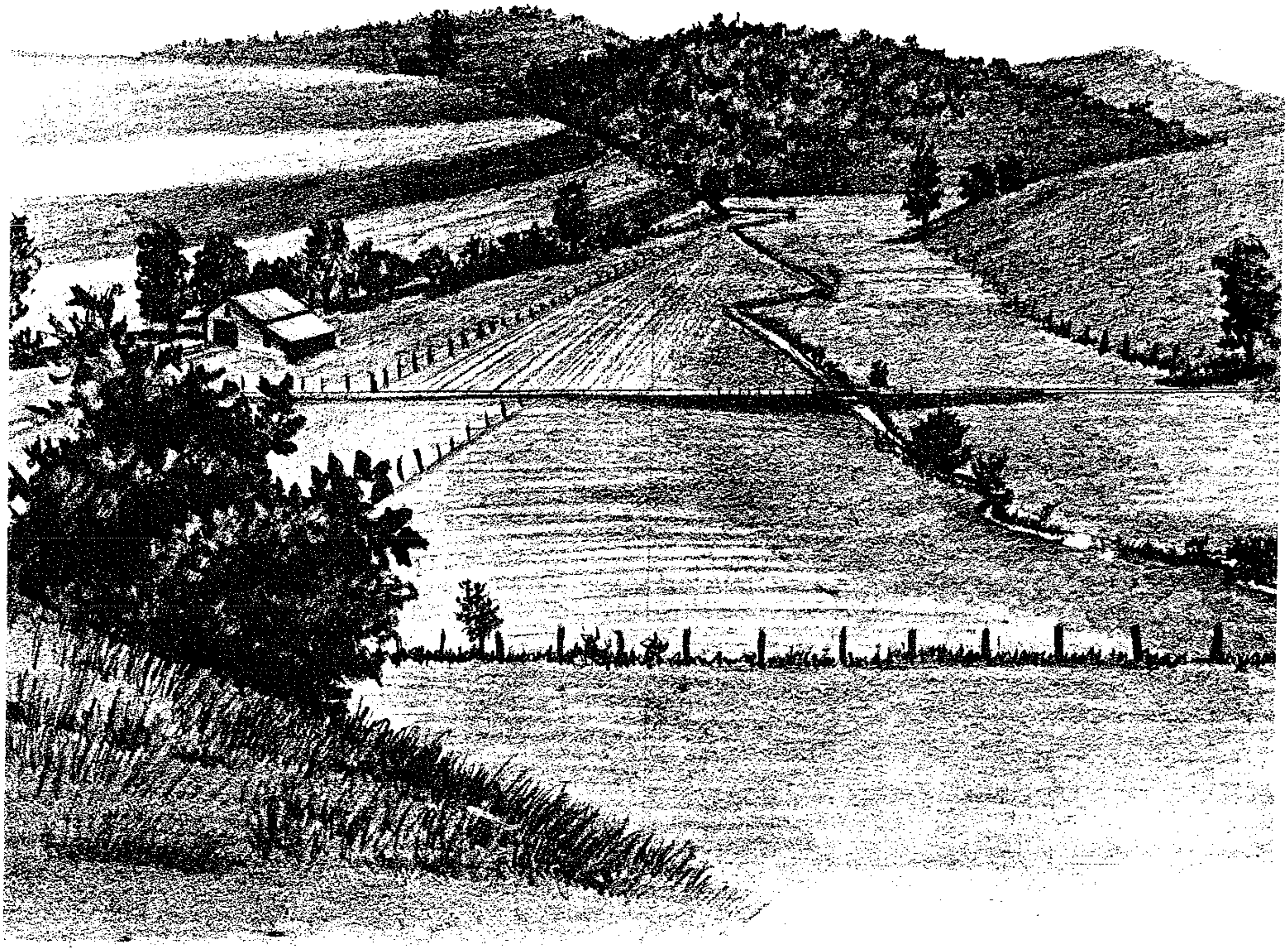
United States
Department of
Agriculture

Soil
Conservation
Service

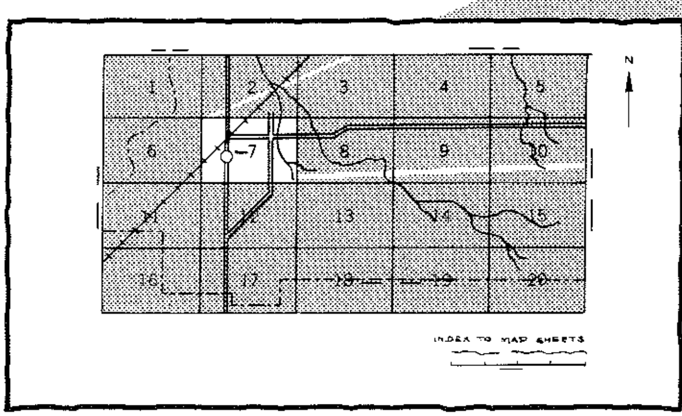
In cooperation with the United States Department of Agriculture, Forest Service, the Ohio Department of Natural Resources, Division of Soil and Water Conservation, and the Ohio Agricultural Research and Development Center

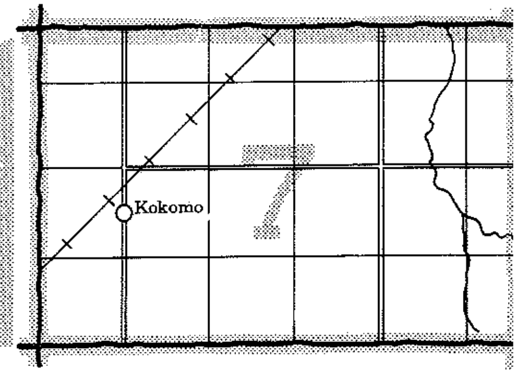
Soil Survey of Jackson County, Ohio



HOW TO US

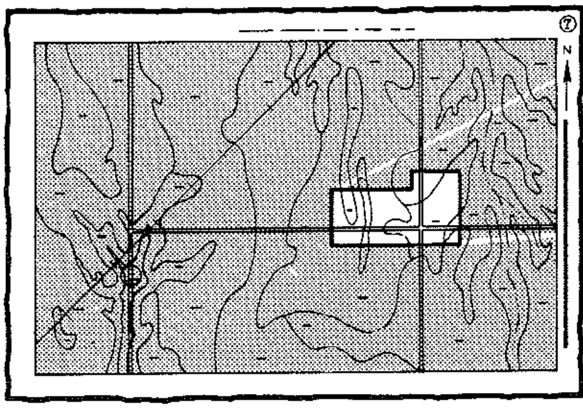
1. Locate your area of interest on the "Index to Map Sheets".

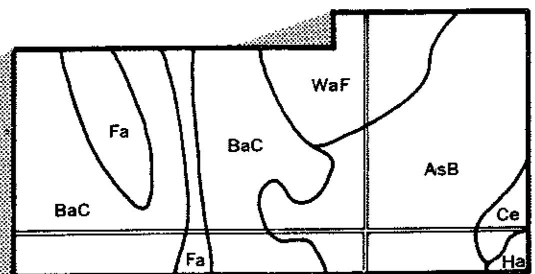




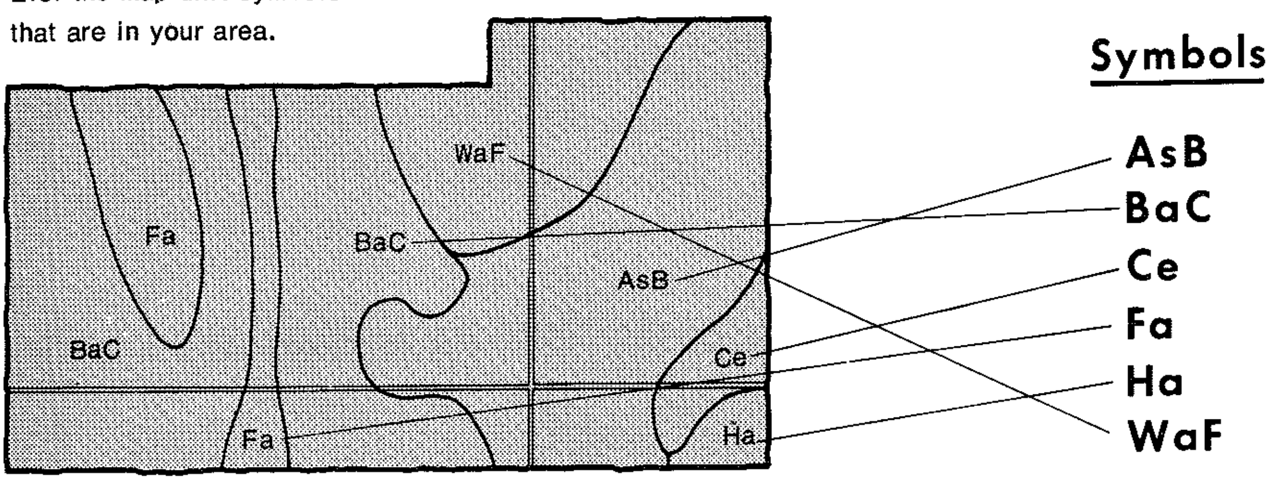
2. Note the number of the map sheet and turn to that sheet.

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



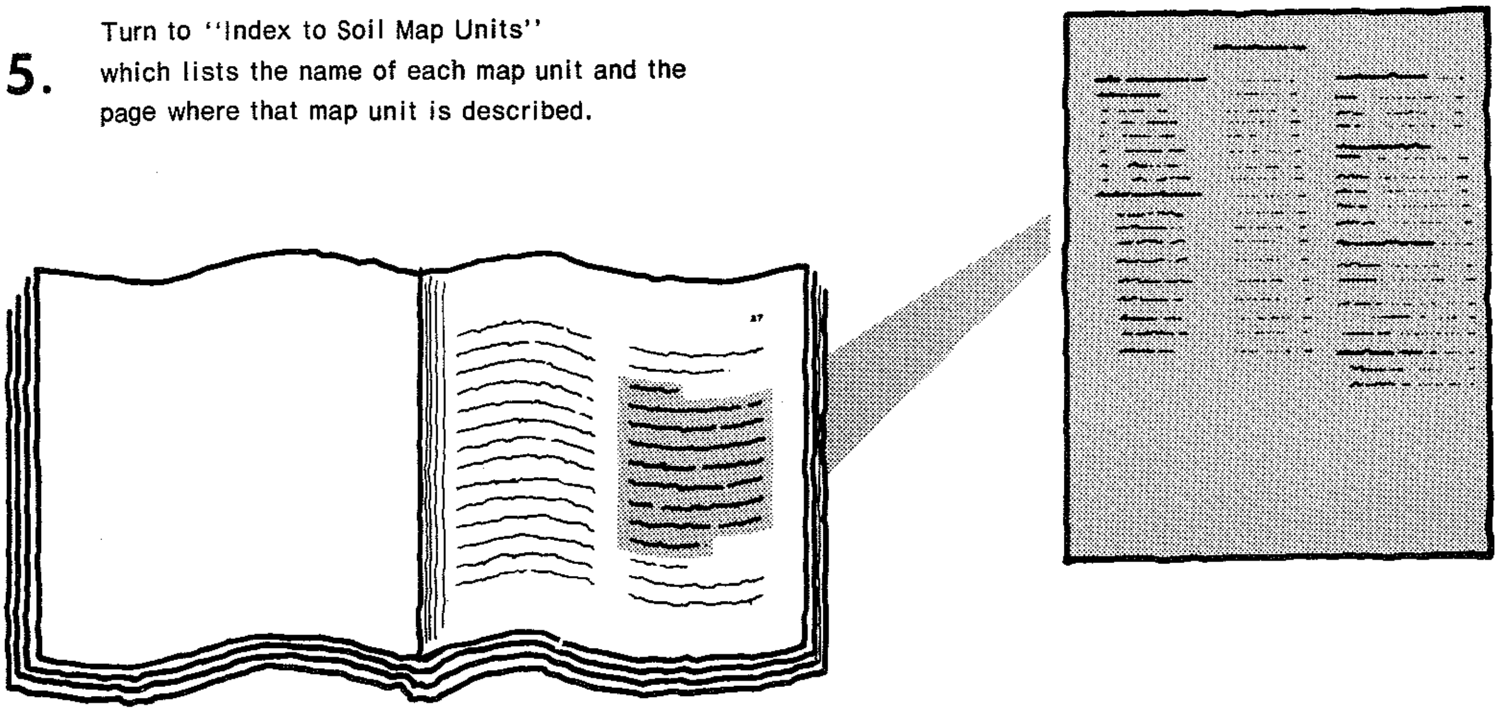


4. List the map unit symbols that are in your area.

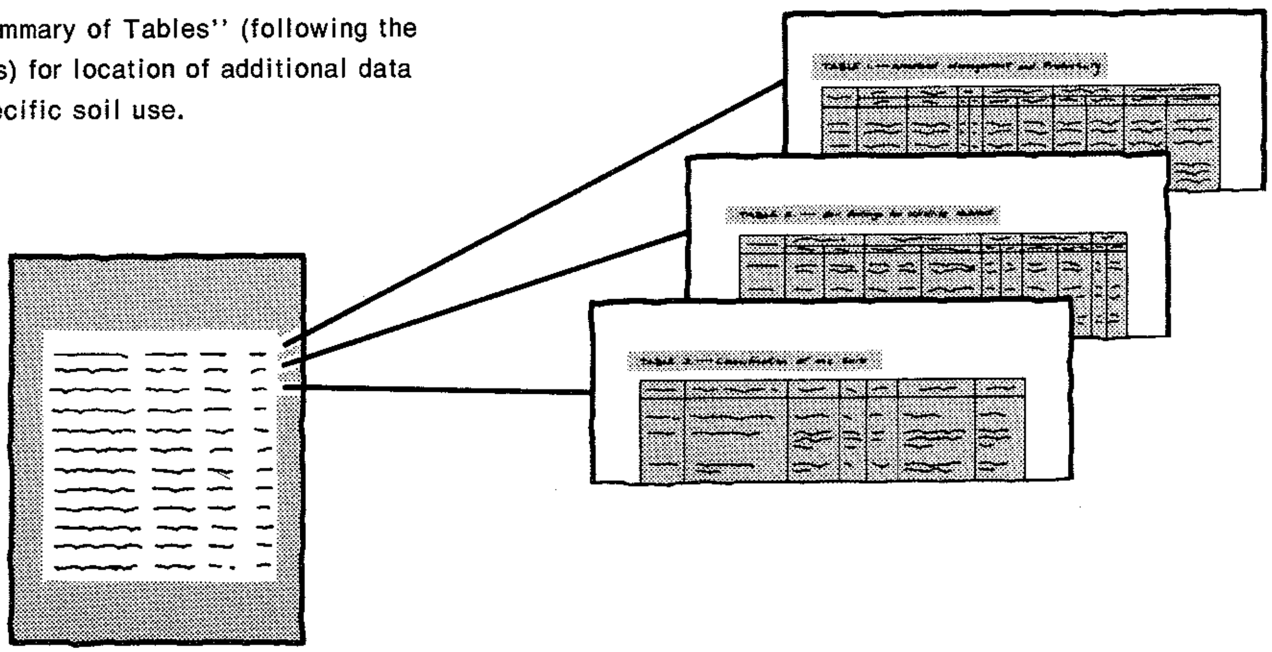


HIS SOIL SURVEY

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.

This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the Ohio Department of Natural Resources, Division of Soil and Water Conservation, and the Ohio Agricultural Research and Development Center. The survey was aided by funds provided by the Jackson County Commissioners. It is part of the technical assistance furnished to the Jackson Soil and Water Conservation District. 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.

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: Represented in this sketch of a typical landscape in Jackson County are areas of Rigley, Rarden, and Shelocta soils on the hillsides and areas of Omulga and Orrville soils on the flats.

Contents

Soil Series

Issued April 1985

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Jackson 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 high water table near the surface makes a soil poorly suited to basements or underground installations.

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

Robert R. Shaw
State Conservationist
Soil Conservation Service

Soil Survey of Jackson County, Ohio

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

General Nature of the Survey Area

John B. Meredith, district conservationist, Soil Conservation Service, helped prepare this section.

JACKSON COUNTY is in southern Ohio (fig. 1). It has an area of about 419 square miles, or 268,256 acres, and a dominantly hilly landscape interrupted by a few broad valleys. In 1980, the population of the county was 30,601. Jackson, the county seat and largest town, had a population of 6,670 in that year; Wellston, the next largest town, had 6,028.

Woodland is the major land use in the county. Most of the woodland is in areas of the steep and very steep soils, which generally are unsuited to crops but are well suited or moderately well suited to trees. The county is in the central hardwood forest region. Pulp and lumber are important forest products.

Agriculture is an important land use also. Beef cattle husbandry and general farming are the major farm uses. The major grain crops, corn and soybeans, are mainly grown in the larger valleys. Apples are an important crop in central and southeastern Jackson County. In the eastern part of the county, many areas farmed in the past have been taken out of production by surface mining. In some parts of the survey area, the cropland and pasture have been abandoned and are reverting to brush and woodland.

Figure 1.—Location of Jackson County in Ohio.

Slope and erosion hazard are the major land use limitations. Seasonal wetness, droughtiness, flood hazard, and the moderately slow to very slow permeability of some soils also limit land use.

Climate

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

Jackson County is cold in winter and fairly warm and humid in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. Normal annual precipitation is adequate for all crops that are adapted to the temperature and length of growing season in the area.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Jackson in the period 1951-78. 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 31 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Jackson on January 29, 1963, is -31 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 102 degrees.

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

The total annual precipitation is about 41 inches. Of this, 23 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 3.76 inches at Jackson on July 14, 1954. Thunderstorms occur on about 45 days each year, and most occur in summer.

The average seasonal snowfall is 21 inches. The greatest snow depth at any one time during the period of record was 15 inches. On an average of 5 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 9 miles per hour, in spring.

Tornadoes and severe thunderstorms strike occasionally. These storms usually are local and of short duration and cause damage in a variable pattern.

Farming

According to the 1981 Ohio Agricultural Statistics (*6*), about one-third of the land in Jackson County is used for farming. This report lists the number of farms in the county at 530.

In 1980, the county received more income from the sale of crops than from livestock and livestock products because of the large mushroom crop. The leading income-producing grain crops were corn and soybeans; however, the cash receipts from the sale of mushrooms were higher than from these grains. Fruits, vegetables, tobacco, and hay were also important income-producing crops.

Another major source of farm income was the sale of livestock and livestock products (*4*). Most of that income was from the sale of cattle and calves; the rest was from hogs, dairy products, poultry, sheep, and wool.

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

Physiography, Relief, and Drainage

Jackson County is in the unglaciated Allegheny Plateau Region. It is extensively dissected by drainageways and has hilly and rough topography, except along the floors of preglacial stream valleys. These valleys were formed by the preglacial Teays River and its tributaries, the Marietta and Hamden Rivers. Subsequently, glacial deposits blocked this Teays drainage system and the glacial meltwater produced the present-day stream pattern (*9, 10, 11*). Many of these newer streams have cut gorge-like valleys.

The maximum difference in elevation in the county is about 445 feet. The lowest point, about 595 feet above sea level, is in Little Salt Creek near the northwestern corner of the county; and the highest point, about 1,040 feet, is on the western edge of the county near the Pike County line. The elevation of the main valleys is between 600 and 700 feet.

Four major watersheds dissect the county. They all drain into the Ohio River.

The Salt Creek Watershed is the county's largest. The topography consists primarily of very steep slopes and narrow ridgetops. It also includes some nearly level to strongly sloping areas left by the Marietta River. The drainage in this watershed now flows northwest.

