown (7.5YR 5/6) sandy loam; weak medium granular structure; very friable; common roots; thin patchy clay films bridging sand grains; strongly acid; clear wavy boundary.

Bt2—14 to 22 inches; strong brown (7.5YR 5/6) sandy loam; weak medium granular structure; very friable; common roots; thin patchy brown (7.5YR 5/4) clay films bridging sand grains; few brown (7.5YR 5/4) bands 1 inch thick; strongly acid; clear wavy boundary.

Bt3—22 to 29 inches; strong brown (7.5YR 5/6) sandy loam; weak medium granular structure; very friable; common roots; thin patchy brown (7.5YR 5/4) clay films on about 50 percent of the faces of coarse fragments; about 5 percent coarse fragments; few brown (7.5YR 5/4) bands 1 inch thick; strongly acid; clear wavy boundary.

Bt4—29 to 36 inches; strong brown (7.5YR 5/6) sandy loam; weak medium granular structure; very friable; thin patchy brown (7.5YR 5/4) clay films bridging sand grain; about 5 percent coarse fragments; few brown (7.5YR 5/4) bands 1 inch thick; strongly acid; clear wavy boundary.

BC1—36 to 42 inches; strong brown (7.5YR 5/6) sandy loam; weak medium granular structure; very friable; thin very patchy brown (7.5YR 5/4) clay films bridging sand grains; about 5 percent coarse fragments; few brown (7.5YR 5/4) bands 1 inch thick; strongly acid; clear wavy boundary.

BC2—42 to 50 inches; strong brown (7.5YR 5/6) loamy sand; weak fine granular structure; very friable; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

C—50 to 60 inches; light yellowish brown (10YR 6/4) loamy sand; massive; very friable; about 5 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The content of coarse fragments is 0 to 10 percent in the solum.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 6. It is sandy loam or loam. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is sandy loam or loamy sand.

Rush Series

The Rush series consists of deep, well drained soils that formed in silty material and in the underlying glacial outwash. These soils are on outwash terraces. Permeability is moderate in the solum and very rapid in the substratum. Slopes range from 0 to 3 percent.

Rush soils are similar to Elkinsville and Wheeling soils and are commonly adjacent to Chili and Wheeling soils. Chili and Wheeling soils are in positions on the outwash terraces similar to those of the Rush soils. They have more sand in the upper part than the Rush soils. Elkinsville soils have a lower base saturation and less sand and gravel in the substratum than the Rush soils.

Typical pedon of Rush silt loam, 0 to 3 percent slopes, about 0.75 mile south of Beach City; in an area of Wayne Township 770 yards south and 1,994 yards west of the northeast corner of sec. 2, T. 10 N., R. 3 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common roots; slightly acid; clear wavy boundary.

BA—10 to 15 inches; brown (7.5YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common roots; slightly acid; clear wavy boundary.

Bt1—15 to 22 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; few patchy very dark gray (10YR 3/1) coatings; medium acid; clear wavy boundary.

Bt2—22 to 31 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common roots; thin patchy clay films on faces of peds; patchy very dark gray (10YR 3/1) coatings; strongly acid; clear wavy boundary.

2Bt3—31 to 37 inches; brown (7.5YR 5/4) loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; patchy very dark gray (10YR 3/1) coatings; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt4—37 to 46 inches; brown (7.5YR 5/4) gravelly loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; about 25 percent coarse fragments; medium acid; clear wavy boundary.

2Bt5—46 to 53 inches; brown (7.5YR 5/4) very gravelly clay loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; about 40 percent coarse fragments; medium acid; clear wavy boundary.

2C—53 to 68 inches; brown (7.5YR 5/4) very gravelly loamy sand; single grained; loose; about 35 percent coarse fragments; medium acid.

The thickness of the solum ranges from 48 to 70 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 5YR or 7.5YR and value and chroma of 4 or 5. It is clay loam or loam and the gravelly or very gravelly analogs of these textures. The gravel content in this horizon ranges from 5 to 50 percent. The B horizon is medium acid or strongly acid. The C horizon is loamy sand or sand and the gravelly or very gravelly analogs of these textures.