The northeastern quarter of the county drains into Raccoon Creek. Sediment from acid mine spoil has clogged many stream channels, causing increased flooding and ponding along Little Raccoon Creek. As clogging of stream channels increased, additional and larger wetlands were produced. Little Raccoon Creek and its tributaries are the drainage outlets for most of the Hamden Valley.

The southeastern quarter of the county drains into Symmes Creek. This stream's watershed includes some of the broad, gently sloping valley left by the preglacial Marietta River. Symmes Creek flows in a southerly direction and is very sluggish. Flooding is a common problem along this creek.

The Little Scioto Basin drains the southwestern part of the county. This area includes extensive acreage of gently sloping terrain, but steep slopes and narrow ridgetops are in part of the watershed. It should be noted that in this area the Little Scioto River crosses the preglacial Teays river valley twice as it flows to the south. This is an unusual physiographic feature.

History

The history of Jackson County has been shaped by the presence of salt, fertile soil, iron ore, timber, and coal.

The salt springs at the present-day site of Jackson, along Little Salt Creek, played an important role in the history of the county. Late in the eighteenth century, pioneers in search of farmland followed the numerous Indian trails that led to this ancient salt lick. Settlers were dependent on the salt for food preservation.

In 1816, Jackson County was organized. At first, the county's economy developed slowly due to the relatively small amount of fertile agricultural land. Then, iron ore was discovered and several furnaces, fueled by charcoal from local timber, were built to produce this valuable metal. Eventually, the stands of trees suitable for charcoal were depleted and the furnace operators had to turn to another fuel—coal. The supply of high-quality coal outlasted the iron ore, and when the iron industry declined, coal production remained an important industry.

In the years since the development of the iron and coal industries, numerous small industries have been established in the county. These, too, have been attracted by the county's natural resources.

Mineral Resources

Jackson County has a wide variety of mineral resources—coal, limestone, clay, sand, and iron ore. The deposits of high-grade iron ore, however, essentially have been depleted.

At least eleven coalbeds are mined in the county. The most productive of these are the Sharon No. 1, Quakertown No. 2, Lower Mercer No. 3, Clarion No. 4a, and Lower Kittanning No. 5. The Brookville No. 4, Middle Kittanning No. 6, and Upper Freeport No. 7 also are important.

The Vanport is the only limestone bed of any economic significance in the county. It generally is mined as part of the coal stripping process.

Three clays—the Sciotoville, the Lower Kittanning, and the Oak Hill—are the only clays presently used.

Silica sand is extracted from the Sharon Conglomerate. This sand is used for molding and for glass production.

Industry and Transportation

The main industries in Jackson County are coal mining, wood processing, steel fabrication, mushroom culture, food processing, the manufacturing of plastics and fire clay products, and other light manufacturing.

Mining occurs primarily in the eastern half of the county. Other industrial activity is concentrated around the towns of Jackson, Wellston, and Oak Hill.

Industry is served by a transportation network that includes U.S. Route 35 and State Routes 93, 124, 139, 279, 327, and 776. Three major railroads serve the county. These are the Consolidated Rail Corporation, The Chessie Railroad System, and the Detroit, Toledo, and Ironton Railroad.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

Soil Descriptions

1. Wharton-Rarden

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

This map unit consists of soils on narrow to broad ridgetops and on side slopes (fig. 2). Areas are dissected by drainageways. On the ridgetops the soils are gently sloping and strongly sloping. On the side slopes, which are broken by seeps or intermittent drainageways, the soils are moderately steep and steep. Slope ranges from 3 to 50 percent.

This map unit makes up about 46 percent of the county. It is about 30 percent Wharton soils, 30 percent Rarden soils, and 40 percent soils of minor extent.

The Wharton soils and the Rarden soils are on ridgetops and side slopes. The Wharton soils are deep,

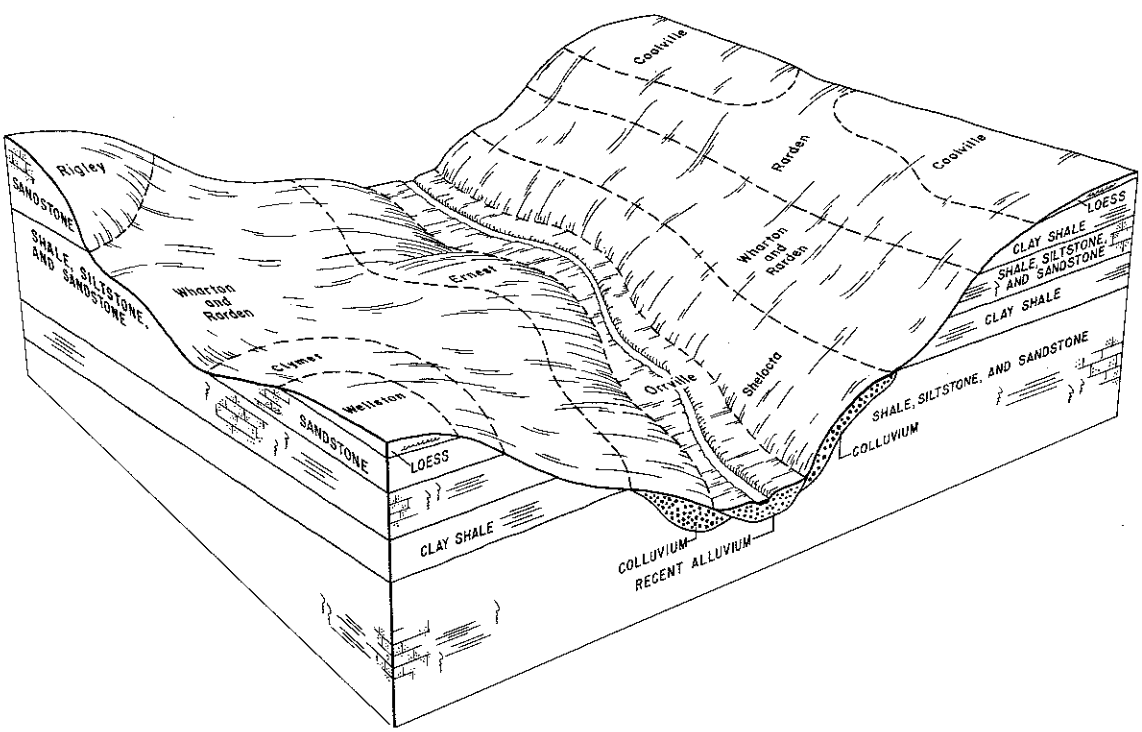

Figure 2.—Typical pattern of soils and parent materials in the Wharton-Rarden map unit.

medium textured, moderately well drained, strongly sloping and moderately steep soils that formed in residuum and colluvium from siltstone and shale. Permeability is slow or moderately slow in these Wharton soils. The Rarden soils are moderately deep, medium textured, moderately well drained, gently sloping to steep soils that formed in residuum from acid clay shale. Permeability is slow in these Rarden soils, and the shrink-swell potential is high.

Of minor extent in this map unit are the well drained Shelocta soils and the sandier Clymer and Rigley soils on side slopes. Coolville soils, which have a thin loess mantle, are on ridgetops. The siltier Tilsit and Wellston soils are on ridgetops also. Ernest soils, which have a fragipan, are on foot slopes. The siltier Omulga soils are in preglacial valleys, and the somewhat poorly drained Orrville soils and the well drained Pope soils are on flood plains along small streams. Bethesda and Fairpoint soils, which have more rock fragments throughout, are in areas disturbed by surface mining.

The moderately steep and steep soils on hillsides in this map unit are used mainly for pasture and woodland. The gently sloping and strongly sloping soils on ridgetops are used for cropland, pasture, and woodland. Some abandoned farmland is reverting to brush, and other areas have been planted to pines. The soils on ridgetops and the strongly sloping soils on side slopes are moderately well suited to corn, soybeans, and small grains and well suited or moderately well suited to hay and pasture. The moderately steep and steep soils are poorly suited or generally unsuited to cropland and moderately well suited to generally unsuited to hay and pasture. These soils are moderately well suited or well suited to woodland. The Wharton soils are better suited to farming than Rarden soils because they have lower clay content in the subsoil and a deeper root zone. Erosion is a hazard, especially where slopes are long.

The gently sloping and sloping soils are moderately well suited as sites for buildings and poorly suited to septic tank absorption fields. The moderately steep and steep soils are poorly suited or generally unsuited to these uses.

2. Rigley-Rarden-Clymer

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

This map unit consists of soils on ridgetops and side slopes dissected by drainageways (fig. 3). The ridgetops mainly are narrow and have many knolls and low saddles. The hillsides make up about half of the mapped area and commonly are benched. Stream valleys generally are narrow. Slope ranges from 3 to 60 percent.

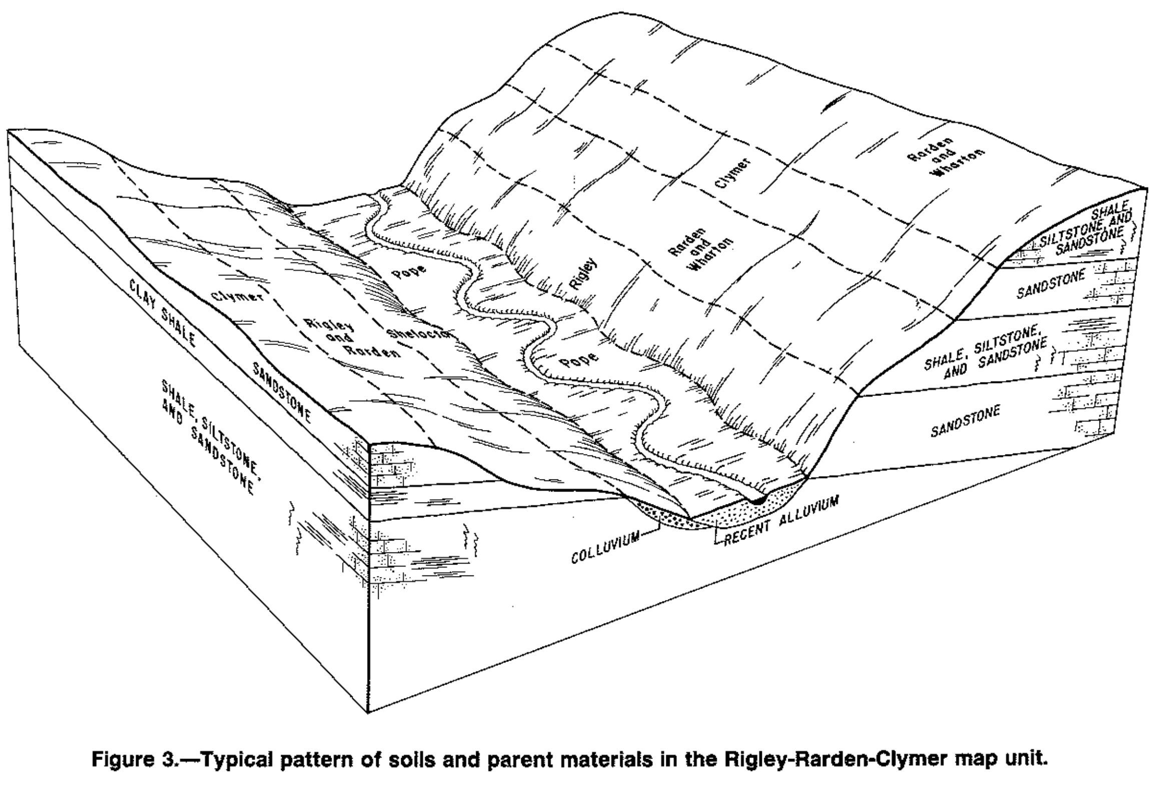

Figure 3.—Typical pattern of soils and parent materials in the Rigley-Rarden-Clymer map unit.

This map unit makes up about 21 percent of the county. It is about 35 percent Rigley soils, 20 percent Rarden soils, 15 percent Clymer soils, and 30 percent soils of minor extent.

Rarden soils are on side slopes and ridgetops; whereas, Rigley soils dominantly are on side slopes and Clymer soils commonly are on ridgetops. Rigley and Clymer soils are deep, well drained soils formed in residuum and colluvium from sandstone. The Rigley soils are strongly sloping to steep, medium textured and moderately coarse textured, moderately rapidly permeable soils. The Clymer soils are gently sloping to steep, medium textured, moderately permeable soils. The Rarden soils are moderately deep, medium textured, moderately well drained, slowly permeable soils formed in residuum from acid clay shale. The shrink-swell potential is high in the Rarden soils.

Of minor extent in this map unit are Shelocta soils on side slopes and Wharton soils on side slopes and ridgetops. These soils have more silt throughout than the dominant soils in the map unit. Also of minor extent are the siltier Omulga soils in preglacial valleys. Orrville and Pope soils that have less development in the subsoil are on flood plains along small streams. Bethesda and Fairpoint soils, which have more rock fragments throughout, are in areas disturbed by surface mining.

The steeper soils are mostly in woodland, and the less sloping soils on ridgetops and in narrow valleys are used as cropland, pasture, and woodland. The gently sloping and strongly sloping soils are well suited to moderately well suited to cropland, pasture, and woodland; whereas, the moderately steep and steep soils are poorly suited or generally unsuited to cropland and well suited or moderately well suited to woodland. Slope, erosion hazard, limited root zone, and droughtiness are major limitations to farming.

The gently sloping and strongly sloping soils are well suited or moderately well suited as sites for buildings and well suited to poorly suited to septic tank absorption fields. The moderately steep and steep soils are poorly suited or generally unsuited to these uses. The Rigley and Clymer soils are better suited to these uses than Rarden soils. Slope, moderate depth to bedrock, seasonal wetness, high shrink-swell potential, and, in the Rarden soils, slow permeability are major limitations.

3. Brownsville-Wharton

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

This map unit consists of soils on narrow ridgetops and hillsides. The side slopes generally are uneven and commonly have less sloping foot slopes. The stream valleys generally are narrow. Slope ranges from 8 to 60 percent.

This map unit makes up about 6 percent of the county. It is about 40 percent Brownsville soils, 15 percent Wharton soils, and 45 percent soils of minor extent.

The Brownsville soils are on the steeper parts of side slopes. They are deep, medium textured, well drained soils formed mainly in colluvium and residuum from siltstone and sandstone. Permeability is moderate or moderately rapid in these soils. The available water capacity is low. The Wharton soils are on the ridgetops and less sloping parts of side slopes. These soils are deep, medium textured, strongly sloping and moderately steep, moderately well drained soils formed in residuum and colluvium from siltstone and shale. Permeability is slow or moderately slow in these soils. The available water capacity is moderate.

Of minor extent in this map unit are the sandy Clymer soils, the more clayey Rarden soils, and the siltier Wellston soils on the ridgetops and the sandier Rigley soils on side slopes. Shelocta soils are on side slopes. Pope and Skidmore soils irregularly decrease in content of organic matter with increasing depth. They are on narrow flood plains.

Most of this map unit consists of steep soils on side slopes that are mainly in woodland. Cleared areas on the ridgetops commonly are used for hay or pasture. Some abandoned farmland is reverting to woodland. The steep soils on side slopes generally are unsuited to cropland and pasture and are moderately well suited to woodland. The strongly sloping and moderately steep soils on ridgetops are moderately well suited or poorly suited to cropland and well suited or moderately well suited to pasture, hay, and woodland. Slope, droughtiness, and erosion hazard are major concerns of management. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because of less evaporation and cooler temperatures. These sites are less exposed to the drying effect of the prevailing winds and the sun.

The soils on ridgetops are moderately well suited or poorly suited as sites for buildings and poorly suited or generally unsuited as septic tank absorption fields. Slope, seasonal wetness, moderately slow or slow permeability, and shrink-swell potential are limitations to these uses. Land shaping is needed in most areas. The soils on side slopes generally are unsuited as building sites and septic tank absorption fields.

4. Rigley-Clymer-Brownsville

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

This map unit consists of soils on ridgetops and hillsides. The side slopes generally are irregular and commonly have rock ledges. The stream valleys generally are narrow. Slope ranges from 3 to 70 percent.

This map unit makes up about 6 percent of the county. It is about 25 percent Rigley soils, 25 percent Clymer soils, 15 percent Brownsville soils, and 35 percent soils of minor extent.

The Rigley and Brownsville soils commonly are on side slopes, and the Clymer soils are on ridgetops. All of these soils are deep, medium textured, and well drained and have a low or moderate available water capacity. The Rigley and Clymer soils formed in residuum and colluvium from sandstone, and the Brownsville soils formed in residuum and colluvium from siltstone and sandstone. The Rigley soils are strongly sloping to very steep, moderately rapidly permeable soils. The Clymer soils are gently sloping to steep and moderately permeable. The Brownsville soils are moderately steep and steep and moderately or moderately rapidly permeable.

Of minor extent in this map unit are the moderately well drained Rarden and Wharton soils. The Rarden soils are on ridgetops and the upper part of side slopes, and the Wharton soils are on ridgetops and side slopes. Shelocta soils are on side slopes. Rock outcroppings are intermingled with Rigley soils in some areas.

Most of this map unit consists of steep and very steep soils on side slopes that are mainly in woodland. Cleared areas on ridgetops are in cropland and pasture. The steep and very steep soils generally are unsuited to cropland and pasture and well suited or moderately well suited to woodland. The gently sloping and strongly sloping soils on ridgetops are well suited or moderately well suited to cropland and well suited to hay, pasture, and woodland. Slope, erosion hazard, and droughtiness are major limitations to farming.

The gently sloping and strongly sloping soils on ridgetops are well suited as sites for buildings and well suited or moderately well suited to septic tank absorption fields. The steeper soils are poorly suited or generally unsuited to these uses. The slope is the major limitation.

5. Omulga-Piopolis

Deep, nearly level to strongly sloping, moderately well drained, poorly drained, and very poorly drained soils formed in loess, colluvium, alluvium, and lacustrine sediments; in preglacial valleys and on flood plains

This map unit consists of soils in valleys of abandoned preglacial drainage systems and on flood plains (fig. 4). The valleys generally are broad, up to a mile and a half across. Slope ranges from 0 to 15 percent.

This map unit makes up about 18 percent of the county. It is about 35 percent Omulga soils, 15 percent Piopolis soils, and 50 percent soils of minor extent.

The Omulga soils are deep, medium textured, moderately well drained, and nearly level to strongly

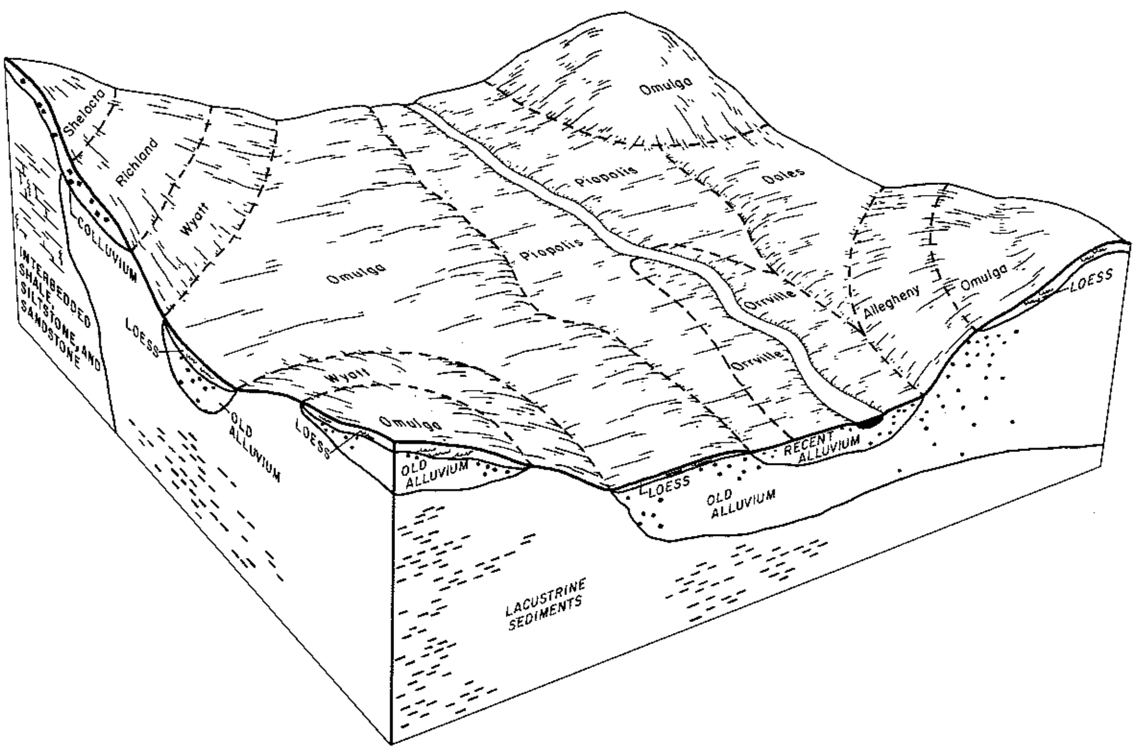

Figure 4.—Typical pattern of soils and parent materials in the Omulga-Piopolis map unit.

sloping. These soils formed in loess, colluvium, alluvium, and underlying lacustrine sediments in the preglacial valleys. Permeability is moderate above the fragipan in these Omulga soils and slow in the fragipan. The Piopolis soils are deep, poorly drained and very poorly drained, medium textured, and nearly level. These soils formed in alluvium on the flood plains. They are subject to frequent flooding and ponding. Permeability is slow in these Piopolis soils.

Of minor extent in this map unit are well drained Allegheny soils on stream terraces and on side slopes of high, dissected terraces. Areas of the somewhat poorly drained Doles and Tygart soils, which have more clay in the subsoil, are on flats. Wyatt soils are on side slopes. The well drained Pope soils and the somewhat poorly drained Orrville and Stendal soils are on flood plains. The well drained Richland soils are on foot slopes, and the well drained Shelocta soils are on valley walls.

In most areas of this map unit the soils are used for cropland and pasture. The Omulga soils are better suited to these uses than the Piopolis soils. Omulga soils are well suited or moderately well suited to row crops and well suited to hay and pasture. Piopolis soils are moderately well suited or generally unsuited to cropland, hay, and pasture. Wetness, the hazard of erosion in areas of the Omulga soils, and the frequent flooding of the Piopolis soils are the major land use limitations. Drainage outlets are difficult to establish in many areas of the Piopolis soils because of their low position on the landscape. The surface layer of Omulga and Piopolis soils crusts after hard rains.

The Omulga soils are moderately well suited as sites for buildings and septic tank absorption fields; whereas, the Piopolis soils, which are subject to ponding and flooding, generally are unsuited to these uses. Seasonal wetness limits the use of Omulga soils as sites for houses with basements, and slow permeability limits their use as septic tank absorption fields.

6. Pope-Omulga-Orrville

Deep, nearly level to strongly sloping, well drained to somewhat poorly drained soils formed in alluvium, loess, colluvium, and lacustrine sediments; on flood plains, low stream terraces, and in preglacial valleys

This map unit consists of soils on flood plains and low stream terraces and in valleys of abandoned preglacial drainage systems. The landscape is characterized by narrow to relatively broad flood plains along the floor of the valley and by slightly higher terraces and knolls above the valley floor. Slope ranges from 0 to 15 percent.

This map unit makes up about 3 percent of the county. It is about 40 percent Pope soils, 35 percent Omulga soils, 15 percent Orrville soils, and 10 percent soils of minor extent.

The Pope soils are on flood plains and low stream terraces. They are deep, nearly level, medium textured and moderately coarse textured, well drained soils that formed in alluvium. These soils are subject to frequent or rare flooding. Permeability is moderately rapid or moderate in these soils.

The Omulga soils are on the slightly higher benches and knolls in the preglacial valleys. They are deep, nearly level to strongly sloping, medium textured, moderately well drained soils that formed in loess, colluvium, or alluvium and in the underlying lacustrine sediments. Permeability is moderate above the fragipan and slow in the fragipan.

The Orrville soils are on flood plains. They are deep, nearly level, medium textured, somewhat poorly drained soils that formed in alluvium. These soils are subject to frequent flooding. Permeability is moderate in these soils.

Of minor extent in the map unit are the poorly drained and very poorly drained Piopolis soils in depressions and Cuba soils on slightly higher positions on flood plains. Doles soils are on lower positions on benches. Allegheny soils are on stream terraces and on high, dissected terraces. Ernest soils are on foot slopes of valley walls.

This map unit is used for pasture, cropland, and woodland. The cropland is mainly on the Omulga soils and the rarely flooded Pope soils. The soils in this map unit are well suited or moderately well suited to corn and soybeans and well suited to hay and woodland. The flooding, erosion, and wetness are the major limitations. Crops such as winter wheat may be severely damaged by flooding in winter and early spring. Artificial drainage is needed in the Orrville soils for optimum crop production. Suitable outlets for subsurface drains are difficult to establish in some areas. Streambank erosion is a major source of sediment, which pollutes water.

Pope and Orrville soils in this map unit generally are unsuited as sites for buildings and septic tank absorption fields; whereas, Omulga soils are moderately well suited to these uses. The flood hazard in areas of the Pope and Orrville soils, the seasonal wetness of the Omulga and Orrville soils, and the slow permeability, slope, and shrink-swell potential of the Omulga soils are limitations.

Detailed Soil Map Units

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

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

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

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

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

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

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. Rarden-Wharton silt loams, 15 to 25 percent slopes, eroded, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Rigley-Clymer association, steep, 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, quarry, 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

AkB—Allegheny loam, 3 to 8 percent slopes. This gently sloping, deep, well drained soil is mainly on low, well defined stream terraces along the larger streams. Slopes typically are smooth or convex with irregularities along some small drainageways. Most areas are long and narrow or irregularly shaped and are 3 to 30 acres in size.

Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil is yellowish brown and strong brown, friable and firm clay loam and loam about 53 inches thick. The substratum to a depth of about 76 inches is yellowish brown and light yellowish brown, mottled, friable sandy clay loam. In some areas, the surface layer is silt loam.

Included with this soil in mapping are small areas of the moderately well drained Omulga soils, which have a fragipan and are slightly higher or lower on the landscape. Also included are small areas of Pope soils on flood plains. The included soils make up about 15 percent of most mapped areas.

In this Allegheny soil, the root zone is deep, and the available water capacity is high. Permeability is moderate. Potential frost action is moderate. Runoff is medium. Unless the soil is limed, the subsoil is strongly acid or very strongly acid.

Most areas of this soil are used for row crops. This soil is well suited to corn, soybeans, and wheat. Cultivated crops can be grown year after year if erosion is controlled. Using conservation tillage that leaves crop residue on the soil surface, including grasses and legumes in the cropping system, and using cover crops and contour tillage reduce erosion. Tilling within the optimum range of moisture content reduces soil compaction.

This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction, excessive runoff, and reduced yields. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key forage species.

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

This soil is well suited as a site for buildings and septic tank absorption fields. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action.

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

AkC—Allegheny loam, 8 to 15 percent slopes. This strongly sloping, deep, well drained soil is on side slopes of terrace remnants and on benches near the heads of drainageways. Most areas are dissected by one or more small drainageways. The areas are mostly long and narrow or irregularly shaped and are 3 to 30 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown and yellowish brown, friable loam; and the lower part is yellowish brown, firm clay loam and sandy clay loam. The substratum to a depth of about 64 inches is strong brown and yellowish brown, friable sandy loam. The surface layer in some areas is silt loam. A few steeper areas of this soil are along drainageways.

Included with this soil in mapping are small areas of the moderately well drained Wyatt and Omulga soils in valleys of abandoned, preglacial drainage systems. Also included, on side slopes, are small areas of Richland soils that have more clay in the substratum than the Allegheny soil. The included soils make up about 20 percent of most mapped areas.

In this Allegheny soil, the root zone is deep, and the available water capacity is moderate. Permeability and the potential frost action are moderate. Runoff is medium or rapid. Unless the soil is limed, the root zone is strongly acid or very strongly acid.

Some areas of this soil are used for row crops. This soil is moderately well suited to corn, soybeans, and small grains. If the soil is cultivated or the plant cover is removed, erosion is a severe hazard. The control of erosion and the maintenance of soil tilth and the organic matter content are concerns of management. Cultivated crops and small grains can be grown about half the time if conservation practices are used. Using conservation tillage that leaves crop residue on the soil surface, including grasses and legumes in the cropping system, and using contour stripcropping, cover crops, grassed waterways, and crop residue for mulch are good management practices. This soil is well suited to no-till planting.

Most areas are used for hay and pasture, for which this soil is well suited. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding to control erosion in pastures can be done with companion crops or cover crops or by the trash mulch or no-till seeding methods. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key forage species.

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

This soil is well suited as a site for buildings and septic tank absorption fields. Slope is the main limitation. Buildings should be designed to conform to the natural slope of the land. Sites for local roads can be improved by providing a suitable base material to reduce damage from frost action. The distribution lines in septic tank absorption fields should be laid out across the slope to reduce seepage of the effluent to the surface. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible.

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

AkD—Allegheny loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is on side slopes of terraces and on benches near the heads of drainageways. Most areas are dissected by one or more small drainageways. Most areas are long and narrow or irregularly shaped and range from 3 to 30 acres in size.

Typically, the surface layer is dark brown, friable loam about 7 inches thick. The subsoil is about 33 inches thick. The upper and middle parts are yellowish brown, firm and friable loam, clay loam, and sandy clay loam; and the lower part is yellowish brown, friable sandy loam. The substratum to a depth of about 63 inches is yellowish brown and strong brown, mottled, friable sandy loam. Some areas have a silt loam surface layer.

Included with this soil in mapping are small areas of the moderately well drained Omulga and Wyatt soils on lower positions in the valleys. Also included are small areas of Richland soils. They have more clay in the substratum and are on side slopes. The included soils make up about 20 percent of most mapped areas.

In this Allegheny soil, permeability is moderate. The root zone is deep, and the available water supply is moderate. Unless the soil is limed, the root zone is strongly acid or very strongly acid. The potential frost action is moderate. Runoff is rapid.

This soil is poorly suited to corn, soybeans, and small grains. The control of erosion and the maintenance of tilth and the organic matter content of the soil are concerns of management. If the soil is cultivated or if the protective plant cover is removed, the erosion hazard is severe. The cropping system should include meadow crops most of the time. No-tillage and other forms of conservation tillage that leave crop residue on the soil surface are suited to this soil.

Most areas of this soil are used for hay and pasture. This soil is moderately well suited to pasture and hay. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding to control erosion in pastures can be done by the trash mulch or no-till seeding methods or with cover crops or companion crops. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key forage species.

This soil is well suited to woodland and habitat for woodland wildlife. Locating skid trails and logging roads on or near the contour and using water bars or other erosion control practices will help reduce soil loss by erosion. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because of less transpiration, cooler temperature, and less exposure to the drying effects of the prevailing winds and the sun.

This soil is poorly suited as a site for buildings and septic tank absorption fields. Land shaping is needed in most areas. Placing the distribution lines of septic tank absorption fields across the slope will reduce lateral seepage of effluent to the soil surface. Locating driveways across the slope will reduce erosion and the angle of incline. Sites for local roads can be improved by using suitable base material to reduce the damage from frost action. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible.

The land capability classification is IVe. The woodland ordination symbol is 2r.

BaD—Barkcamp gravelly loamy sand, 8 to 25 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is on rounded mine spoil ridges and on side slopes in areas surface mined for coal. It is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the original soil. Most areas are irregularly shaped and 3 to 35 acres in size.

Typically, the surface layer is yellowish brown, very friable gravelly loamy sand about 5 inches thick. The substratum to a depth of about 60 inches is multicolored, very friable very gravelly sandy loam and loose gravelly loamy sand. In a few areas, the surface layer is sand or gravelly sand.

Included with this soil in mapping, and making up about 10 percent of most mapped areas, are small areas of Rigley, Bethesda, and Fairpoint soils. The Rigley soils have more clay throughout. The Bethesda and Fairpoint soils are less acid and have more clay throughout.

Permeability is moderately rapid or rapid in this Barkcamp soil, and runoff is rapid. The available water capacity is very low. The risk of corrosion of uncoated steel and concrete is high. The root zone is extremely acid (pH is less than 3.6).

In most areas, vegetation is sparse. This soil is too toxic to support most vegetation. In order to create a zone favorable for root development, the soil must be extensively modified through such practices as neutralizing the extremely acid reaction, adding plant nutrients, and blanketing the soil with a suitable soil material. Acid-tolerant plants will grow if large amounts of sewage sludge, manure, fly ash, and natural soil materials present before mining are incorporated into the soil. The erosion hazard is severe. Reclaimed areas could be planted to trees and used as habitat for openland wildlife. This soil generally is unsuited as a reservoir site because water can seep through the moderately rapidly permeable or rapidly permeable substratum.

Areas where slopes are 15 to 25 percent generally are unsuited as sites for buildings and septic tank absorption fields, but those with 8 to 15 percent slopes are poorly suited as sites for buildings and moderately well suited to septic tank absorption fields after settling has occurred. Onsite investigation is needed. The thickness of the soil over bedrock should be considered during the site investigation. Areas that have not had sufficient time to settle are unsuited as sites for buildings and septic tank absorption fields. Concrete and uncoated steel in contact with this soil are subject to severe corrosion. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering may result in the pollution of ground water supplies. If this soil is used as a construction site, erosion is a hazard; therefore, a plant cover should be kept on the site as much as possible. Because this soil is extremely droughty, sites used for lawns should be blanketed with a suitable soil material to provide a more favorable root zone and increase the available water capacity.

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

BhB—Bethesda shaly clay loam, 0 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is on narrow to broad ridgetops in areas mined for coal. Ridge crests commonly are rounded and have smooth slopes. Rills and small gullies have formed on some ridges. Most basins are drained by a small waterway, but some do not have drainage outlets and contain intermittent pools. This soil is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. Rock fragments, mostly flat and 1 to 5 inches long, are mainly shale, siltstone, and sandstone and smaller amounts of coal. Most areas are 3 to 45 acres in size.

Typically, the surface layer is brown, friable shaly clay loam about 4 inches thick. The substratum to a depth of about 60 inches is brown, firm very shaly silty clay loam and very channery clay loam. In a few areas, the surface layer and upper part of the substratum are clay loam or silty clay loam.

Included with this soil in mapping are small areas of the more acid and coarser textured Barkcamp soils. Also included are small areas of the less acid, reclaimed Fairpoint soils. The included soils are on landscape positions similar to those of the Bethesda soil and make up about 15 percent of most mapped areas.

Permeability is moderately slow in this Bethesda soil, and runoff is medium. Available water capacity is low. Potential frost action is moderate. The root zone is strongly acid to extremely acid in unlimed areas. Depth of the root zone varies within short distances because of differences in the density of the soil material.

This soil generally is unsuited to corn, wheat, and hay because the rock fragments in the surface layer interfere with tillage. Also, it is droughty, low in fertility, and very low in organic matter content. The surface layer puddles and crusts easily. Erosion is a moderate hazard in cultivated areas.

Many areas are in poor stands of grasses. This soil is poorly suited to pasture. The acidity, low fertility, shaly surface layer, and droughtiness are major concerns in pasture management. Areas that have not been limed and fertilized generally have thin stands of grasses with barren spots. Much of the rainfall in these areas runs off because of the poor structure of the soil and the lack of a plant cover. A protective plant cover and surface mulch can reduce runoff and soil loss by erosion and increase the water intake rate. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that make the best growth on this soil. Overgrazing reduces the stand and increases runoff. Proper stocking rates and rotation grazing are needed. Limiting grazing in winter and other periods helps to prevent surface compaction. In many areas, a water supply for livestock is not available, but potential reservoir sites are available.

Many areas are in poor stands of trees. This soil is best suited to trees that tolerate strongly acid to extremely acid, droughty soils. Mechanical planting is not practical in many areas because of the rock fragments in the surface layer. In most areas, mowing for weed control is possible.

Once settling has taken place, this soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Areas that have not had sufficient time to settle are unsuited to these uses. An onsite investigation is needed. Because of the differential settlement of the soil, depth to bedrock should be considered in the site investigation. Stones hinder the digging of shallow excavations. Moderately slow permeability limits the use of this soil for septic tank absorption fields. Placing distribution lines in suitable fill material helps to improve septic tank absorption fields. If this soil is used as a construction site, erosion is a hazard; therefore, a vegetative cover should be kept on the site as much as possible. Sites for lawns are droughty and difficult to mow because of rock fragments in the surface layer. They should be blanketed with a suitable soil material to provide a more favorable root zone, to increase the available water capacity, and to cover small stones that would interfere with mowing.

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

BhD—Bethesda shaly clay loam, 8 to 25 percent slopes. This strongly sloping and moderately steep, deep, well drained soil is mainly on mine spoil side slopes and to a lesser extent on mine spoil benches in areas mined for coal. Most areas have uneven slopes, and shallow gullies are common. Most areas are 3 to 100 acres in size.

Typically, the surface layer is yellowish brown, firm shaly clay loam about 5 inches thick. The substratum to a depth of about 60 inches is multicolored, firm very shaly clay loam. In some areas, the surface layer is channery clay loam, clay loam, or silty clay loam.

Included with this soil in mapping are small areas of the more acid, coarser textured Barkcamp soils. Also included are small areas of the less acid, reclaimed Fairpoint soils. The included soils are on landscape positions similar to those of the Bethesda soil and occupy about 15 percent of most mapped areas.

Permeability is moderately slow in this Bethesda soil, and runoff is rapid or very rapid. The available water capacity is low because of the high content of coarse fragments and compactness in the root zone. The potential frost action is moderate. Unless the soil is limed, the root zone is strongly acid to extremely acid. Depth of the root zone varies within short distances because of differences in the density of the soil material.

Most areas support a sparse stand of grasses. This soil is generally unsuited to the commonly grown field crops and hay crops and is poorly suited to pasture. The soil is a poor medium for root development; it is droughty, low in fertility, and very low in organic matter content. The surface layer is shaly, has weak structure, and puddles and crusts easily. Erosion is a severe or very severe hazard in cultivated areas. Areas that have not been limed and fertilized generally support thin stands of grasses and are interspersed with barren spots. The use of ground cover and surface mulch reduces runoff and erosion and increases the water intake rate. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow best on this soil. Overgrazing reduces the stand and increases runoff and soil loss by erosion. A water supply for livestock often is not available, but many areas have potential reservoir sites.

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

Once the soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings and poorly suited to septic tank absorption fields. Onsite investigation is needed. Areas where the soil has not had sufficient time to settle or where slopes are 15 to 25 percent are generally unsuited to these uses. Because of the differential settlement of the soil, the depth to bedrock should be considered during the site investigation. Hillside slippage and runoff are important considerations also. The moderately slow permeability and slope limit the use of this soil for septic tank absorption fields. Septic tank absorption fields can be improved by placing the distribution lines in suitable fill material. Keeping a vegetative cover on the soil as much as possible during construction will reduce erosion. Because of the compact root zone, the soil is droughty if used for lawns, and the rock fragments interfere with mowing. The sites for lawns should be blanketed with suitable fill material.