Sebring Series

The Sebring series consists of deep, poorly drained, moderately slowly permeable soils that formed in silty lacustrine sediments on slack water terraces along streams. Slopes range from 0 to 3 percent.

Sebring soils are commonly adjacent to the somewhat poorly drained Fitchville and Orrville soils. Fitchville soils are on the slightly higher parts of the terraces, and Orrville soils are on flood plains.

Typical pedon of Sebring silt loam, 2 miles southeast of Sugarcreek; in an area of Auburn Township 528 yards west and 115 yards south of the northeast corner of sec. 11, T. 8 N., R. 4 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; common roots; few olive (5Y 5/6) concretions; neutral; abrupt smooth boundary.

BEg—10 to 19 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; friable; common roots; common pale brown (10YR 6/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Btg1—19 to 29 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy gray (N 6/0) clay films on faces of peds; many very dark brown (10YR 2/2) concretions; medium acid; clear wavy boundary.

Btg2—29 to 46 inches; gray (10YR 6/1) silt loam; common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy gray (N 6/0) clay films; few very dark brown (10YR 2/2) concretions; slightly acid; clear wavy boundary.

C—46 to 63 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; friable; many very dark brown (10YR 2/2) concretions slightly acid.

The thickness of the solum ranges from 40 to 55 inches. Unless limed, the Ap horizon ranges from medium acid to very strongly acid. The Btg horizon has hue of 10YR, value of 6, and chroma of 1 or 2. It is silty clay loam or silt loam. The average clay content in the textural control section is 22 to 35 percent. The Btg horizon ranges from slightly acid to very strongly acid. Some pedons have a BC horizon. The C horizon has hue of 10YR or is neutral in hue. It has value of 5 or 6 and chroma of 0 to 6. It is silt loam or silty clay loam and is commonly stratified.

Shinrock Series

The Shinrock series consists of deep, moderately well drained soils that formed in lacustrine sediments on dissected parts of former glacial lakebeds. Permeability is moderately slow. Slopes range from 8 to 20 percent.

Shinrock soils are commonly adjacent to Fitchville and Bogart Variant soils. The somewhat poorly drained Fitchville soils are in the lower lying areas. The Bogart Variant soils have more sand and less clay in the subsoil than the Shinrock series. They are on the flatter parts of the former glacial lakebeds.

Typical pedon of Shinrock silty clay loam, 8 to 20 percent slopes, severely eroded, about 0.5 mile north of New Cumberland; in an area of Warren Township 137 yards north and 303 yards east of the southwest corner of sec. 30, T. 15 N., R. 7 W.

Ap—0 to 5 inches; brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; moderate medium angular blocky structure; firm; common fine roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; neutral; abrupt smooth boundary.

Bt1—5 to 15 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; common fine roots; thin patchy gray (10YR 6/1) clay films on faces of peds; thin patchy dark brown (10YR 4/3) coatings; common very dark grayish brown (10YR 3/2) concretions; slight effervescence; mildly alkaline; clear wavy boundary.

Bt2—15 to 28 inches; yellowish brown (10YR 5/4) silty clay; common medium faint brown (7.5YR 5/4) and common medium distinct gray (10YR 6/1) mottles; moderate medium angular blocky structure; firm; common fine roots; thin patchy brown (10YR 5/3) and gray (10YR 6/1) clay films on faces of peds; common very dark grayish brown (10YR 3/2) concretions; slight effervescence; mildly alkaline; clear wavy boundary.