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

BhE—Bethesda shaly clay loam, 25 to 40 percent slopes. This deep, well drained, steep soil is mainly on mine spoil side slopes in areas surface mined for coal. Slopes are uneven, and gullies are common. This soil consists of a mixture of rock fragments and of partly weathered fine-earth material that was in or below the original soil. Rock fragments are mainly shale, siltstone, and sandstone. Most areas are long and narrow or irregularly shaped and 3 to 60 acres in size.

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

Included with this soil in mapping are small areas of the more acid and coarser textured Barkcamp soils. Also included are small areas of the less acid, reclaimed Fairpoint soils. The included soils are on landscape positions similar to those of the Bethesda soil and make up about 15 percent of most mapped areas.

In this Bethesda soil, permeability is moderately slow, and runoff is very rapid. The available water capacity is low. The organic matter content is very low. The potential frost action is moderate. Unless the soil is limed, the root zone is strongly acid to extremely acid. Depth of the root zone varies within short distances because of differences in density of the soil material.

Most areas have a sparse cover of grasses and trees. This soil generally is unsuited to hay, pasture, and the commonly grown field crops because of its steep slope, droughtiness, low fertility, and very low organic matter content. In most places, the high content of coarse fragments in the surface layer prevents tillage with normal equipment. If the soil is cultivated, erosion is a very severe hazard. The limed and fertilized areas generally support thin stands of grasses and are interspersed with barren spots. Use of ground cover and surface mulch reduces runoff and erosion and increases the water intake rate.

This soil is best suited to trees that can tolerate strongly acid to extremely acid, droughty soils. Grasses and legumes commonly are used to provide ground cover during the establishment of trees. Mechanical planting is not practical because of the steep slope and rock fragments throughout the soil.

This soil generally is unsuited to sanitary facilities and building site development because of the steep slope, possibility of hillside slippage, and moderately slow permeability.

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

BrD—Brownsville channery silt loam, 15 to 25 percent slopes. This deep, well drained, moderately steep soil is on hillsides. Most areas are long and irregularly shaped and 5 to 120 acres in size.

Typically, the surface layer is dark brown, friable channery silt loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown, firm very channery silt loam and channery loam about 18 inches thick. The substratum is brownish yellow and yellowish brown, friable very channery loam. Siltstone bedrock is at a depth of about 45 inches. The surface layer in some areas is channery loam.

Included with this soil in mapping are a few small areas of the Rigley soils. They have more sand and fewer coarse fragments in the subsoil and are on the upper part of side slopes and on benches. Also included are a few areas of the moderately well drained Wharton soils on the lower part of hillsides and in coves. The included soils make up about 15 percent of most mapped areas.

Permeability is moderate or moderately rapid in this Brownsville soil. The available water capacity is low.

Runoff is very rapid. In unlimed areas, the root zone is strongly acid to extremely acid.

In many areas this soil is used for pasture. It is moderately well suited to pasture and hay and poorly suited to corn and small grains. The cropping system should include meadow crops most of the time. No-tillage and other forms of conservation tillage that leave crop residue on the soil surface and contour stripcropping are good management practices to reduce soil loss by erosion. This soil is especially well suited to grazing and seeding early in spring. Conserving moisture and controlling erosion are major concerns of management. Reseeding by the trash mulch or no-till seeding methods or with cover crops or companion crops can be used to control erosion in seeded areas. Seedings should be made early in spring because of the low available water capacity of the soil. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key forage species.

Many areas are in woodland. This soil is moderately well suited to this use. Mechanical tree planting is hindered by rock fragments in the surface layer. Mowing to reduce plant competition is possible on this soil. Planting seedlings that have been transplanted once will reduce the seedling mortality rate. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because of less evaporation and cooler temperatures. These sites are less exposed to the drying effect of the prevailing winds and the sun.

This soil is poorly suited as a site for buildings and septic tank absorption fields because of the slope. Land shaping is needed in most areas. The distribution lines of septic tank absorption fields should be placed across the slope to reduce seepage of effluent to the soil surface. Locating driveways across the slope will reduce erosion and the angle of incline. Erosion is a hazard if this soil is used as a construction site; therefore, a plant cover should be kept on the site as much as possible. If trails are laid out in recreation areas, they should be protected against erosion and be on the contour, if possible.

The land capability classification is IVe. The woodland ordination symbol is 3f on the north aspect and 4f on the south aspect.

BsF—Brownsville-Shelocta association, steep. These deep, well drained, steep soils are on side slopes of uplands. Slopes generally are smooth, but some have benches and sharp breaks at sandstone escarpments. Slopes are dominantly 35 to 60 percent, but in some areas they are 25 to 35 percent. Most areas are 10 to 300 acres and long and narrow. Brownsville channery silt loam makes up about 50 percent of the association, and Shelocta silt loam makes up about 25 percent. The Brownsville soil is on the upper part of side slopes, and the Shelocta soil is on the lower concave part. Because of present and expected uses of the soils, it was not considered practical to map them separately at the scale used.

Typically, the Brownsville soil has a surface layer of very dark grayish brown, friable channery silt loam about 3 inches thick. The subsoil is brown and yellowish brown, friable channery silt loam and very channery silt loam about 34 inches thick. The substratum is brownish yellow, friable extremely channery silt loam. Fine grained sandstone bedrock is at a depth of about 45 inches. In some areas, the surface layer is thicker and the subsoil less acid.

Typically, the Shelocta soil has a surface layer of dark brown, friable silt loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is brown and yellowish brown, firm silt loam and silty clay loam; and the lower part is yellowish brown, firm channery silty clay loam. Siltstone bedrock is at a depth of about 48 inches.

Included with this association in mapping are small areas of Rarden and Rigley soils and some well drained, shallow and moderately deep soils. Rarden soils are in bands on hillsides, and the moderately deep and shallow soils and the Rigley soils are on the upper part of side slopes. Also of minor extent are sandstone escarpments on the upper part of slopes. Inclusions make up about 25 percent of the association. Individual areas of the inclusions are less than 20 acres.

Permeability is moderate or moderately rapid in the Brownsville soil and is moderate in the Shelocta soil. In the Brownsville soil, available water capacity is low; in the Shelocta soil, it is moderate. The subsoil of the Brownsville soil is strongly acid to extremely acid, and that of the Shelocta soil is strongly acid or very strongly acid. Runoff is very rapid on both soils.

A few areas are in unimproved pasture. Some areas used for pasture are reverting back to brush. These soils generally are unsuited to row crops, hay, and pasture because of the steep slope and erosion hazard of both soils and the droughtiness of the Brownsville soil.

Most areas are in woodland. These soils are moderately well suited to woodland and use as habitat for woodland wildlife. The slope limits the use of planting and logging equipment. Erosion can be reduced by locating logging roads and skid trails on or near the contour and by using water bars or other erosion control practices. The north- and east-facing slopes are better woodland sites than south- and west-facing slopes because of less evapotranspiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate of the Brownsville soil.

Because of the steep slopes, these soils generally are unsuited as sites for buildings and septic tank absorption fields. The hazard of erosion is severe if the plant cover is removed. Trails in recreation areas should be protected against erosion and established across the slope, if possible.

The land capability classification is VIIe. For the Brownsville soil, the woodland ordination symbol is 3f on the north aspect and 4f on the south aspect; for the Shelocta soil, it is 2r on the north aspect and 3r on the south aspect.

ChD—Clymer loam, 15 to 25 percent slopes. This deep, moderately steep, well drained soil is in narrow bands around the upper part of hillsides and on ridgetops. Most slopes are smooth and convex. Areas range from 3 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 5 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable loam; and the lower part is strong brown and yellowish brown, firm channery clay loam and channery sandy clay loam. The substratum is strong brown and brownish yellow, friable channery sandy clay loam. Hard sandstone bedrock is at a depth of about 50 inches. In a few areas, the surface layer is silt loam or sandy loam.

Included in mapping are small areas of Brownsville soils that have more coarse fragments in the subsoil and are on side slopes. Also included are a few small areas of the moderately well drained Rarden soils on the upper part of hillsides and a few small areas of rock outcrops near slope breaks. The inclusions make up about 15 percent of most mapped areas.

In this Clymer soil, permeability is moderate. The root zone is deep. The available water capacity is low. Runoff is rapid. In unlimed areas, the root zone is strongly acid or very strongly acid.

Many areas are used for hay and pasture. This soil is moderately well suited to pasture and hay. It is poorly suited to corn, soybeans, and small grains. The cropping system should include meadow crops most of the time. No-tillage and other forms of conservation tillage that leave crop residue on the soil surface, contour stripcropping, and including grasses and legumes in the cropping system reduce soil loss by erosion. This soil is especially well suited to grazing and planting early in spring. If plowed for reseeding, the hazard of erosion is very severe. Conserving moisture and controlling erosion are major concerns of management. To control erosion in seeded areas, reseeding can be done by trash mulch or no-till seeding methods or with cover crops or companion crops. Seedings should be made early in spring because of droughtiness in summer. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key species.

Many areas are used for woodland. This soil is well suited to woodland. Locating skid trails and logging roads on or near the contour, using water bars, or other erosion control practices can reduce soil loss by erosion. Locating logging roads and skid trails on or near the contour will also reduce the equipment limitation. Mowing or disking to reduce plant competition is possible on this soil. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because of less evapotranspiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun.

This soil is poorly suited as a site for buildings and septic tank absorption fields because of the slope, moderate permeability, and hard bedrock at a depth of 40 to 84 inches. Land shaping is needed in most areas. The bedrock hinders excavation in most areas. The distribution lines of septic tank absorption fields should be placed across the slope to reduce seepage of effluent to the soil surface. Locating driveways across the slope will reduce erosion and the angle of incline. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action. During construction, a vegetative cover should be maintained on the site as much as possible to reduce soil loss by erosion.

The land capability classification is IVe. The woodland ordination symbol is 2r on the north aspect and 3r on the south aspect.

CkB—Clymer silt loam, 3 to 8 percent slopes. This deep, gently sloping, well drained soil is on ridgetops. Most areas are irregularly shaped and range from 3 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown and strong brown, friable and firm loam, sandy clay loam, and sandy loam about 30 inches thick. The substratum to a depth of about 60 inches is strong brown and brownish yellow, friable channery sandy loam. In a few areas, the surface layer is loam.

Included with this soil in mapping are small areas of the moderately well drained Coolville and Rarden soils on the broader ridgetops. Also included are small areas of the moderately well drained Tilsit soils on the more nearly level parts of ridgetops. The included soils make up about 15 percent of most mapped areas.

In this Clymer soil, permeability is moderate, and the available water capacity is moderate or low. The root zone is deep. Runoff is medium. In unlimed areas, the root zone is strongly acid or very strongly acid.

Most of the acreage is farmed. This soil is well suited to corn, soybeans, and small grains. The hazard of erosion is moderate. Controlling erosion, conserving moisture, and maintaining the tilth and the organic matter content of the soil are concerns of management. Using conservation tillage that leaves crop residue on the soil surface, including grasses and legumes in the cropping system, incorporating crop residue into the plow layer, and using cover crops, contour tillage, and stripcropping are good management practices.

This soil is well suited to hay and pasture. It is well suited to deep-rooted legumes and to grazing early in spring. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key forage species.

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

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. The hard bedrock at a depth of 40 to 84 inches hinders excavation in some areas. The soil is better suited to houses without basements than to houses with basements. Septic tank absorption fields can be improved by placing the distribution lines in suitable fill material. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action.

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

CkC—Clymer silt loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on rounded knolls and ridgetops and in bands around hillsides. Slopes generally are smooth except for irregularities around shallow drainageways in some areas. Most areas are 5 to 170 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, friable loam; and the lower part is yellowish brown, strong brown, and brown, firm channery sandy clay loam and channery clay loam. The substratum is strong brown and brownish yellow, firm channery sandy clay loam and very channery sandy clay loam. Hard sandstone bedrock is at a depth of about 61 inches. The surface layer in some areas is loam.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are small areas of the moderately well drained Rarden and Tilsit soils, commonly on narrow ridge crests or near slope breaks.

In this Clymer soil, permeability is moderate. Available water capacity is moderate or low. The root zone is deep, and the soil is strongly acid or very strongly acid unless limed. Runoff is medium or rapid.

This soil is moderately well suited to corn and small grains. If the soil is cultivated or the vegetative cover is removed for other purposes, the hazard of erosion is severe. This soil can be used for cultivated crops and small grains about half the time if conservation practices are used. No-tillage and other forms of conservation tillage that leave crop residue on the soil surface, contour stripcropping, and including grasses and legumes in the cropping system are good management practices.

Many areas are used for hay and pasture. This soil is well suited to hay and pasture. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by using the trash mulch or no-till seeding methods or with cover crops or companion crops will reduce soil loss by erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer are good management practices.

Many areas are in woodland. This soil is well suited to woodland and habitat for woodland wildlife. Mechanical tree planting and mowing to reduce plant competition are possible on this soil.

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. The slope, moderate permeability, and hard bedrock at a depth of 40 to 84 inches limit these uses. The soil is better suited to houses without basements than to houses with basements. Land shaping is needed in some areas. Driveways should be located across the slope to reduce erosion and the angle of incline. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action. Septic tank absorption fields can be improved by placing the distribution lines across the slope and in suitable fill material. If this soil is used as a construction site, erosion is a hazard; therefore a protective plant cover should be maintained on the site as much as possible.

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

CoB—Coolville silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is mainly on ridgetops. Slopes typically are smooth and uniform. Most areas range from 3 to 25 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silty clay loam; and the lower part is yellowish brown and red, firm and very firm silty clay and clay. The subsoil is mottled below a depth of about 10 inches. The substratum is multicolored, very firm silty clay and shaly silty clay. Weathered shale bedrock is at a depth of about 60 inches.

Included with this soil in mapping, and making up about 10 percent of most mapped areas, are small areas of Tilsit and Wellston soils. The well drained Wellston soils have less clay in the lower part of the subsoil. Tilsit soils have a fragipan.

In this Coolville soil, permeability is moderate in the upper part and slow or very slow in the lower part. A seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The available water capacity is moderate. Runoff is medium. The frost action potential is high, and the shrink-swell potential is moderate in the lower part of the subsoil and in the substratum. Unless the soil is limed, the root zone is strongly acid or very strongly acid.

Most of the acreage is farmed. This soil is well suited to corn, soybeans, and small grains. In cultivated areas, the erosion hazard is moderate. Cultivated crops can be grown year after year if erosion is controlled and good management is used. Maintenance of tilth and the organic matter content of the soil is a concern of management. Using conservation tillage that leaves crop residue on the soil surface, including grasses and legumes in the cropping system, incorporating crop residue into the plow layer, and using contour tillage or stripcropping and grassed waterways maintain tilth and reduce runoff and soil loss by erosion. Tilling within the optimum moisture content reduces soil compaction. Subsurface drainage usually is not needed except for intensive uses, such as special crops.

This soil is well suited to pasture and hay. If the soil is overgrazed or plowed for seedbed preparation, however, erosion is a moderate hazard. To control erosion in pastures, reseeding can be done with cover crops or companion crops or by the trash mulch or no-till seeding methods. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help maintain a maximum stand of key forage species. Controlled grazing during winter months and other wet periods reduces soil compaction.

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

Despite the seasonal wetness and moderate shrink-swell potential, this soil is moderately well suited as a site for buildings. It is better suited to houses without basements than to houses with basements. Drains at the base of footings and exterior wall coatings commonly are used to help keep basements dry. Backfilling along foundations with a material having low shrink-swell potential will reduce damage from shrinking and swelling of the soil. Damage from shrinking and swelling can also be reduced by designing walls that have pilasters and are reinforced with concrete or by supporting the walls on a large spread footing. Sites for local roads can be improved by using artificial drainage and suitable base material to reduce damage from low soil strength and frost action.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and slow or very slow permeability in the lower part of the soil. Using perimeter drains around absorption fields and enlarging the absorption field will increase the absorption of effluent.

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

Cu—Cuba silt loam, occasionally flooded. This nearly level, deep, well drained soil is on the highest positions on the flood plains of the major streams. Slope ranges from 0 to 3 percent. Most areas range from 20 to 400 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable silt loam about 26 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. Some areas have more sand and less clay in the subsoil.

Included with this soil in mapping, and making up about 20 percent of most mapped areas, are small areas of the somewhat poorly drained Stendal soils and the poorly drained and very poorly drained Piopolis soils in slight depressions, in abandoned stream channels, and in narrow bands adjacent to slope breaks to terraces and uplands. The included soils are ponded for short periods following floods and periods of heavy rainfall.

Permeability in this Cuba soil is moderate. The root zone is deep and has a high available water capacity. In unlimed areas, the root zone is strongly acid or very strongly acid. Surface runoff is slow. The frost action potential is high.

Under good management, this soil is well suited to continuous cropping of corn and soybeans. Planting of crops is delayed in some years because of flooding in spring. Winter grain crops are damaged by flooding in some years. The surface layer crusts after hard rains. Tilling within the optimum range of moisture content reduces soil compaction and helps to maintain soil structure and improve tilth. Random subsurface drains are needed in included areas of wetter soils.

This soil is well suited to pasture and hay. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of fertilizer and lime help to maintain a maximum stand of key forage species. Limited grazing during winter months and other wet periods reduces soil compaction.

This soil is well suited to trees, and many areas are in woodland use. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil generally is unsuited as a site for buildings and septic tank absorption fields because of the flood hazard. Diking to control flooding is difficult. If the soil is used for local roads, fill material can be used to elevate the road above normal flood levels. Special measures are needed in some places to reduce streambank erosion. This soil is well suited to such recreation uses as picnic areas, golf fairways, and hiking trails.

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

DbA—Doles silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is in preglacial valleys. Most areas are irregularly shaped and range from 3 to 335 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is light yellowish brown, friable silt loam about 3 inches thick. The subsoil to a depth of about 71 inches is light yellowish brown and yellowish brown, mottled, friable and firm silt loam in the upper part; a light brownish gray and yellowish brown, mottled, very firm and brittle silty clay loam and silt loam fragipan in the middle part; and gray, mottled, firm silty clay loam in the lower part. In some areas, the subsoil contains more clay and the soil does not have a fragipan.

Included with this soil in mapping, and making up about 10 percent of most mapped areas, are small areas of Omulga, Piopolis, and Tygart soils. The Omulga soils are moderately well drained and are on slight rises. The poorly drained and very poorly drained Piopolis soils are in shallow depressions and along drainageways. Tygart soils have more clay in the subsoil and do not have a fragipan.

In the Doles soil, permeability is slow. Runoff is slow. Unless the soil is limed, the root zone is strongly acid or very strongly acid. The root zone is mainly restricted to the zone above the fragipan. The available water capacity of this zone is moderate. A perched seasonal high water table is between depths of 12 and 24 inches during extended wet periods. The frost action potential is high.

In most areas, this soil is farmed (fig. 5). Artificial drainage is needed for crop production. If drained, the soil is well suited to corn, soybeans, small grains, and hay and can be cropped intensively. A system of drains placed on or above the slowly permeable fragipan is the most effective. The surface layer of this soil crusts after hard rains. Minimizing tillage and incorporating crop residue into the plow layer help to maintain the tilth and the organic matter content of the soil. Tilling within the optimum range of moisture content reduces soil compaction.

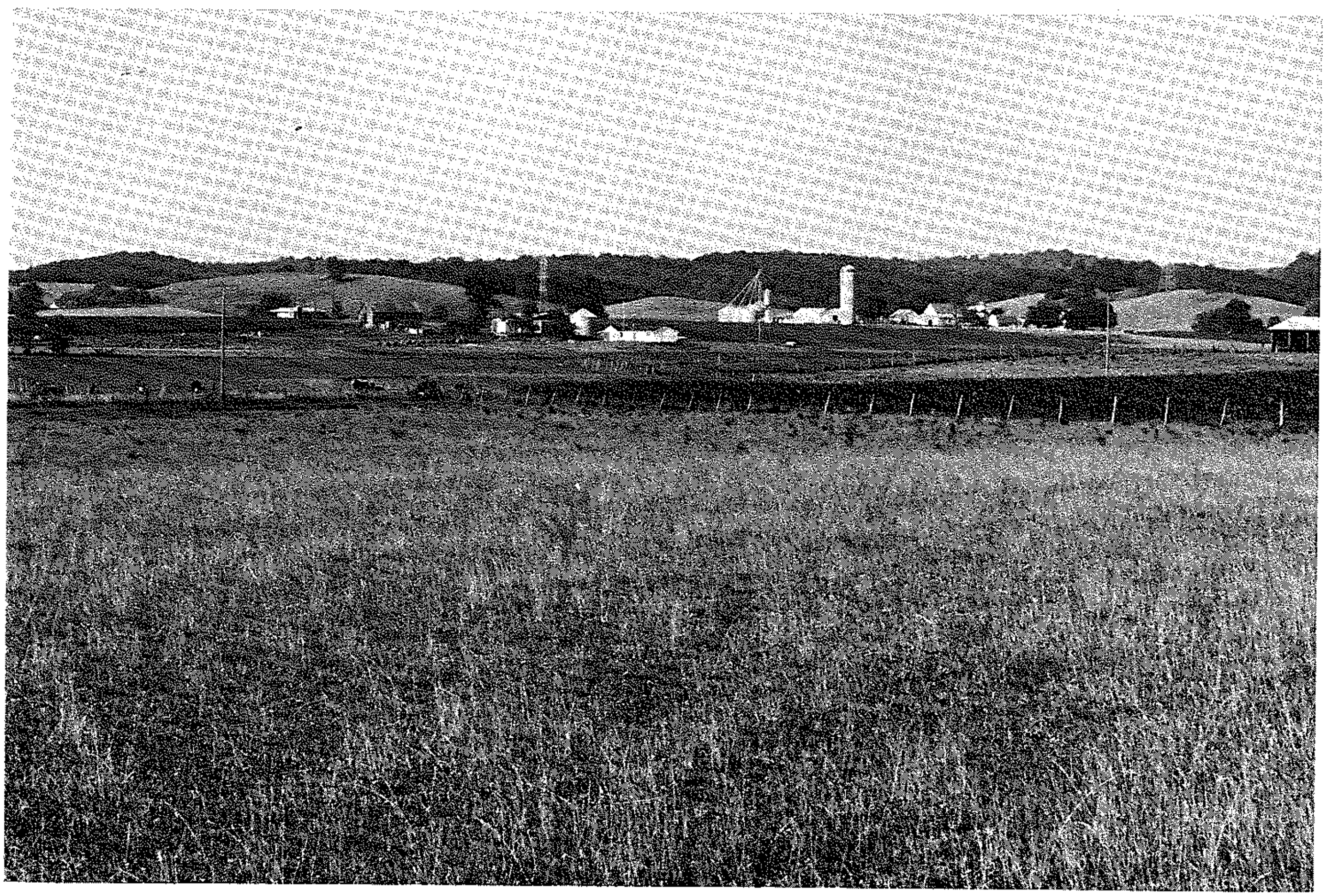

Figure 5.—Doles silt loam, 0 to 3 percent slopes, is mainly used for farming. Drained areas of this soil qualify as prime farmland.

Undrained areas of this soil are used for pasture; however, they are poorly suited to grazing early in spring. Drained areas are well suited to this use. Bluegrass, tall fescue, Ladino clover, alsike clover, birdsfoot trefoil, and reed canarygrass are suited to this soil. Stands of deep-rooted legumes are difficult to maintain. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help to keep the soil and the pasture in good condition. Limited grazing during wet periods reduces soil compaction.

This soil is well suited to woodland, but only a small acreage is used for this purpose. Species selected for planting should be tolerant of some wetness. Mechanical planting and mowing to reduce plant competition can be used on this soil.

Because of its wetness and slow permeability, this soil is poorly suited as a site for buildings and septic tank absorption fields. It is better suited to houses without basements than to houses with basements. Drainage can be improved by the use of subsurface drains and open ditches. Landscaping on building sites is needed to keep surface water away from foundations. Sites for local roads can be improved by using artificial drainage and a suitable base material to reduce damage from low soil strength and frost action. Increasing the size of septic tank absorption fields and using perimeter drains around the absorption fields will increase the absorption of effluent.

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

Dd—Dumps. This miscellaneous area consists mostly of cement, bricks, cinders, slag, and other debris of industrial origin. Some areas are sanitary landfills containing mainly home refuse. Most areas are 5 to 30 acres in size.

The areas of Dumps commonly have poor physical properties for plant growth. Reaction is quite variable. Erosion of any fine earth is a hazard unless the area is adequately covered by a suitable soil layer and vegetation is established.

No land capability classification or woodland ordination symbol is assigned.

Dm—Dumps, mine. This miscellaneous area consists of nearly level to steep areas of waste from coal mining operations. The material is quite variable; it is mostly soft, impure coal and black, carbonaceous (roof) shale that originally had a relatively high content of sulfur compounds. The material is locally referred to as "mine gob, gob, or gob piles." A few areas contain low-grade limestone. Some dumps that have burned or have oxidized with time consist of hard, red to gray, shaly or gravelly material referred to locally as "red dog."

The material in Dumps was acid when mined. Oxidized material, or red dog, is medium acid to neutral. The burned and unburned materials have poor physical properties for plant growth, and most areas are barren. Mine gob has a high content of organic carbon but is very low in the type of organic matter found in natural soil material. Oxidized material is very low in organic carbon and does not contain organic matter. Both burned and unburned materials have a low or very low available water capacity. The water percolating through the extremely acid material is a source of local stream pollution in many areas.

Abandoned areas should be reclaimed to prevent erosion, sedimentation, and acid drainage. The soil material used on these areas should be seeded with grasses or planted to trees that can grow in acid soils having a fairly low available water capacity.

No land capability classification or woodland ordination symbol is assigned.

ErC—Ernest silt loam, 8 to 15 percent slopes. This deep, moderately well drained, strongly sloping soil is on foot slopes, at the heads of drainageways, and on high, concave saddles on uplands. Most areas are irregularly shaped and range from 3 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 54 inches thick. The upper part is strong brown, firm silt loam; the middle part is yellowish brown, mottled firm shaly silt loam; and the lower part is a yellowish brown, mottled, very firm and brittle shaly loam and shaly silt loam fragipan. The substratum to a depth of about 70 inches is yellowish brown, mottled, firm loam.

Included with this soil in mapping are narrow bands of Wharton and Clymer soils that do not have a fragipan and are on the slightly higher, steeper parts of slopes. Also included are small areas of the well drained Richland soils on the lower part of slopes. The included soils make up about 20 percent of most mapped areas.

Permeability in this Ernest soil is moderate above the fragipan and moderately slow or slow in the fragipan. The root zone is mainly restricted to the 24- to 36-inch zone above the fragipan. The available water capacity of this zone is low. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The frost action potential is moderate. Unless the soil is limed, the root zone is strongly acid or very strongly acid. Runoff is rapid.

Many areas of this soil are used as cropland. This soil is moderately well suited to corn, soybeans, and small grains. Controlling erosion and maintaining tilth and the organic matter content of the soil are the main management concerns. Including meadow crops in the cropping system reduces the erosion hazard, increases the organic matter content, and improves tilth. Tilling within the optimum moisture content reduces soil compaction, clodding, and runoff. Grassed waterways help to reduce runoff and erosion.

Many areas are used for pasture. This soil is suited to hay and pasture. Overgrazing or grazing when the soil is wet causes compaction, increased runoff, and reduced yields. Pasture rotation and restricted use during wet periods help to keep the pasture and the soil in good condition. No-till seeding or the trash-mulch method of pasture renovation reduces the erosion hazard during reseeding.

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

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Seasonal wetness, slope, slow or moderately slow permeability, and moderate shrink-swell potential limit these uses. The soil is better suited to houses without basements than to houses with basements. Land shaping is needed in some areas. If basements are constructed on areas of this soil, landscaping for good surface drainage away from foundations and using drains at the base of footings help keep the basements dry. Sites for local roads can be improved by using artificial drainage and a suitable base material to reduce damage from seasonal wetness and low soil strength. Driveways should be laid out across the slope to reduce erosion and the angle of incline. If this soil is used as a construction site, erosion is a hazard; therefore, a plant cover shoud be kept on the site as much as possible. Septic tank absorption fields can be improved by increasing the size of the absorption field or providing an alternate absorption field. Distribution lines should be placed across the slope to reduce seepage of effluent to the soil surface.

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

ErD—Ernest silt loam, 15 to 25 percent slopes. This deep, moderately well drained, moderately steep soil is on foot slopes. Most areas are narrow and long and range from 3 to 40 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 and firm shaly silt loam; and the lower part is a yellowish brown, mottled, very firm and brittle shaly silt loam and shaly clay loam fragipan. The substratum to a depth of about 70 inches is yellowish brown, mottled, firm shaly silt loam. In some areas, the surface layer is loam.

Included with this soil in mapping are narrow bands of Brownsville and Wharton soils, which do not have a fragipan and are on the slightly higher and steeper parts of the slopes. Also included are small areas of the well drained Richland soils on the lower part of slopes. The included soils make up about 20 percent of most mapped areas.

In this Ernest soil, permeability is moderate above the fragipan and moderately slow or slow in the fragipan. The root zone is mainly restricted to the 24- to 36-inch zone above the fragipan. This zone has low available water capacity. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Unless the soil is limed, the root zone is strongly acid or very strongly acid. Runoff is very rapid.

Many areas are used for pasture. This soil is poorly suited to corn and small grains and moderately well suited to pasture. The hazard of erosion is severe in cultivated or overgrazed areas. The cropping system should include meadow crops most of the time. During reseeding of pastures, the use of cover crops, companion crops, or the trash mulch method of seeding reduces erosion. Proper stocking rates and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is well suited to trees, and many areas are in woodland use. Locating logging roads and skid trails on or near the contour, using water bars, or other practices can help to reduce erosion. The slope limits the use of equipment. Mechanical tree planting and weed control can be accomplished if safety precautions are followed.

This soil is poorly suited as a site for buildings and generally unsuited to septic tank absorption fields. The water movement over the fragipan causes seeps on slopes. Using subsurface drains upslope from buildings intercepts this seepage and helps keep basements dry. Using drains at the base of footings and exterior wall coatings also helps keep basements dry. Land shaping is needed in most areas. Placing driveways across the slope will reduce erosion and the angle of incline. The better suited soils nearby should be used for sanitary facilities. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible.

The land capability classification is IVe. The woodland ordination symbol is 2r.

FaB—Fairpoint silty clay loam, 0 to 8 percent slopes. This deep, nearly level and gently sloping, well drained soil is on narrow and broad ridgetops in areas surface mined for coal. Most slopes are smooth. The soil has been reclaimed by grading and blanketing the surface with a layer of soil material. The substratum is a mixture of rock fragments and of partly weathered fine earth material that was in or below the profile of the original soil. The rock fragments are mostly shale, siltstone, and sandstone. Most areas are long and narrow or irregularly shaped and range from 3 to 75 acres in size.

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

Included with this soil in mapping are small areas of the more acid, more droughty Barkcamp soils and the more acid Bethesda soils on similar landscape positions. Also included are small unreclaimed areas with irregular slopes. These areas have more rock fragments in the surface layer that interfere with tillage. The inclusions make up about 20 percent of most mapped areas.

In this Fairpoint soil, permeability is moderately slow. Runoff is slow or medium. The available water capacity is low because of the high content of coarse fragments and compactness of the substratum. The frost action potential is moderate. The root zone is medium acid to neutral unless the soil is limed. The depth of the root zone is highly variable within short distances because of differences in the content of coarse fragments and the compactness of the substratum.

Most areas of this soil are in grasses. This soil is poorly suited to row crops and is moderately well suited to hay and pasture. Areas that have not been limed and fertilized generally have thin stands of grasses. The soil is droughty, and no-tillage is well suited to this soil. A protective plant cover and mulch reduce runoff and soil loss by erosion and increase the water intake rate. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage crops that grow well on this soil. Overgrazing reduces the stand and increases runoff. Proper stocking rates, pasture rotation, mowing for weed control, and frequent applications of lime and fertilizer are needed to maintain a good stand of key forage plants. A water supply for livestock generally is not available, but many areas have potential reservoir sites.

This soil is best suited to trees that are tolerant of droughty soil. Mechanical planting and mowing to reduce plant competition are possible in most areas. Grasses and legumes provide ground cover during the establishment of trees.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields after settling has occurred. Onsite investigation is needed. Areas that have not had sufficient time to settle are unsuited to these uses. Because of differential settlement, the depth to bedrock should be considered during the site investigation. The moderately slow permeability limits the use of the soil for septic tank absorption fields. Absorption fields can be improved by placing the distribution lines in suitable fill material or enlarging the size of the absorption field. Keeping a vegetative cover on the soil as much as possible during construction will reduce erosion. Droughtiness is a hazard for lawns during dry periods.

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

FaD—Fairpoint silty clay loam, 8 to 25 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is on side slopes and benches in areas surface mined for coal (fig. 6). Most slopes are smooth. The soil has been reclaimed by grading and blanketing the surface with a layer of soil material. The substratum is a mixture of rock fragments and of partly weathered fine-earth material that was in or below the profile of the original soil. The rock fragments are mostly shale, siltstone, and sandstone. Most areas are long and narrow or irregularly shaped and range from 3 to 110 acres in size.

Typically, the surface layer is yellowish brown, firm silty clay loam about 3 inches thick. The substratum to a depth of about 60 inches is multicolored, firm shaly silty clay loam and very channery silty clay loam.

Included with this soil in mapping are small areas of the more acid, more droughty Barkcamp soils and the more acid Bethesda soils on similar landscape positions. Also included are small areas that have not been reclaimed. In these areas, slopes are irregular, and the surface layer contains more rock fragments. Also included are unreclaimed areas that have slopes of 25 to 70 percent and long, narrow, high walls. The inclusions make up about 20 percent of most mapped areas.

Permeability is moderately slow in this Fairpoint soil, and runoff is rapid or very rapid. The available water capacity is low. The frost action potential is moderate. The root zone is medium acid to neutral. The depth of the root zone varies within short distances because of differences in the content of coarse fragments and the compactness of the substratum.

Most areas of this soil are in a fair to poor stand of grasses. This soil is poorly suited to row crops and hay because it is droughty, highly susceptible to erosion, and low in fertility and organic matter content. It is moderately well suited to pasture. The hazard of erosion is severe if the soil is plowed for seedbed preparation. A protective plant cover and mulch reduce runoff and soil loss by erosion and increase the water intake of the soil. Orchardgrass, tall fescue, and Korean lespedeza are some of the forage plants that grow well on this soil. Overgrazing reduces the stand and increases runoff. Reseeding with companion crops or cover crops or by using trash mulch or no-till seeding methods reduces the hazard of erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applications of lime and fertilizer are needed to maintain a good stand of key forage plants.

This soil is best suited to trees that are tolerant of dry soil. Using mechanical tree planters and mowing to reduce plant competition are possible on this soil, except on the steep and very steep included soils. Grasses and legumes can be used to provide ground cover to reduce erosion during the establishment of trees. The soils in coves and on the north- and east-facing slopes are the best woodland sites. They have more moisture available for plant growth and have cooler temperatures because they have less exposure to prevailing winds and the sun.

Once the soil has settled, areas where slopes are 8 to 15 percent are moderately well suited as sites for buildings and poorly suited to septic tank absorption fields. Onsite investigation is needed. Because of the differential settlement of the soil, depth to bedrock should be considered during the site investigation. Storm-water runoff and susceptibility of the soil to hillside

Figure 6.—Good cover of tall fescue and orchardgrass on Fairpoint silty clay loam, 8 to 25 percent slopes. The high wall is part of the boundary of the surface-mined area.

slippage also are important considerations. Areas where the soil has not had sufficient time to settle or where slope is 15 to 25 percent generally are unsuited as sites for buildings and septic tank absorption fields because of the slope and slippage hazard. The slope and moderately slow permeability limit the use of this soil for septic tank absorption fields. Placing distribution lines on the contour will reduce lateral seepage of effluent to the soil surface. Increasing the size of the absorption field or installing a double absorption field system will increase the absorption of effluent. On sites for local roads, erosion can be reduced by locating the road on the contour and by seeding the roadcut. If this soil is used as a construction site, erosion is a hazard; therefore, a plant cover should be kept on the site as much as possible.

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

OmA—Omulga silt loam, 0 to 3 percent slopes. This deep, moderately well drained, nearly level soil is in preglacial valleys. Most areas are irregularly shaped and range from 3 to 150 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 11 inches thick. The subsoil is about 68 inches thick. The upper part is yellowish brown, friable and firm silt loam; the middle part is a yellowish brown, very firm and brittle silt loam fragipan; and the lower part is yellowish brown, very firm and firm silty clay loam, clay, and sandy clay loam. The subsoil is mottled between depths of about 22 and 27 inches. The substratum to a depth of about 85 inches is yellowish brown, friable sandy loam. In places, the subsoil has more clay and the soil does not have a fragipan.

Included with this soil in mapping and making up about 15 percent of most mapped areas, are small areas of Wyatt and Doles soils. The Wyatt soils contain more clay in the subsoil and are on convex slopes and along drainageways. The somewhat poorly drained Doles soils are in slight depressions and drainageways.

In this Omulga soil, permeability is moderate above the fragipan and slow in the fragipan. The root zone is mainly restricted to the moderately deep zone above the fragipan. The available water capacity of this zone is low. A perched seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The frost action potential is high in the Omulga soil. Unless the soil is limed, the root zone is medium acid to extremely acid.

Many areas of this soil are in row crops. This soil is well suited to corn and soybeans (fig. 7). Row crops can be grown year after year if intensive management is used. If row crops are grown, artificial drainage and maintaining soil tilth and a high fertility level are the main management concerns. The surface layer crusts after hard rains. Crusting retards moisture and air penetration. Incorporating crop residue or other organic matter into the surface layer increases the rate of water infiltration, improves tilth, and reduces crusting. In most areas, subsurface drains can be used to improve drainage; these drains are more effective if they are placed on or above the slowly permeable fragipan.

Figure 7.—Omulga silt loam, 0 to 3 percent slopes, is well suited to corn.

Some areas of this soil are in hay and pasture. This soil is well suited to hay and pasture. Overgrazing or grazing when the soil is wet, however, causes surface compaction and poor tilth. Proper stocking rates to maintain key plant species, rotation of pasture, deferment of grazing, and restricted grazing during wet periods help to keep the pasture and the soil in good condition.

A few areas are in woodland. This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of the seasonal wetness, the soil is better suited to houses without basements than to houses with basements. Drains at the base of footings and exterior wall coatings help to keep basements dry. Backfilling along foundations with a material having low shrink-swell potential reduces damage from the shrinking and swelling of the soil. Sites for local roads can be improved by providing artificial drainage and suitable base material to reduce damage resulting from frost action in the soil and the low strength of the soil. The slow permeability and seasonal wetness that limit the use of the soil for septic tank absorption fields can be partly overcome by using an absorption area that is larger than normal and by installing perimeter drains around the absorption field.