Bt3—28 to 33 inches; yellowish brown (10YR 5/4) silty clay; common medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; common fine roots; thin patchy gray (10YR 6/1) and brown (10YR 5/3) clay films on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

C1—33 to 40 inches; yellowish brown (10YR 5/4) silty clay; common medium faint yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; weak medium angular blocky structure; firm; common fine roots; thin patchy light brownish gray (10YR 6/2) and brown (10YR 5/3) clay films on faces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

C2—40 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (2.5Y 5/2) and common medium faint yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; firm; few fine roots; thin patchy light brownish gray (10YR 6/2) and brown (10YR 5/3) clay films on faces of peds; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is medium acid to neutral. The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is medium acid to mildly alkaline in the upper part and slightly acid to mildly alkaline in the lower part. The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is neutral to moderately alkaline.

Sparta Series

The Sparta series consists of deep, excessively drained, rapidly permeable soils that formed in sandy outwash deposits on glacial outwash and stream terraces. Slopes range from 0 to 3 percent.

Sparta soils are similar to Plainfield soils and are commonly adjacent to Chili, Nolin, Orrville, and Wheeling soils. None of the similar or adjacent soils have a mollic epipedon. Chili, Plainfield, and Wheeling soils are in landscape positions similar to those of the Sparta soils. Chili and Wheeling soils have more clay in the subsoil and more gravel in the substratum than the Sparta soils. The well drained Nolin and somewhat poorly drained Orrville soils are on flood plains.

Typical pedon of Sparta loamy fine sand, 0 to 3 percent slopes, about 1.25 miles southeast of New Philadelphia; in an area of Goshen Township 137 yards northwest along State Route 259 from the intersection of State Route 259 and Township Road 187A, then 480 yards west, T. 8 N., R. 2 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) loamy fine sand; dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

Bw1—11 to 15 inches; dark brown (7.5YR 4/4) loamy sand; moderate medium granular structure; friable; common roots; common very dark grayish brown (10YR 3/2) coatings on faces of peds; medium acid; clear wavy boundary.

Bw2—15 to 19 inches; dark brown (7.5YR 4/4) loamy sand; moderate medium granular structure; friable; common roots; medium acid; clear wavy boundary.

Bw3—19 to 26 inches; dark yellowish brown (10YR 4/4) loamy sand; moderate medium granular structure; very friable; common roots; medium acid; clear wavy boundary.

Bw4—26 to 34 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium granular structure; very friable; common roots; medium acid; clear wavy boundary.

Bw5—34 to 40 inches; yellowish brown (10YR 5/4) loamy sand; weak medium granular structure; very friable; common roots; medium acid; clear wavy boundary.

C1—40 to 45 inches; yellowish brown (10YR 5/4) sand; single grained; loose; medium acid; clear wavy boundary.

C2—45 to 65 inches; dark brown (7.5YR 4/4) sand; single grained; loose; medium acid.

The solum ranges from 24 to 40 inches in thickness. It is medium acid or slightly acid throughout.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand or loamy sand. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4.

Tioga Series

The Tioga series consists of deep, well drained soils that formed in alluvium on flood plains. Permeability is moderate or moderately rapid. Slopes range from 0 to 3 percent.

Tioga soils are commonly adjacent to Chili, Glenford, and Orrville soils. Chili and Glenford soils have an argillic horizon and are on the higher benches along streams. The somewhat poorly drained Orrville soils are in slight depressions on flood plains.

Typical pedon of Tioga loam, occasionally flooded, about 1 mile east of Newcomerstown; in an area of Oxford Township 1,408 yards north and 1,265 yards west of the southeast corner of sec. 2, T. 5 N., R. 3 W.

Ap—0 to 10 inches; brown (10YR 4/3) loam, yellowish brown (10YR 5/4) dry; moderate medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

Bw1—10 to 16 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common roots; brown (10YR 4/3) coatings of soil material from the Ap horizon on faces of peds; slightly acid; abrupt smooth boundary.

Bw2—16 to 21 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few roots; slightly acid; clear wavy boundary.

Bw3—21 to 28 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium subangular blocky structure; very friable; slightly acid; clear wavy boundary.

C1—28 to 33 inches; dark yellowish brown (10YR 4/4) loamy sand; massive; very friable; medium acid; clear wavy boundary.

C2—33 to 40 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; very friable; medium acid; clear wavy boundary.

C3—40 to 46 inches; dark yellowish brown (10YR 4/4) loamy sand; single grained; very friable; medium acid; clear wavy boundary.

C4—46 to 60 inches; yellowish brown (10YR 5/4) loamy sand; single grained; loose; medium acid.

The solum ranges from 25 to 40 inches in thickness. It is slightly acid to strongly acid unless it is limed.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam, loam, and sandy loam but has thin subhorizons of loamy sand in some pedons. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It ranges from silt loam to loamy sand.

Upshur Series

The Upshur series consists of deep, well drained, slowly permeable soils on the tops of ridges and the upper part of side slopes in the uplands. These soils formed in material weathered from shale. Slopes range from 8 to 15 percent.

Upshur soils are similar to Guernsey soils and are commonly adjacent to Berks, Guernsey, Hazleton, and Westmoreland soils on hillsides and ridgetops. Berks, Hazleton, and Westmoreland soils have less clay in the subsoil than the Upshur soils. Guernsey soils are moderately well drained.

Typical pedon of Upshur silt loam, 8 to 15 percent slopes, about 3.5 miles east of Gilmore; in an area of Rush Township 123 yards west and 247 yards north of the southeast corner of sec. 23, T. 6 N., R. 1 W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; friable; common roots; strongly acid; abrupt smooth boundary.

Bt1—7 to 12 inches; red (2.5YR 4/6) silty clay; moderate medium subangular blocky structure; firm, sticky and plastic; common roots; common dark yellowish brown (10YR 4/4) krotovinas; thin very patchy red (2.5YR 4/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—12 to 17 inches; reddish brown (2.5YR 4/4) silty clay; moderate medium subangular blocky structure; firm, sticky and plastic; common roots; thin patchy reddish brown (2.5YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—17 to 25 inches; reddish brown (2.5YR 4/4) silty clay; moderate medium subangular blocky structure; firm, sticky and plastic; common roots; thin patchy reddish brown (2.5YR 4/4) clay films on faces of peds; occasional slickensides and many pressure faces; very strongly acid; clear wavy boundary.

Bt4—25 to 35 inches; reddish brown (2.5YR 4/4) silty clay; moderate medium subangular blocky structure; firm, sticky and plastic; thin patchy reddish brown (2.5YR 4/4) clay films on faces of peds; occasional slickensides and many pressure faces; common weak red (2.5YR 5/2) weathered shale fragments; strongly acid; clear wavy boundary.

Bt5—35 to 44 inches; weak red (10R 4/4) silty clay; common medium distinct light brownish gray (2.5Y 6/2) and olive yellow (2.5Y 6/6) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; thin patchy weak red (10R 4/4) clay films on faces of peds; occasional slickensides and many pressure faces; strongly acid; clear wavy boundary.

Bt6—44 to 48 inches; dark red (2.5YR 3/6) silty clay; moderate medium subangular blocky structure; firm, sticky and plastic; thin patchy dark red (2.5YR 3/6) clay films on faces of peds; occasional slickensides and many pressure faces; strongly acid; clear wavy boundary.

C—48 to 64 inches; dark red (10R 3/6) silty clay; weak medium subangular blocky structure; firm, sticky and plastic; thin patchy dark red (10R 3/6) clay films on faces of peds; occasional slickensides and many pressure faces; slightly acid.

The thickness of the solum ranges from 26 to 50 inches. The depth to paralithic contact is more than 60 inches. The content of coarse fragments is 0 to 5 percent in the solum. In unlimed areas, the A and Bt horizons are very strongly acid to slightly acid and the C horizon is strongly acid to moderately alkaline.

The Ap horizon has hue of 10YR or 7.5YR and value and chroma of 4. The B horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 3 to 6. The C horizon has colors similar to those of the B horizon, but in some pedons it has variegated colors of olive, olive brown, or yellow. It is silty clay loam, silty clay, or clay.