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

OmB—Omulga silt loam, 3 to 8 percent slopes. This deep, moderately well drained, gently sloping soil is on slight rises in preglacial valleys. Most areas are irregularly shaped and range from 3 to 115 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 11 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish brown, firm silt loam and silty clay loam; the middle part is a strong brown, mottled, very firm and brittle silty clay loam fragipan; and the lower part is strong brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm silty clay loam. In some areas, the subsoil contains more clay and the soil does not have a fragipan.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are small areas of Wyatt and Doles soils. The Wyatt soils, on knolls and along drainageways, have more clay in the subsoil than this Omulga soil. The somewhat poorly drained Doles soils are in slight depressions and in drainageways.

In this Omulga soil, permeability is moderate above the fragipan and slow in the fragipan. Runoff is medium. The root zone is mainly restricted to the moderately deep zone above the fragipan; the available water capacity of this zone is low. A perched seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The frost action potential is high. Unless the soil is limed, the root zone is medium acid to extremely acid.

Many areas of this soil are in row crops, hay, and pasture. This soil is well suited to corn, soybeans, hay, and pasture (fig. 8). It is easily farmed, but it is susceptible to surface crusting and erosion. The surface layer crusts after hard rains. Using conservation tillage that leaves crop residue on the soil surface, returning crop residue to the soil, and planting cover crops reduce erosion, improve tilth, and maintain the organic matter content of the soil. Random subsurface drains are needed in included areas of wetter soils. If the soil is overgrazed or grazed when wet, the surface becomes compacted, and poor tilth results. Proper stocking rates and restricted grazing during wet periods help to keep the pasture and the soil in good condition.

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

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of the seasonal wetness, the soil is better suited to houses without basements than to houses with basements. Drains at the base of footings and exterior wall coatings help to keep basements dry. Sites for local roads can be improved by providing artificial drainage and a suitable base material to reduce the risk of damage resulting from frost action in the soil and from the low strength of the soil. The slow permeability and seasonal wetness that limit the use of the soil for septic tank absorption fields can be partly overcome by using an absorption field that is larger than normal and by installing perimeter drains around the field. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible.

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

OmC—Omulga silt loam, 8 to 15 percent slopes. This deep, moderately well drained, strongly sloping soil is on side slopes, at the head of drainageways, and in high, concave saddles in preglacial valleys. Most areas are long and narrow or irregularly shaped and range from 3 to 285 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is about 56 inches thick. The upper part is yellowish brown, firm silt loam and silty clay loam; the middle part is a yellowish brown and strong brown, very firm and brittle silty clay loam fragipan; and the lower part is pale brown and yellowish brown, mottled, firm silty clay. The substratum to a depth of about 70 inches is yellowish brown,

Figure 8.—Omulga silt loam, 3 to 8 percent slopes, is well suited to soybeans and corn.

mottled, firm silty clay loam. In some areas, the subsoil is loam or sandy clay loam.

Included with this soil in mapping are small areas of the Allegheny and Wyatt soils and narrow bands of the Richland soils. The well drained Allegheny soils are on slope breaks. The Wyatt soils contain more clay in the subsoil than the Omulga soil and are on knolls and along drainageways. The well drained Richland soils are on the slightly higher and steeper parts of the slope. The included soils make up about 15 percent of the mapped areas.

In this Omulga soil, permeability is moderate above the fragipan and slow in the fragipan. Runoff is rapid. The root zone is mainly restricted to the moderately deep zone above the fragipan. The available water capacity of this zone is low. A perched seasonal high water table is between depths of 24 and 42 inches during extended wet periods. The frost action potential is high. Unless the soil is limed, the root zone is medium acid to extremely acid.

Most areas of this soil are used for pasture and hay; a few areas are used for row crops. This soil is well suited to hay and pasture and is moderately well suited to corn and soybeans. If the cropping system includes hay and pasture, the soil can be cropped successfully. Erosion is a concern, especially where the slopes are long. The surface layer crusts after hard rains. Using conservation tillage that leaves crop residue on the surface and using cover crops can improve the organic matter content and tilth of the soil, increase the rate of water infiltration, and reduce erosion. Overgrazing or grazing when the soil is soft and sticky as a result of wetness can result in surface compaction, an increase in runoff, and poor tilth. Random surface drains are needed in included areas of wetter soils.

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

This soil is moderately well suited as a site for buildings and septic tank absorption fields. Because of the seasonal wetness, the soil is better suited to houses without basements than to houses with basements. Buildings should be designed to conform to the natural shape of the land. Land shaping is needed in some areas. Drains at the base of foundations and exterior wall coatings help to keep basements dry. Backfilling along foundations with a material having low shrink-swell potential will reduce damage from the shrinking and swelling of the soil. The slow permeability that limits the use of the soil for septic tank absorption fields can be partly overcome by using an absorption area that is larger than normal. The distribution lines in absorption fields should be laid out across the slope to reduce seepage of unfiltered effluent to the soil surface. Sites for local roads and streets can be improved by providing artificial drainage and a suitable base material to reduce the risk of damage caused by frost action in the soil and by the low strength of the soil. If this soil is used as a construction site, erosion is a hazard; thus, a plant cover should be kept on the site as much as possible.

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

Or—Orrville silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. Slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 3 to 250 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is yellowish brown and light brownish gray, mottled, friable silt loam and loam about 26 inches thick. The substratum to a depth of about 60 inches is light brownish gray, mottled, friable loam and sandy loam.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are narrow bands of the well drained Pope soils on slight rises.

Permeability is moderate in this Orrville soil. Runoff is slow. The seasonal high water table is between depths of 12 and 30 inches during extended wet periods. The root zone is deep, and the available water capacity is moderate or high. The subsoil is slightly acid or medium acid.

Many areas are in pasture. If drained, this soil is well suited to row crops, such as corn, and to pasture. Flooding and seasonal wetness delay planting and limit the choice of crops. Undrained areas can be used for pasture, but maintaining soil tilth and desirable forage stands is difficult. Surface drainage can be used to remove excess surface water. Subsurface drains are also needed to remove excess water from the subsoil, but suitable outlets are difficult to establish in some areas. Planting cover crops helps to maintain the organic matter content of the soil and to protect the soil surface during flooding.

This soil is well suited to trees, and many areas are in woodland use. Species selected for planting should be able to withstand flooding and to tolerate some wetness. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, and disking.

This soil generally is unsuited as a site for buildings, septic tank absorption fields, and most recreation uses because of the flood hazard and seasonal wetness. It has potential for such recreation uses as hiking during the drier part of the year. Diking to control flooding is difficult. Sites for local roads and streets can be improved by using fill material to raise the road above the flood level and by using a suitable base material to reduce the risk of damage from frost action.

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

Pb—Piopolis silt loam, frequently flooded. This deep, nearly level, poorly drained and very poorly drained soil is on flood plains. Slope ranges from 0 to 3 percent. Most areas are broad or long and narrow and range from 4 to 425 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 7 inches thick. The substratum to a depth of about 60 inches is gray and light gray, mottled, friable and firm silty clay loam. Some areas have a silty clay loam surface layer. In a few areas the substratum is silt loam or loam.

Included in mapping are narrow strips of somewhat poorly drained Stendal soils on low stream terraces and Orrville soils on flood plains. These included soils make up about 15 percent of most mapped areas.

Permeability is slow in this Piopolis soil, and runoff is very slow or ponded. A seasonal high water table is near or above the soil surface during extended wet periods. The root zone is deep, and the available water capacity is high. The substratum is strongly acid or very strongly acid.

Many areas are in pasture. This soil is moderately well suited to corn, soybeans, hay, and pasture. Flooding and wetness limit the use of this soil for cultivated crops, hay, and pasture. Surface drains are commonly used to remove ponded water. Subsurface drains are used in areas where outlets are available. Drainage outlets are difficult to establish in many areas because of the low position on the landscape. Perennial plants selected for planting should be tolerant of wetness. If artificially drained, this soil is well suited to no-tillage. It is poorly suited to grazing early in spring. Overgrazing or grazing when the soil is soft and sticky as a result of wetness causes compaction and poor tilth.

Many areas are in woodland. This soil is well suited to trees adapted to wet sites and to habitat for wetland wildlife. Planting and logging can be done during the drier parts of the year. Using seedlings that have been transplanted once will reduce seedling mortality. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is generally unsuited as a site for buildings and septic tank absorption fields because of frequent flooding, prolonged wetness, and slow permeability. Diking to control flooding is difficult. Sites for local roads can be improved by filling to raise the road above high flooding and ponding levels and by using a suitable base material to reduce damage resulting from the low strength of the soil.

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

Pc—Piopolis silt loam, ponded. This deep, nearly level, poorly drained and very poorly drained soil is on flood plains. It is subject to frequent flooding of long duration and is ponded most of the year. The depth of ponded water fluctuates with the amount of runoff from surrounding, higher lying soils. Slope ranges from 0 to 3 percent. Most areas are irregularly shaped and 5 to 165 acres in size.

Typically, the surface layer is dark grayish brown, firm silt loam about 10 inches thick. The substratum to a depth of about 60 inches is gray, mottled, firm silty clay loam.

The seasonal high water table is near or above the surface most of the year, and the soil is ponded. Permeability is slow. The depth of rooting of most plants is related to the depth to the water table. The available water capacity is high. The substratum is strongly acid or very strongly acid.

Most areas are in wetland vegetation and support good habitat for ducks, muskrats, and other wetland wildlife (fig. 9). This soil generally is unsuited to cropland, pasture, woodland, building site development, septic tank absorption fields, and recreation uses because of the frequent flooding, ponding, and slow permeability. Drainage outlets are difficult to establish. The fluctuating water level limits the survival of many trees.

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

Pt—Pits, quarry. This miscellaneous area consists mainly of open excavations where the sandstone bedrock has been removed by stripmining. These quarries commonly are in areas having a relatively thin layer of soil material over sandstone bedrock. Typically, the quarries are adjacent to areas of Clymer and Rigley soils. The mined areas range from 3 to 20 acres in size.

All the overlying soil material has been removed and spread out in the form of spoil banks in areas next to the excavations; or it has been used as fill material or as the base under access roads. The soil material in spoil banks varies within short horizontal distances. The stripped soil material generally is very low in organic matter content, and its available water capacity is variable; therefore, it is poorly suited to the growth of plants. It is subject to erosion and is a source of siltation.

Establishing vegetation in abandoned areas reduces the hazard of erosion. Only the grasses and trees that can grow in soils that have a fairly low available water capacity and poor physical properties should be selected for seeding and planting. The areas may need blanketing with a favorable soil material in order to establish a good vegetative cover.

Ponded areas generally are suitable for development of wildlife habitat and recreational sites.

No land capability classification or woodland ordination symbol is assigned.

Pv—Pope sandy loam, frequently flooded. This deep, nearly level, well drained soil is on flood plains. Slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 20 to 200 acres in size.

Typically, the surface layer is dark brown, friable sandy loam about 7 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable sandy loam about 25 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, loose loamy sand. The surface layer in some areas is loam or silt loam. In a few areas, the substratum is gravelly loam or gravelly loamy sand.

Included with this soil in mapping are small areas of the more droughty Skidmore soils and areas of soils that have a loamy sand and sand subsoil and substratum. Also included are small areas of the somewhat poorly drained Orrville soils at slightly lower positions on flood plains. The included soils make up about 15 percent of most mapped areas.

In this Pope soil, permeability is moderate or moderately rapid. Runoff is slow. The root zone is deep and has a moderate available water capacity. Unless the soil is limed, the surface layer and subsoil are strongly acid or very strongly acid.

A few areas are used as cropland. Although the choice of crops is limited, the soil is well suited to corn and soybeans. Crops such as winter wheat may be severely damaged by floodwater in winter and early spring. Weed control is a problem because weed seeds are carried in by floodwater. The surface layer can be worked throughout a wide range in moisture content. Winter cover crops protect the soil from scouring. Eroded soil material in streambanks is a major source of sediment, which results in water pollution. Stabilizing streambanks is difficult in most areas.

Many areas are used for pasture. The soil is well suited to pasture and hay crops.

This soil is well suited to woodland, and many areas are wooded. Species selected for planting should be able to withstand flooding. Plant competition can be reduced by spraying, mowing, or disking.

This soil generally is unsuited as a site for most types of buildings and septic tank absorption fields. Diking to control flooding is difficult. Fill can be used to elevate road sites above the normal flood level. The soil is moderately well suited to extensive recreation uses, such as golf fairways, hiking trails, and picnic areas. In some places, special measures are needed to control streambank erosion and gouging by floodwater.

Figure 9.—Piopolis silt loam, ponded, is well suited to habitat for wetland wildlife.

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

Pw—Pope fine sandy loam, rarely flooded. This deep, nearly level, well drained soil is on low stream terraces. Slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 3 to 40 acres in size.

Typically, the surface layer is dark brown, friable fine sandy loam about 7 inches thick. The subsoil is yellowish brown and dark yellowish brown, friable and firm sandy loam about 41 inches thick. The substratum to a depth of about 60 inches is yellowish brown and brown, loose loamy sand. In some areas, the surface layer and the upper part of the subsoil are silt loam or loam.

Included with this soil in mapping, and making up about 10 percent of most mapped areas, are small areas of Allegheny soils that have more clay in the subsoil.

In this Pope soil, permeability is moderate or moderately rapid. Runoff is slow. The root zone is deep, and the available water capacity is moderate. The subsoil is strongly acid or very strongly acid.

Most areas are used for row crops. This soil is well suited to corn, soybeans, wheat, and specialty crops, such as tobacco and truck crops. Flooding generally does not damage crops. Management practices such as conservation tillage that leaves crop residue on the soil surface and planting cover crops conserve moisture, increase the organic matter content of the soil, and improve tilth.

This soil is well suited to pasture and hay. It is especially well suited to grazing early in spring. Proper stocking rates to maintain key plant species, pasture rotation, and deferment of grazing during wet periods will help to keep the pasture and the soil in good condition.

This soil commonly is not used as woodland, even though it is very well suited to this use. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil generally is unsuited as a site for buildings because of the flood hazard. The buildings in recreation areas should be elevated above the high flood level; or foundations should be designed to prevent structural damage caused by flooding. This soil is well suited to such recreation uses as picnic areas and golf fairways. The flooding occurs mainly during the idle period.

The capability class is I. The woodland ordination symbol is 2o.

Px—Pope silt loam, frequently flooded. This deep, nearly level, well drained soil is on flood plains. Slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 20 to 200 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil is brown, dark yellowish brown, and light yellowish brown, friable silt loam and loam about 31 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, friable sandy loam and loose loamy sand. In a few areas, the surface layer is sandy loam.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are narrow strips of the somewhat poorly drained Orrville soils, which are in slightly lower positions on the flood plains.

In this Pope soil, permeability is moderate or moderately rapid. Runoff is slow. The root zone is deep and has a moderate or high available water capacity. Unless the soil is limed, the surface layer and subsoil are strongly acid or very strongly acid.

Although the choice of crops is limited because of the flood hazard, this soil is well suited to corn and soybeans. Crops such as winter wheat may be severely damaged by flooding in winter and early spring. The surface layer crusts after hard rains. Planting cover crops is important in maintaining the organic matter content and in protecting the soil surface during flooding.

Many areas are used for pasture. This soil is well suited to grasses and legumes for pasture. Floodwater usually leaves sediment on forage crops. Pasture rotation, proper stocking rates, mowing for weed control, and timely application of fertilizer and lime help maintain a maximum stand of key forage species.

This soil is well suited to woodland, and many areas are wooded. The species selected for planting should be able to withstand flooding. Plant competition can be reduced by spraying, mowing, or disking.

This soil generally is unsuited as a site for buildings and septic tank absorption fields because of the flood hazard. Diking to control flooding is difficult. Fill material can be used to elevate road sites above the normal flood level. This soil is moderately well suited to extensive recreation uses, such as golf fairways, hiking trails, and picnic areas. In some places, special measures are needed to control streambank erosion and gouging by floodwater.

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

RaB—Rarden silt loam, 3 to 8 percent slopes. This moderately deep, gently sloping, moderately well drained soil is mainly on ridgetops. Most areas are long and narrow and range from 3 to 25 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 23 inches thick. The upper part is strong brown and yellowish red, firm silty clay loam; and the lower part is yellowish red, red, and reddish brown, mottled, firm silty clay. The substratum is yellowish brown, mottled, firm silty clay. Weathered shale bedrock is at a depth of about 35 inches. In places, the subsoil is dominantly brown and strong brown.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are small areas of Clymer and Tilsit soils. The well drained Clymer soils are on knolls and contain more sand and less clay in the subsoil than the Rarden soil. The Tilsit soils are in less sloping areas. They have a dense fragipan.

Permeability is slow in this Rarden soil, and runoff is medium. A seasonal high water table is between depths of 24 and 36 inches during extended wet periods. The root zone is moderately deep, and the available water capacity is low. The shrink-swell potential is high. Unless the soil is limed, the root zone is strongly acid or very strongly acid.

Most of the acreage of this soil is used for pasture and hay. This soil is moderately well suited to corn, soybeans, and small grains and well suited to hay and pasture. Under optimum management, it can be used frequently for row crops. Contour cultivation, conservation tillage that leaves crop residue on the soil surface, use of cover crops, and incorporating crop residue into the soil reduce erosion, improve tilth, and help maintain the organic matter content of the soil. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky. Grazing when the soil is wet causes compaction and reduces the quality and quantity of forage.

This soil is moderately well suited to woodland. Machine planting of tree seedlings is practical on this soil. Species selected for planting should be tolerant of a high clay content in the subsoil. Good site preparation and disking, spraying, or mowing will help reduce plant competition and insure seedling survival and growth. Using seedlings that have been transplanted once or mulching the soil will reduce the seedling mortality rate. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness and the high shrink-swell potential, it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Drains at the base of footings and exterior wall coatings commonly are used to help keep basements dry. On sites for local roads and streets, artificial drainage and a suitable base material will reduce damage from the shrinking and swelling of the soil. Placing the distribution lines of septic tank absorption fields in suitable fill material and using an absorption area that is larger than normal will increase the absorption of effluent.

The land capability classification is IIe. The woodland ordination symbol is 4c.

RaC2—Rarden silt loam, 8 to 15 percent slopes, eroded. This moderately deep, strongly sloping, moderately well drained soil is on ridgetops and in bands around hillsides. Slopes are dominantly smooth, except for irregularities around shallow drainageways in some areas. Erosion has removed part of the original surface layer, and the present surface layer is a mixture of the original surface layer and the subsoil material. Most areas are long and narrow or irregularly shaped and range from 3 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is strong brown and yellowish red, firm silty clay loam and silty clay; and the lower part is yellowish red and yellowish brown, mottled, firm silty clay. Depth to weathered shale bedrock is generally about 34 inches; in places, depth to shale bedrock is more than 40 inches. In many places, the surface layer is mixed brown and strong brown silty clay loam.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are small areas of Clymer, Tilsit, Wellston, and Wharton soils. Clymer and Wharton soils have less clay in the subsoil than the Rarden soil and are on knolls. The Tilsit soils, which have a fragipan, and the well drained Wellston soils are in less sloping areas.

Permeability is slow in this Rarden soil, and runoff is rapid. A seasonal high water table is between depths of 24 and 36 inches during extended wet periods. The root zone is moderately deep, and the available water capacity is low. The shrink-swell potential is high. Unless the soil is limed, the root zone is strongly acid or very strongly acid.

Many areas are used for pasture and hay. This soil is moderately well suited to corn, soybeans, small grains, hay, and pasture. It can be cropped successfully, but the cropping system should include a high proportion of hay or pasture crops. Erosion is a serious hazard, especially where the slopes are long. Hard clods and a crust on the surface form if the soil is cultivated when it is soft and sticky. Standard management practices such as conservation tillage that leaves crop residue on the soil surface, use of cover crops, and tilling at the proper moisture content reduce erosion, improve tilth, and help to maintain the organic matter content of the soil. Grazing when the soil is wet causes compaction and reduces the quality and quantity of the forage.