Weinbach Series

The Weinbach series consists of deep, somewhat poorly drained soils that formed in old alluvium on outwash terraces. These soils have a fragipan. Permeability is moderate above the fragipan and very slow in the fragipan. Slopes range from 0 to 3 percent.

Weinbach soils are similar to Fitchville soils and are commonly adjacent to Chili, Conotton, and Wheeling soils. The adjacent soils are in the slightly higher positions on terraces. Fitchville soils are on slack water terraces. They do not have a fragipan.

Typical pedon of Weinbach silt loam, 0 to 3 percent slopes, about 1 mile north of Tuscarawas; in an area of Warwick Township 138 yards south of the intersection of State Route 416 and county road 61, along State Route 416, then 303 yards east, T. 7 N., R. 1 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, light brownish gray (2.5Y 6/2) dry; weak medium granular structure; friable; common fine roots; few pebbles; commmon strong brown (7.5YR 5/6) concretions (iron and manganese oxides); slightly acid; abrupt smooth boundary.

Bt1—8 to 14 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin patchy gray (10YR 6/1) clay films on faces of peds; common black (10YR 2/1) concretions (iron and manganese oxides); few pebbles; strongly acid; clear wavy boundary.

Bt2—14 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy gray (10YR 6/1) clay films on faces of peds; common black (10YR 2/1) concretions (iron and manganese oxides); few pebbles; strongly acid; clear wavy boundary.

Bt3—18 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and common medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few roots; thin patchy gray (10YR 6/1) clay films on faces of peds; continuous gray (10YR 6/1) coatings; common black (10YR 2/1) concretions (iron and manganese oxides); few pebbles; strongly acid; clear wavy boundary.

Btx1—27 to 33 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct gray (10YR 5/1) and common medium faint yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium angular blocky; very firm; brittle; thin patchy gray (10YR 5/1) clay films on vertical faces of peds; continuous gray (10YR 5/1) coatings on vertical faces of peds; common black (10YR 2/1) concretions (iron and manganese oxides); few pebbles; strongly acid; clear wavy boundary.

Btx2—33 to 41 inches; dark yellowish brown (10YR 4/4) silt loam; many medium distinct gray (10YR 5/1) and common medium faint yellowish brown (10YR 5/4) mottles; moderate very coarse prismatic structure parting to moderate medium angular blocky; very firm; brittle; thin patchy gray (10YR 5/1) clay films and continuous gray (10YR 5/1) coatings on vertical faces of peds; common very dark gray (10YR 3/1) concretions (iron and manganese oxides); few pebbles; strongly acid; clear wavy boundary.

BC1—41 to 50 inches; yellowish brown (10YR 5/6) silt loam; many medium faint yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; continuous gray (10YR 5/1) coatings on faces of peds; common black (10YR 2/1) coatings (iron and manganese oxides) on faces of peds; few pebbles; strongly acid; clear wavy boundary.

BC2—50 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct gray (10YR 5/1) and common medium faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; continuous gray (10YR 5/1) coatings on faces of peds; common black (10YR 2/1) coatings (iron and manganese oxides); few pebbles; strongly acid.

The thickness of the solum ranges from 45 to 72 inches. The Ap horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 2 or 3. It is strongly acid to slightly acid. Some pedons have a BE horizon. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is silt loam or silty clay loam and strongly acid or very strongly acid. The Btx horizon has hue of 10YR and value and chroma of 4 to 6. It is silt loam, silty clay loam, clay loam, or loam. It is strongly acid or very strongly acid. The BC horizon has colors similar to those of the Btx horizon. It is clay loam, silt loam, or sandy loam.

Westmoreland Series

The Westmoreland series consists of deep, moderately permeable, well drained soils on upland ridges and hillsides. These soils formed in colluvium and residuum derived from siltstone, sandstone, and limestone. Slopes range from 8 to 60 percent.