Many areas are in woodland. This soil is moderately well suited to woodland. Species selected for planting should be tolerant of a high clay content in the subsoil. Laying out logging roads and skid trails on the contour facilitates the use of equipment. Using seedlings that have been transplanted once or mulching the surface will reduce the seedling mortality rate. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is moderately well suited as a site for buildings and is poorly suited to septic tank absorption fields. Because of seasonal wetness and the high shrink-swell potential, it is better suited to houses without basements than to houses with basements. Foundations should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around foundations should be backfilled with a material having low shrink-swell potential. Drains at the base of footings and exterior wall coatings commonly are used to help keep basements dry. The distribution lines in septic tank absorption fields should be laid out across the slope to reduce seepage to the soil surface. Placing the distribution lines of septic tank absorption fields in a suitable fill material will increase the absorption of effluent. Erosion is a serious hazard during construction, so a protective plant cover should be maintained on as much of the site as possible. On sites for local roads and streets, artificial drainage and replacing the surface layer and subsoil with a suitable base material will reduce the damage from shrinking and swelling of the soil. Some areas are suitable sites for ponds.

The land capability classification is IIIe. The woodland ordination symbol is 4c.

RbC2—Rarden-Wharton silt loams, 8 to 15 percent slopes, eroded. This complex consists of strongly sloping, moderately well drained soils on the upper part of side slopes and on narrow ridgetops. Erosion has removed part of the original surface layer of these soils, and the present surface layer is a mixture of the original surface layer and the subsoil material. The moderately deep Rarden soil makes up 40 to 45 percent of most areas, and the deep Wharton soil makes up 35 to 40 percent. Because the two soils occur in relatively narrow alternating bands on the hillsides, it is not practical to separate them in mapping. Most areas of this complex are long and narrow and 3 to 100 acres in size.

Typically, the Rarden soil has a dark brown, friable silt loam surface layer about 6 inches thick. The subsoil is about 28 inches thick. The upper part is strong brown, firm silty clay loam; the middle part is yellowish red, mottled, firm and very firm silty clay; and the lower part is yellowish brown, mottled, very firm silty clay loam. Weathered shale bedrock is at a depth of about 34 inches.

Typically, the Wharton soil has a brown, friable silt loam surface layer about 6 inches thick. The subsoil is about 40 inches thick. The upper part is strong brown, friable silt loam; and the lower part is strong brown, mottled, firm clay loam. Weathered shale and siltstone bedrock is at a depth of about 46 inches.

Included with these soils in mapping, and making up about 15 percent of most mapped areas, are small areas of well drained Clymer and Rigley soils. These included soils are on small knolls.

Permeability is slow in the Rarden soil and slow or moderately slow in the Wharton soil. A seasonal high water table is between depths of 24 and 36 inches in the Rarden soil and 18 and 36 inches in the Wharton soil. The available water capacity is low in the Rarden soil and moderate in the Wharton soil. Runoff is rapid. The Rarden soil is strongly acid or very strongly acid in the subsoil. The Wharton soil is strongly acid to extremely acid in the subsoil.

Most areas are used for pasture and hay. These soils are well suited to hay and pasture and moderately well suited to corn, soybeans, and small grains. The Wharton soil is better suited to crops and pasture than the Rarden soil because it has less clay in the subsoil and a deeper root zone. A cropping system on these soils should include a high proportion of hay or pasture plants. Erosion is a serious hazard, especially where the slopes are long. Standard management practices, such as conservation tillage that leaves crop residue on the soil surface, use of cover crops, and tilling at proper moisture content, reduce erosion, improve tilth, and maintain the organic matter content of the soil. Grazing when the soil is wet causes compaction, reduces the quality of the protective plant cover, and lowers forage production.

Many areas are used for woodland. These soils are well suited to moderately well suited to woodland. Species selected for planting on the Rarden soil should be tolerant of a high clay content in the subsoil. Using seedlings that have been transplanted once or mulching will reduce seedling mortality on the Rarden soil. The windthrow hazard can be reduced on this soil by harvesting techniques such as evencutting. Laying out logging roads and skid trails on the contour facilitates the use of equipment.

These soils are moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. The Wharton soil is better suited to these uses than the Rarden soil. Because of the seasonal wetness of both soils and the high shrink-swell potential of the Rarden soil, they are better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around foundations should be backfilled with a material having low shrink-swell potential. Drains at the base of footings and exterior wall coatings commonly are used to help keep basements dry. Erosion is a serious hazard during construction, so a protective plant cover should be maintained on the site as much as possible during construction. On sites for local roads and streets, artificial drainage and a suitable base material will reduce the damage from the low strength and shrinking and swelling of the soils and from frost action in the soils. The distribution lines in septic tank absorption fields should be laid out across the slope to reduce seepage to the soil surface. Placing the distribution lines of septic tank absorption fields in suitable fill material will increase the absorption of effluent.

The land capability classification is IIIe. The woodland ordination symbol is 4c for the Rarden soil and 2o for the Wharton soil.

RbD2—Rarden-Wharton silt loams, 15 to 25 percent slopes, eroded. This complex consists of moderately steep, moderately well drained soils on side slopes. Erosion has removed part of the original surface layer of these soils, and the present surface layer is a mixture of the original surface layer and the subsoil material. The moderately deep Rarden soil makes up 40 to 45 present of most areas, and the deep Wharton soil makes up 40 to 45 percent. Because the two soils are in relatively narrow alternating bands on the hillsides, it is not practical to separate them in mapping. The areas commonly are long and narrow and are dissected by small drainageways. Most areas are 10 to 150 acres in size.

Typically, the Rarden soil has a brown, friable silt loam surface layer about 8 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown and yellowish red, firm silty clay loam and silty clay; the middle part is yellowish red, mottled, firm clay; and the lower part is yellowish red and strong brown, mottled, firm shaly silty clay loam. Weathered shale bedrock is at a depth of about 38 inches. In some places, the subsoil is not as red.

Typically, the Wharton soil has a brown, friable silt loam surface layer about 5 inches thick. The subsoil is yellowish brown and strong brown, mottled, firm silty clay loam about 47 inches thick. The substratum is yellowish brown, mottled, firm silty clay loam. Weathered shale bedrock is at a depth of about 60 inches.

Included with these soils in mapping, and making up about 10 percent of most mapped areas, are small areas of well drained Clymer and Rigley soils. These included soils are on shoulder slopes.

Permeability is slow in the Rarden soil and slow or moderately slow in the Wharton soil. A seasonal high water table is between depths of 24 and 36 inches in the Rarden soil and 18 and 36 inches in the Wharton soil. The available water capacity is low in the Rarden soil and moderate in the Wharton soil. Runoff is very rapid. In the Rarden soil, the subsoil is strongly acid or very strongly acid; in the Wharton soil, it is strongly acid to extremely acid.

Many areas are used for pasture and hay (fig. 10). These soils generally are unsuited to corn and soybeans and poorly suited to small grains, hay, and pasture. The erosion hazard is severe if these soils are cultivated, plowed for seedbed preparation, or overgrazed. Maintaining a permanent plant cover is the best means of controlling erosion. During pasture seeding, the use of cover crops, companion crops, and no-till seeding helps control erosion. Proper stocking rates and pasture rotation prevent overgrazing and erosion.

Most areas are in woodland. These soils are moderately well suited to woodland (fig. 11). Locating logging roads and skid trails on or near the contour will reduce soil loss by erosion and the equipment limitation. Using water bars or other erosion control practices will also reduce soil loss by erosion. Species selected for planting on the Rarden soil should be tolerant of high clay content in the subsoil. Using seedlings that have been transplanted once or mulching will reduce seedling mortality on the Rarden soil. The windthrow hazard can be reduced on this soil by harvesting techniques such as evencutting.

These soils are poorly suited as sites for buildings and generally are unsuited to septic tank absorption fields. The Wharton soil is better suited as a site for buildings than the Rarden soil because it is deeper over bedrock and has less clay in the subsoil. Drains at the base of footings and exterior wall coatings help to keep basements dry. Excavations around foundations should be backfilled with a material having low shrink-swell potential. If these soils are used as construction sites, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible. Most local roads require considerable excavation and may be subject to slippage. On sites for local roads and streets, artificial drainage and a suitable base material will reduce the damage from frost action in the soils and from the low strength and shrinking and swelling of the soils.

The land capability classification is VIe. For the Rarden soil, the woodland ordination symbol is 3c on the north aspect and 4c on the south aspect; for the Wharton soil, it is 2r on the north aspect and 3r on the south aspect.

RcC—Richland silt loam, clayey substratum, 8 to 15 percent slopes. This deep, well drained, strongly sloping soil is on foot slopes of valley walls adjacent to broad terraces. Seeps are common. Most areas are 10 to 50 acres in size and are long and narrow.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown and dark yellowish brown friable silt loam; the middle part is strong brown, firm clay loam; and the lower part is yellowish brown, mottled, firm channery clay loam. The substratum to a depth of about 60 inches is brown, mottled, firm silty clay. In a few areas, the surface layer is channery silt loam or channery loam. In some areas, the soil material between depths of 20 and 40 inches is silty clay or clay. The slope is 15 to 25 percent in a few areas.

Included with this soil in mapping are small areas of the moderately well drained Wyatt and Omulga soils, on foot slopes and toe slopes. Also included are somewhat poorly drained soils in seeps. The included soils make up about 20 percent of most mapped areas.

In this Richland soil, permeability is moderate in the subsoil and slow or very slow in the substratum. The available water capacity is moderate. A seasonal high water table is between depths of 36 and 72 inches during extended wet periods. Runoff is rapid. The shrink-swell potential is moderate in the subsoil and high in the substratum. Unless the soil is limed, the root zone is strongly acid or medium acid.

Some areas are used for cropland. This soil is moderately well suited to corn, soybeans, and small grains. If the soil is cultivated or the vegetative cover is removed for other purposes, the hazard of erosion is severe. Controlling erosion and draining the included seep spots are the main concerns of management. If conservation practices are used, this soil can be used for cultivated crops and small grains about half the time. Using conservation tillage that leaves crop residue on the soil surface, planting cover crops, returning crop residue to the soil, grassed waterways, and including grasses and legumes in the cropping system are good management practices. In some areas, diversions can be used to intercept runoff from adjacent slopes.

In many areas, this soil is used for pasture. It is well suited to hay and pasture. If the soil is overgrazed or plowed for seedbed preparation, however, the hazard of erosion is severe. Reseeding by the trash mulch or no-till seeding methods or with cover crops or companion

Figure 10.—Pastureland on Rarden-Wharton silt loams, 15 to 25 percent slopes.

crops reduces the risk of erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help to maintain the stand of key forage species. Controlled grazing during winter and other wet periods reduces soil compaction.

Many areas of this soil are in woodland. This soil is well suited to woodland and to habitat for woodland wildlife. Seedlings grow well if competing vegetation is controlled or removed by cutting, spraying, or girdling.

This soil is moderately well suited as a site for buildings because of the seasonal wetness, slope, and the high shrink-swell potential in the substratum. Excavations around foundations should be backfilled with a material having low shrink-swell potential. The damage from shrinking and swelling can also be reduced by designing walls that have pilasters and are reinforced with concrete or by supporting the walls on a large spread footing. Using drains at the base of footings and exterior wall coatings will help keep basements dry. On sites for local roads and streets, artificial drainage and a suitable base material will reduce damage from frost action and the low strength of the soil. Driveways should be located across the slope to reduce erosion and the angle of incline.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or

Figure 11.—Rarden-Wharton silt loams, 15 to 25 percent slopes, are moderately well suited to woodland.

very slow permeability in the substratum. The absorption fields can be improved by using perimeter drains and increasing the size of the field. The distribution lines should be laid out on the contour to reduce lateral seepage of effluent to the soil surface.

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

RgC—Rigley sandy loam, 8 to 15 percent slopes. This deep, strongly sloping, well drained soil is on ridgetops and in bands around hillsides. Most areas are long and narrow or irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable sandy loam about 7 inches thick. The subsoil is yellowish brown and strong brown, firm sandy loam about 36 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable channery loamy sand. In some areas, sandstone bedrock is between depths of 40 and 60 inches. The subsoil has more clay in some areas.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are small areas of Clymer soils on side slopes and areas of the moderately well drained Rarden and Wharton soils in seeps on side slopes.

In this Rigley soil, permeability is moderately rapid. Runoff is medium or rapid. The root zone is deep. The available water capacity is low. Unless the soil is limed, the root zone is strongly acid to extremely acid.

Many areas are in pasture. This soil is moderately well suited to corn and soybeans and is well suited to hay and pasture. Controlling erosion and conserving moisture are the major concerns of management. The surface layer is easily tilled throughout a wide range of moisture content. Using conservation tillage that leaves crop residue on the soil surface, winter cover crops, grassed waterways, and contour stripcropping and including grasses and legumes in the cropping system help to maintain tilth, reduce runoff, and control erosion. Because nutrients are moderately rapidly leached, this soil responds better to smaller but more frequent or timely applications of fertilizer than to one large application. This soil is well suited to grazing early in spring. In summer, pasture plants grow slowly because the soil is droughty. Proper stocking rates and pasture rotation help to prevent overgrazing and reduce erosion.

Many areas are in woodland, and this soil is well suited to woodland. Seedlings grow well if competing vegetation is controlled or removed by spraying, mowing, or disking.

This soil is well suited as a site for buildings and septic tank absorption fields, even though the slope limits these uses. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Driveways should be located across the slope to reduce erosion and the angle of incline. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action. The distribution lines of septic tank absorption fields should be laid out across the slope to reduce seepage to the surface. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible.

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 in bands around hillsides and on ridgetops. Most areas are long and narrow and 5 to 125 acres in size.

Typically, the surface layer is dark brown, friable sandy loam about 3 inches thick. The subsurface layer is brown, friable sandy loam about 4 inches thick. The subsoil is yellowish brown and strong brown, friable and firm sandy loam and channery sandy loam about 37 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable extremely channery sandy loam. Bedrock is between depths of 40 and 60 inches in some areas.

Included with this soil in mapping are small areas of Brownsville soils that contain more coarse fragments throughout the soil and are on the lower part of slopes. Also included are small areas of the moderately well drained Rarden soils, which are on benches, and small areas of the moderately well drained Wharton soils, in seeps. The included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in this Rigley soil, and runoff is rapid. The root zone is deep, and the available water capacity is low. Unless the soil is limed, the root zone is strongly acid to extremely acid.

Many areas of this soil are used for pasture and hay. This soil is poorly suited to corn and small grains and moderately well suited to hay and pasture. Erosion is a very severe hazard if the soil is cultivated, plowed for seedbed preparation, or overgrazed. The surface layer is easily tilled throughout a wide range of moisture content. The cropping system should include meadow crops most of the time. Conservation tillage that leaves crop residue on the soil surface, winter cover crops, grassed waterways, and contour stripcropping help to maintain tilth, reduce runoff, and control erosion. The soil is well suited to grazing early in spring. During pasture seeding, the use of cover crops, companion crops, or no-till seeding helps to control erosion. Proper stocking rates and pasture rotation help to prevent overgrazing.

This soil is well suited to trees, and many areas are in woodland. Plant competition can be reduced by spraying, mowing, or disking. Erosion can be reduced by locating roads and skid trails on the contour, using water bars, and other erosion control practices. Locating logging roads and skid trails on or near the contour will also reduce the equipment limitation. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because of less evapotranspiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun.

This soil is poorly suited as a site for buildings and septic tank absorption fields. Land shaping is needed in most areas. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be maintained on the site as much as possible. Placing the distribution lines of septic tank absorption fields across the slope will reduce lateral seepage of effluent to the soil surface. Locating driveways across the slope will reduce the hazard of erosion and the angle of incline. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action.

The land capability classification is IVe. The woodland ordination symbol is 2r on the north aspect and 3r on the south aspect.

RkD—Rigley-Rarden complex, 15 to 25 percent slopes. This complex consists of deep, well drained Rigley loam and moderately deep, moderately well drained Rarden silt loam on side slopes and ridgetops. The Rigley soil makes up about 40 to 45 percent of most areas, and the Rarden soil makes up 40 to 45 percent. Because the two soils occur as relatively narrow alternating bands on the hillsides, it is not practical to separate them at the scale used in mapping. Areas commonly are long and narrow and 5 to 40 acres in size.

Typically, Rigley soil has a surface layer of dark brown, friable loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown and strong brown, friable and firm loam; and the lower part is strong brown, firm sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable channery sandy loam. In places, the texture of the surface layer is silt loam or sandy loam.

Typically, the Rarden soil has a surface layer of dark brown, friable silt loam about 3 inches thick. The subsoil is about 25 inches thick. The upper part is strong brown, firm silty clay loam; and the lower part is yellowish red and yellowish brown, mottled, firm silty clay. The substratum is yellowish brown, mottled, firm shaly silty clay. Weathered shale bedrock is at a depth of about 36 inches. In some places, the subsoil is not as red.

Included with these soils in mapping, and making up about 15 percent of most mapped areas, are small areas of Brownsville soils on the lower part of slopes and Wharton soils on benches. Brownsville soils have more coarse fragments in the subsoil than the Rigley and Rarden soils. Wharton soils have a clay content intermediate between that of Rigley and Rarden soils.

The Rigley soil has moderately rapid permeability. It has a deep root zone with a low or moderate available water capacity. The subsoil of the Rigley soil is strongly acid to extremely acid. The Rarden soil is slowly permeable. It has a seasonal high water table between depths of 24 and 36 inches during extended wet periods. The subsoil of the Rarden soil is strongly acid or very strongly acid. Runoff is very rapid on both soils.

These soils are used for pasture and hay. They generally are unsuited to corn and soybeans and poorly suited to small grains, hay, and pasture. The erosion hazard is severe if the soils are cultivated, plowed for seedbed preparation, or overgrazed. During pasture seeding, the use of cover crops, companion crops, or no-till seeding helps to control erosion. Proper stocking rates and pasture rotation help to prevent overgrazing and erosion.

Many areas are used for woodland. The Rigley soil is well suited to woodland use, and the Rarden soil is moderately well suited. To control erosion and reduce the equipment limitation, logging roads and skid trails should be on the contour, and water bars and other erosion control practices are needed. Species selected for planting on the Rarden soil should be tolerant of a high clay content in the subsoil. Coves and north- and east-facing slopes are better woodland sites than south- and west-facing slopes. These sites have more water available for plant growth and cooler temperatures because of less exposure to the prevailing winds and the sun. On the Rarden soil, using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate. The windthrow hazard on this soil can be reduced by harvesting techniques such as evencutting.

These soils are poorly suited as sites for buildings and generally unsuited to septic tank absorption fields. The Rigley soil is better suited to those uses than the Rarden soil because it is deeper to bedrock and has less clay in the subsoil, better drainage, and moderately rapid permeability. Land shaping is needed in most areas of this complex. If basements are constructed in areas of the Rarden soil, drains at the base of footings and exterior wall coatings are needed to keep the basement dry. Foundations in the Rarden soil should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around foundations in the Rarden soil should be backfilled with a material having low shrink-swell potential. Erosion is a hazard on construction sites; therefore, plant cover should be maintained on the site as much as possible. Most sites for local roads require considerable excavation and may be subject to slippage.

The land capability classification is VIe. For the Rigley soil, the woodland ordination symbol is 2r on the north aspect and 3r on the south aspect; for the Rarden soil, it is 3c on the north aspect and 4c on the south aspect.