Westmoreland soils are similar to Coshocton and Rigley soils and are commonly adjacent to Berks, Coshocton, and Hazleton soils on ridgetops and side slopes. Berks and Hazleton soils have a higher content of coarse fragments in the subsoil than the Westmoreland soils. Coshocton soils are moderately well drained and have mottles of low chroma in the subsoil. Rigley soils contain more sand and less clay in the subsoil than the Westmoreland soils.

Typical pedon of Westmoreland silt loam, 8 to 15 percent slopes, about 5 miles west of Stone Creek; in an area of Bucks Township 400 yards west and 800 yards north of the southeast corner of sec. 13, T. 7 N., R. 4 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many roots; about 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

Bt1—9 to 16 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; many roots; thin patchy brown (10YR 5/3) clay films on faces of peds; few black (10YR 2/1) concretions; about 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—16 to 23 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; friable; many roots; thin patchy brown (10YR 5/3) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—23 to 29 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; many roots; thin patchy brown (10YR 4/3) clay films on faces of peds; about 5 percent coarse fragments; strongly acid; clear wavy boundary.

Bt4—29 to 35 inches; yellowish brown (10YR 5/4) channery loam; weak fine subangular blocky structure; friable; many roots; thin patchy brown (10YR 4/3) clay films on faces of peds; about 30 percent coarse fragments; strongly acid; clear wavy boundary.

BC—35 to 40 inches; yellowish brown (10YR 5/4) extremely channery loam; weak fine subangular blocky structure; friable; few roots; about 60 percent coarse fragments; strongly acid; clear wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) extremely channery loam; massive; friable; few roots; about 65 percent coarse fragments; strongly acid; clear wavy boundary.

R—60 to 64 inches; yellowish brown (10YR 5/4) sandstone bedrock.

The thickness of the solum ranges from 30 to 40 inches. The depth to bedrock ranges from 50 to more than 60 inches. The content of coarse fragments is 2 to 30 percent in the Bt horizon, 10 to 70 percent in the BC horizon, and 45 to 85 percent in the C horizon. Unless limed, the solum is very strongly acid to medium acid. The C horizon is strongly acid or medium acid.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. Some pedons have an A horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay loam, clay loam, silt loam, or loam and the channery analogs of these textures. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is the very channery or extremely channery analogs of sandy loam, loam, or silt loam.

Wheeling Series

The Wheeling series consists of deep, well drained soils that formed in loamy material and in the underlying gravelly and sandy glacial outwash. These soils are on outwash terraces. Permeability is moderate in the loamy material and rapid in the glacial outwash. Slopes range from 0 to 3 percent.

Wheeling soils are similar to Elkinsville and Rush soils and are commonly adjacent to Chili and Weinbach soils. Chili soils are in positions on the outwash terraces similar to those of the Wheeling soils. Chili soils have a higher base saturation in the substratum than the Wheeling soils. Elkinsville and Rush soils have less sand in the upper part of the subsoil than the Wheeling soils. The somewhat poorly drained Weinbach soils have a fragipan. They are on slightly depressional parts of outwash terraces.

Typical pedon of Wheeling loam, 0 to 3 percent slopes, about 0.5 mile east of Seventeen; in an area of Clay Township 83 yards southwest along U.S. Route 36 from the intersection of U.S. Route 36 and State Route 416, then 330 yards south, T. 6 N., R. 2 W.

Ap—0 to 11 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; common roots; medium acid; abrupt smooth boundary.

Bt1—11 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—16 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; few very dark grayish brown (10YR 3/2) stains (iron and manganese oxides) on faces of peds in the upper part; medium acid; clear wavy boundary.

Bt3—27 to 32 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; thin patchy dark yellowish brown

(10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt4—32 to 39 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

2BC—39 to 50 inches; yellowish brown (10YR 5/6) gravelly sandy loam; weak medium subangular blocky structure; friable; about 15 percent coarse fragments; strongly acid; clear wavy boundary.

2C1—50 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy sand; single grained; loose; about 55 percent coarse fragments; strongly acid; abrupt wavy boundary.

2C2—60 to 70 inches; yellowish brown (10YR 5/4) extremely gravelly loamy sand; single grained; loose; about 70 percent coarse fragments; medium acid.

The thickness of the solum ranges from 40 to 60 inches. By weighted average, the content of coarse fragments is 0 to 5 percent in the Ap and Bt horizons. It is 15 to 70 percent in the C horizon. Unless limed, the soils are strongly acid or medium acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly loam, clay loam, silt loam, or silty clay loam, but thin subhorizons of sandy loam are in some pedons. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is the gravelly, very gravelly, or extremely gravelly analogs of sand or loamy sand.

Formation of the Soils

This section describes the major factors of soil formation, describes how these factors have affected the soils in Tuscarawas County, and explains some of these processes in 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 that the parent material has been acted upon. The relative importance of each factor differs from place to place. In some areas 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 Tuscarawas County formed in several kinds of parent material: residuum, colluvium, loess, glacial outwash, surface mine spoil, lacustrine sediments, organic deposits, alluvium, and glacial till.

Bedrock residuum is the most extensive parent material in the county. It includes the material weathered from shale, sandstone, siltstone, and limestone. The Berks soils formed in bedrock residuum. The soils in small areas on ridges and side slopes formed in as much as 36 inches of loess and in the underlying residuum. The Keene soils formed in loess and in the underlying siltstone and shale residuum.

Most of the soils on side slopes formed in residuum and colluvium. Colluvium is weathered bedrock and soil material that has been moved downhill by gravity. Residuum and colluvium weathered from sandstone bedrock are coarse textured or moderately coarse textured. The soils that formed in this combination of parent materials dominantly are coarse textured to medium textured in the subsoil. The Hazleton and Rigley soils are examples. Residuum and colluvium weathered from clayey shale or limestone are fine textured or moderately fine textured. The soils that formed in these parent materials dominantly are fine textured or moderately fine textured in the subsoil. The Upshur soils formed in shale residuum. Residuum and colluvium weathered from siltstone, shale, and sandstone are medium textured or moderately fine textured. The soils that formed in this combination of parent materials, such as the Coshocton soils, dominantly are medium textured or moderately fine textured in the subsoil.

Sand and gravel outwash was deposited by melt water along glacial streams. Much of this fairly well sorted coarse material was covered by finer textured loamy deposits. The Wheeling and Chili soils are examples of soils formed in these materials.

Surface mine spoil is a mixture of partly weathered fine-earth material and fragments of shale, sandstone, siltstone, and limestone that was piled up or graded during surface mining for coal or clay shale. The Bethesda and Morristown soils formed in strip mine spoil dominated by fragments of rock and some sand, silt, and clay.

Areas of lacustrine material, or lake bottom sediments, are moderately extensive in this county. The layered characteristics of the parent material in these areas are reflected in the subsoil of the Glenford and Sebring soils.

Alluvium, or floodwater deposits, is the youngest parent material in the county. It is still accumulating as fresh sediment is added by the overflow of streams. The sediment is from the surface layer of the higher lying soils in the county. The Nolin and Tioga soils formed in alluvium.

Glacial till, a general term applied to glacial deposits, is one of the least extensive parent materials in the county. It is fairly homogenous and uniform in texture. The Canfield soils formed in this parent material.

The solum of the Linwood soils formed in decayed plant material that accumulated in depressions. Permanent wetness slowed decomposition, and the organic matter has accumulated.

Climate

Because the climate in Tuscarawas County is uniform, it has not greatly contributed 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 from the solum of some soils any carbonates that were in the parent material when soil formation began. This leaching has occurred in the Chili and Canfield soils. Frequency of rainfall caused wetting and drying cycles that favor the translocation of clay minerals and the formation of soil structure in Coshocton, Westmoreland, and other soils.

The range of temperature variation has favored both physical change and chemical weathering of the parent materials. Freezing and thawing have aided the formation of soil structure. Warm temperatures in summer have 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 the soils. More information about the climate is available under the heading "General Nature of the County."

Relief

Relief affects the natural drainage of soils. It influences the amount of runoff and the depth to the seasonal high water table. Water that runs off sloping soils collects in depressions or is removed through a drainage system. Therefore, from an equal amount of rainfall, the sloping soils receive less total water and the depressional soils more total water than the nearly level soils. Gently sloping soils generally show the most development because they are neither saturated nor droughty. Soil formation on steep slopes tends to be inhibited by erosion and the limited amount of water that penetrates the surface.

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. The Glenford and Sebring soils, for example, both formed in lacustrine sediments. The moderately well drained, more sloping Glenford soils are on the higher parts of terraces. Their seasonal high water table generally is not close to the surface. The poorly drained, nearly level Sebring soils are in the lower areas along streams. Their seasonal high water table is close to or above the surface.

Living Organisms

Plants, animals, bacteria, fungi, and other living organisms affect soil formation. At the time that the county was settled, the vegetation was dominantly hardwood forest of oak, hickory, maple, yellow-poplar, and ash. The soils that formed in these forested areas, such as Chili and Conotton soils, 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 casts are common in the surface layer of well drained soils, such as the Rush and Elkinsville soils. Crawfish channels are evident in poorly drained soils, such as the Sebring soils.

Human activities also affect soil formation. Examples of these activities are cultivation, seeding, drainage systems, irrigation, cutting and filling, and surface mining. Another example is the application of lime and fertilizer, which affects soil chemistry.

Time

Time is needed for the other factors of soil formation to produce their effects. The age of a soil is indicated, to some extent, by the degree of profile development. If the parent material weathers slowly, the soil forms slowly. In many areas, 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 of the soils in the county are old and have a strongly expressed profile. The youngest soils are those that formed in strip mine spoil, namely the Bethesda and Morristown soils. On flood plains deposits of fresh sediments periodically interrupt soil formation. As a result, the Melvin and Orrville soils do not have a strongly expressed profile.

Processes of Soil Formation

Most soils in Tuscarawas County have a strongly expressed profile because the processes of soil formation have distinctly changed the parent material. These are the upland soils on ridgetops and side slopes and the soils on terraces along the major streams. In contrast, the parent material on flood plains and in surface mined areas is only slightly modified.

All the factors of soil formation act in unison to control the processes that form different layers in the soil. These processes are additions, removals, transfers, and transformations (*11*). Some processes result in differences among the surface layer, subsoil, and substratum.

In this county the most important addition to the soil is that of organic matter to the surface layer. A thin layer of organic matter accumulates under forest vegetation. If the soil is cleared and cultivated, this organic matter is mixed with underlying mineral material. In some severely eroded soils, such as Shinrock soils, nearly all evidence of this addition has been removed.

Leaching of carbonates from calcareous parent material is one of the most significant removals. It precedes many other chemical changes in the soil. This parent material is in areas where limestone and calcareous shale overlie undisturbed soils. Most of the soils on uplands and terraces do not have carbonates within 5 feet of the surface and are very strongly acid to medium acid in the subsoil. Other minerals in the soil are subject to the chemical weathering that results from 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 patchy or nearly continuous clay films on the faces of peds in the subsoil of most soils on uplands and terraces. Guernsey and Chili soils are examples.

Transformations of minerals occur in most soils. The results are most apparent in the formation of layers not affected by rapid erosion or by the accumulation of material at the surface. When the silicate minerals are weathered chemically, other minerals, mainly layer lattice silicate clays, are produced. Most of the layer lattice clays remain in the subsoil.

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Glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

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.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Perimeter drain. An artificial drain placed around the perimeter of a septic tank absorption field to lower the water table; also called a curtain drain.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slack water deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 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. Includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and 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 sunflower) wilts so much that it does not recover when placed in a humid, dark chamber. Page start for tables - 121