RmE—Rigley-Clymer association, steep. These deep, well drained soils are on side slopes of uplands. Slopes commonly are smooth, but some slopes have benches and sharp breaks at sandstone escarpments. Slopes dominantly are 25 to 40 percent. Areas of this association are 10 to 120 acres in size and generally are long and narrow. Rigley sandy loam makes up about 50 percent of this map unit, and Clymer loam makes up 25 percent. Rigley sandy loam is on the upper two-thirds of the side slopes, and Clymer loam is on the lower concave part. Because of present and expected uses of the soils, it was not considered practical or necessary to separate them at the scale used in mapping.

Typically, the Rigley soil has a surface layer of dark grayish brown, friable sandy loam about 3 inches thick. The subsurface layer is brown, friable sandy loam about 4 inches thick. The subsoil is yellowish brown and strong brown, friable and firm sandy loam and channery sandy loam about 37 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable very channery loamy sand.

Typically, the Clymer soil has a surface layer of very dark grayish brown, friable loam about 3 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown, friable loam; and the lower part is strong brown, firm channery sandy clay loam. The substratum is light brown, friable channery sandy loam. Sandstone bedrock is at a depth of about 45 inches.

Included in mapping, and making up about 25 percent of the association, are Brownsville, Rarden, and Wharton soils. Brownsville soils have more coarse fragments in the subsoil than the Rigley and Clymer soils and are on the lower part of side slopes. Rarden soils, which occur as narrow strips across the slope, have more clay in the subsoil. Wharton soils are moderately well drained soils on the lower part of slopes. Also included are long, narrow sandstone escarpments. Individual areas of the inclusions are less than 20 acres in size.

Permeability is moderately rapid in the Rigley soil and moderate in the Clymer soil. The root zone is deep and the available water capacity is low in both soils. Reaction in the subsoil is strongly acid to extremely acid in the Rigley soil and strongly acid or very strongly acid in the Clymer soil. Runoff is very rapid on both soils.

These soils generally are unsuited to cultivated crops, hay, and pasture because of the steep slope and erosion hazard.

Most areas are in woodland. These soils are well suited to woodland and habitat for woodland wildlife. The slope limits the use of planting and logging equipment. Erosion can be reduced by locating logging roads and skid trails on or near the contour, using water bars, or other erosion control practices. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because of less evapotranspiration and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun.

Because of the steep slopes, these soils generally are unsuited as sites for buildings and septic tank absorption fields. The hazard of erosion is severe if the plant cover is removed. Trails in recreation areas should be protected against erosion and established across the slope, if possible.

The land capability classification is VIIe. The woodland ordination symbol is 2r on the north aspect and 3r on the south aspect.

RnE—Rigley-Rarden association, steep. This association consists of a deep, well drained Rigley soil and a moderately deep, moderately well drained Rarden soil on side slopes. Slopes dominantly are 25 to 50 percent but are 50 to 60 percent in some areas. Most areas are in irregular width bands around hillsides and are 40 to 200 acres in size. Rigley loam makes up about 45 percent of most areas, and Rarden silt loam makes up about 30 percent. Rigley loam commonly is on the upper two-thirds of side slopes, and Rarden silt loam is on the lower one-third of side slopes and on benches. Because of present and expected uses of the soils, it was not considered practical or necessary to separate them at the scale used in mapping.

Typically, the Rigley soil has a dark brown, friable loam surface layer about 4 inches thick. The subsoil is strong brown and yellowish brown, firm loam and sandy loam about 36 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable channery loamy sand.

Typically, the Rarden soil has a dark brown, friable silt loam surface layer about 5 inches thick. The subsoil is strong brown, firm silty clay loam in the upper part and yellowish red, firm silty clay in the lower part. Shale bedrock is at a depth of about 28 inches. In some places, the subsoil is not as red.

Included in mapping, and making up about 25 percent of the association, are Brownsville, Clymer, Shelocta, and Wharton soils. The Brownsville, Clymer, and Shelocta soils commonly are on the middle of side slopes, and Wharton soils are on the lower part. These included soils contain more siltstone coarse fragments throughout than the dominant soils. Individual areas of the included soils are less than 20 acres in size.

The Rigley soil has moderately rapid permeability. It has a deep root zone with a low available water capacity. The subsoil of the Rigley soil is strongly acid to extremely acid. The Rarden soil is slowly permeable. It has a seasonal high water table between depths of 24 and 36 inches during extended wet periods. The root zone is moderately deep in this soil, and the available water capacity is low. The subsoil of the Rarden soil is strongly acid or very strongly acid. Runoff is very rapid on both soils.

These soils generally are unsuited to cultivated crops, hay, and pasture because of the steep slope and erosion hazard.

Most of the acreage of these soils is in woodland. The Rigley soil is well suited to woodland, and the Rarden soil is moderately well suited to this use. The slope limits the use of planting and logging equipment. Erosion can be reduced by locating logging roads and skid trails on or near the contour, using water bars, or other erosion control practices. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because of less evaporation and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate on the Rarden soil. The windthrow hazard on this soil can be reduced by harvesting techniques such as evencutting.

These soils generally are unsuited as sites for buildings and septic tank absorption fields because of the steep slope of both soils and the slow permeability, high shrink-swell potential, seasonal wetness, slippage hazard, and moderate depth to bedrock of the Rarden soil. The hazard of erosion is severe if the plant cover is removed. Trails in recreation areas should be protected against erosion and established across the slope, if possible.

The land capability classification is VIIe. For the Rigley soil, the woodland ordination symbol is 2r on the north aspect and 3r on the south aspect; for the Rarden soil, it is 3c on the north aspect and 4c on the south aspect.

RrG—Rigley-Rock outcrop association, very steep. This deep, well drained Rigley soil and Rock outcrop are in bands around hillsides and on hillsides along deeply dissected drainageways. Slopes dominantly are 40 to 70 percent. The areas are 10 to 200 acres in size. Rigley sandy loam makes up about 60 percent of most areas, and Rock outcrop makes up 15 percent. The Rigley soil dominantly is on the upper two-thirds of side slopes, and Rock outcrop occurs as high, massive sandstone bedrock escarpments on the upper part of side slopes. Because of present and expected uses, it was not considered practical to separate the soil and Rock outcrop at the scale used in mapping.

Typically, the Rigley soil has a surface layer of very dark brown, friable sandy loam about 3 inches thick. The subsurface layer is mixed dark brown and brown, friable sandy loam about 3 inches thick. The subsoil, about 35 inches thick, is yellowish brown and brownish yellow, friable sandy loam. The substratum to a depth of about 60 inches is light yellowish brown, loose channery sandy loam. The surface layer in areas below Rock outcrop commonly is channery or bouldery sandy loam. The subsoil has more sand or clay in some areas.

Rock outcrop is on vertical cliffs and ledges and in some places in gorges and caves. The maximum height of the cliffs is about 150 feet. Ledges and overhangs 5 to 10 feet high are numerous and discontinuous.

Included in mapping, and making up about 25 percent of the association, are Brownsville, Shelocta, and Wharton soils; shallow, excessively drained soils; and moderately deep, somewhat excessively drained soils that have bedrock at a depth of 10 to 40 inches. Brownsville, Shelocta, and Wharton soils are on the lower one-third of the side slopes, and the shallow and moderately deep soils are on the upper half of side slopes. Areas of the included soils are less than 20 acres in size.

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

This association generally is unsuited to cropland and pasture because of the very steep slope, Rock outcrop, and erosion hazard.

This association is moderately well suited to woodland, and most areas are used for woodland. Erosion is a severe hazard. It can be reduced by locating logging roads and skid trails on or near the contour, using water bars, or other erosion control practices. The slope and Rock outcrop severely limit the use of planting and harvesting equipment. Coves and north- and east-facing slopes are the best sites for woodland. These sites have more water available for growth and cooler temperatures because of less exposure to the prevailing wind and the sun. Tree growth is considerably less on included soils near the bedrock escarpments. Hemlock, mountain laurel, magnolia, and maidenhair fern grow in coves and on north- and east-facing slopes.

Because of the steep slopes and rock outcroppings, this association generally is unsuited as a site for buildings and sanitary facilities. Construction of facilities for recreation and urban uses is very difficult on this association. Some areas are scenic and can be used for hiking trails, parks, and lookout points. The hazard of erosion is severe if the plant cover is removed. Trails in recreation areas should be protected against erosion and should cross the slope, if possible.

The land capability classification is VIIe. The woodland ordination symbol is 2r for the Rigley soil on the north aspect and 3r on the south aspect. Rock outcrop is not assigned a woodland ordination symbol.

ShE—Shelocta-Rarden association, steep. This association consists of a deep, well drained Shelocta soil and a moderately deep, moderately well drained Rarden soil on side slopes of uplands. Areas are in bands of irregular width around hillsides and are 10 to 200 acres in size. Slopes dominantly are 25 to 50 percent and are both smooth and benched. Shelocta silt loam makes up 50 percent of most areas, and Rarden silt loam makes up 25 percent. The Shelocta soil commonly is on the upper and lower parts of side slopes, and the Rarden soil is on mid-slope benches and on shoulder slopes. Because of present and expected uses of the soils, it was not considered practical or necessary to separate them at the scale used in mapping.

Typically, the Shelocta soil has a surface layer of dark brown, friable silt loam about 4 inches thick. The subsurface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, firm silt loam and channery silty clay loam; and the lower part is yellowish brown, firm shaly silty clay loam and extremely channery silty clay loam. Hard siltstone interbedded with thin layers of shale is at a depth of about 48 inches.

Typically, the Rarden soil has a surface layer of dark brown, friable silt loam about 3 inches thick. The subsoil is about 29 inches thick. The upper part is brown, firm silty clay loam; and the lower part is reddish brown and yellowish red, mottled, firm silty clay. Shale bedrock is at a depth of about 32 inches. In some areas, the soil is deeper to bedrock.

Included in mapping, and making up about 25 percent of the association, are areas of Brownsville and Rigley soils; moderately deep, well drained soils having more coarse fragments in the subsoil; and Wellston soils with a silt mantle. Brownsville and Rigley soils are in a random pattern throughout most areas, the moderately deep soils are on shoulder slopes, and Wellston soils are on ridgetops. Areas of these soils are less than 20 acres in size.

Permeability is moderate in the Shelocta soil. This soil has a deep root zone and a low available water capacity. Permeability is slow in the Rarden soil. This soil has a moderately deep root zone and a low available water capacity. It has a high shrink-swell potential and a seasonal high water table between depths of 24 and 36 inches. Runoff is very rapid on both soils. The subsoil is strongly acid or very strongly acid in both soils.

A few areas are in permanent pasture. These soils generally are unsuited to cultivated crops, hay, and pasture because of the steep slope and erosion hazard. In areas of the Rarden soil, moderate depth to bedrock and high clay content in the subsoil are additional limitations.

Most of the acreage is in woodland. These soils are moderately well suited to woodland and well suited to habitat for woodland wildlife. The slope limits the use of equipment. Erosion can be reduced by locating logging roads and skid trails on or near the contour and using water bars or by other erosion control practices. The north- and east-facing slopes are better woodland sites than the south- and west-facing slopes because of less evaporation and cooler temperatures. These sites are less exposed to the drying effects of the prevailing winds and the sun. Using seedlings that have been transplanted once or mulching the Rarden soil will reduce the seedling mortality rate. The windthrow hazard on this soil can be reduced by harvesting techniques such as evencutting.

These soils generally are unsuited as sites for buildings and septic tank absorption fields. The steep slope is a limitation for both soils. For the Rarden soil, the high shrink-swell potential, slow permeability, seasonal wetness, hillside slippage (fig. 12), and moderate depth to bedrock are additional limitations. The hazard of erosion is severe if the plant cover is removed. Trails in recreation areas should be protected against erosion and established across the slope, if possible.

The land capability classification is VIIe. For the Shelocta soil, the woodland ordination symbol is 2r on the north aspect and 3r on the south aspect; for the Rarden soil, it is 3c on the north aspect and 4c on the south aspect.

Sk—Skidmore gravelly loam, frequently flooded. This nearly level, deep, well drained soil is on narrow flood plains. Slope ranges from 0 to 3 percent. Most areas range from 6 to 25 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is yellowish brown, friable gravelly loam; and the lower part is strong brown, very friable very gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, very friable very gravelly sandy loam and light yellowish brown, loose extremely gravelly loamy sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Orrville soils in depressions and abandoned stream channels. Also included are small areas of Pope soils that contain fewer coarse fragments throughout and are on landscape positions similar to those of the Skidmore soil. The included soils make up about 15 percent of most mapped areas.

Permeability is moderately rapid in this Skidmore soil, and runoff is slow. The available water capacity is low. The subsoil is slightly acid or medium acid. A seasonal high water table is between depths of 36 and 48 inches.

This soil is used for cropland and pasture. It is moderately well suited to corn and soybeans and well suited to hay and pasture. The major limitations are flooding and droughtiness. Winter wheat may be severely damaged by flooding in winter and spring. It is difficult to stabilize eroded streambanks in most places. Controlling weeds is difficult because weed seeds are carried in by floodwater. Planting cover crops is important in maintaining the organic matter content of the soil and in protecting the surface during flooding.

This soil is well suited to trees, and many areas are in woodland use. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil generally is unsuited as a site for buildings and septic tank absorption fields because of the flood hazard and wetness. Diking to control flooding is difficult. Fill material can be used to elevate road sites above normal flood level. Special measures are needed in some places to control streambank erosion.

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

St—Stendal silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. Slope ranges from 0 to 3 percent. Most areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 12 inches thick. The underlying material to a depth of about 60 inches is brown and light brownish gray, mottled, friable and firm silty clay loam. In some areas, the underlying material is loam.

Included with this soil in mapping, and making up about 15 percent of most mapped areas, are narrow strips of well drained Cuba soils on slight rises and

Figure 12.—Hillside slippage in an area of the Shelocta-Rarden association, steep.

poorly drained and very poorly drained Piopolis soils in old meander channels.

In this Stendal soil, the seasonal high water table is between depths of 12 and 36 inches during extended wet periods. Permeability is moderate, and runoff is slow. The root zone is deep, and the available water capacity is high. The substratum is strongly acid or very strongly acid.

Most of the acreage is in cropland or pasture. In drained areas, this soil is well suited to corn, soybeans, hay, and pasture. Flooding and wetness limit the choice of crops and delay planting. The undrained areas can be used for pasture, but maintaining tilth and desirable forage stands is difficult. This soil is poorly suited to grazing early in spring. Surface drains can be used to remove excess surface water. Subsurface drains are also needed, but suitable outlets are difficult to establish in some areas. The surface layer crusts after hard rains. Cover crops help to maintain the organic matter content and protect the soil surface during flooding.

This soil is well suited to woodland. The species selected for planting should be able to tolerate wetness caused by flooding and the high water table. Seedlings grow well if competing vegetation is controlled or removed by such practices as spraying, mowing, or disking.

This soil generally is unsuited as a site for buildings and septic tank absorption fields because of the flood hazard and seasonal wetness. Diking to control flooding is difficult. Sites for local roads can be improved by using fill material to raise the road above the flood level and by using a suitable base material to reduce the damage from frost action.

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

TeB—Tilsit silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops. Most areas are irregularly shaped and long and narrow. They are 5 to 25 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 10 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam; and the lower part is yellowish brown, mottled, very firm silt loam and silty clay loam. Shale bedrock is at a depth of about 58 inches.

Included with this soil in mapping, and making up about 15 percent of most areas, are small areas of the well drained Clymer soils and the moderately well drained Wharton soils on slight rises.

In this Tilsit soil, the seasonal high water table is between depths of 18 and 30 inches in winter and in spring and other extended wet periods. Permeability is moderate above the fragipan and slow in the fragipan. Runoff is medium. The root zone is mainly restricted to the moderately deep zone above the fragipan. This zone has moderate available water capacity and is strongly acid or very strongly acid unless the soil is limed.

Most of the acreage is in cropland. This soil is well suited to corn, soybeans, and small grains. The erosion hazard is moderate in cultivated areas. The surface layer crusts after hard rains. Cultivated crops can be grown year after year if erosion is controlled and good management is used. Maintenance of tilth and the organic matter content is a concern of management. Using conservation tillage that leaves crop residue on the soil surface, including grasses and legumes in the cropping system, and using contour tillage, stripcropping, and grassed waterways are good management practices. Tilling within the optimum moisture content reduces soil compaction. Subsurface drainage generally is not needed except for soil under intensive use, such as special crops.

Many areas are in pasture. This soil is well suited to pasture. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is moderate. Reseeding with cover crops or companion crops or by the trash mulch or no-till seeding methods reduces the risk of erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely application of lime and fertilizer help to maintain a maximum stand of key forage species. Controlled grazing during winter months and other wet periods reduces soil compaction.

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

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. It is better suited to houses without basements than to houses with basements because of the seasonal wetness. For houses with basements, drains at the base of footings and exterior wall coatings are commonly used to help keep basements dry. Sites for local roads can be improved by using artificial drainage and suitable base material to reduce damage from the low strength of the soil and from frost action in the soil. Installing perimeter drains around septic tank absorption fields and using an absorption area that is larger than normal will help increase the absorption of effluent.

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

TrA—Tygart silt loam, 0 to 3 percent slopes. This deep, nearly level, somewhat poorly drained soil is in preglacial valleys. Most areas are irregularly shaped and are 3 to 73 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 46 inches thick. The upper part is brown and yellowish brown, mottled, firm silt loam and silty clay loam; and the middle and lower parts are yellowish brown, mottled, firm and very firm silty clay and clay. The substratum to a depth of about 66 inches is light olive gray, mottled, very firm clay. Calcareous material is in the substratum in some areas.

Included with this soil in mapping are small areas of the moderately well drained Wyatt soils on slight rises and areas of Doles soils that have less clay in the subsoil. The included soils, which are near the edge of the map unit, make up about 15 percent of most areas.

In the Tygart soil, a seasonal high water table is between depths of 6 and 18 inches during extended wet periods. Permeability and runoff are slow. The subsoil is very strongly acid to medium acid. The available water capacity is moderate.

Most areas are in cropland. This soil is moderately well suited to corn and soybeans and well suited to pasture and hay. Tillage and planting are delayed in undrained areas. Because of the slow internal water movement, surface and subsurface drainage is needed in most areas. Even if the soil is drained, it dries out slowly in spring. It can be tilled within only a narrow range of moisture content. The soil crusts after hard rains and puddles and clods if worked when wet. It is poorly suited to grazing early in spring and is better suited to grasses and shallow-rooted legumes than to deep-rooted legumes. Grazing should be controlled to prevent excessive surface compaction.

Undrained areas of this soil are well suited to woodland. Species selected for planting should be tolerant of the high clay content in the subsoil and of wetness. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is poorly suited as a site for buildings and septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Ditches and subsurface drains can be used to improve drainage. Building sites should be landscaped for good surface drainage away from foundations. Sites for local roads and streets can be improved by using artificial drainage and a suitable base material to reduce damage from wetness and to improve soil strength. Using an absorption field that is larger than normal and using perimeter drains around the absorption field will increase the absorption of effluent.

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

WeB—Wellston silt loam, 3 to 8 percent slopes. This deep, well drained, gently sloping soil is on ridgetops. Most areas are irregularly shaped and 10 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 34 inches thick. The upper part is brown and yellowish brown, friable silt loam; and the lower part is yellowish brown and light yellowish brown, mottled, firm loam and clay loam. Weathered sandstone is at a depth of about 42 inches.

Included with this soil in mapping are small areas of the moderately well drained Tilsit soils that have a fragipan and small areas of Rigley soils. The included soils are on the edge of ridgetops and make up about 15 percent of most mapped areas.

In this Wellston soil, permeability is moderate. Runoff is medium. The root zone is deep, and the available water capacity is high. The potential frost action is high. In unlimed areas, the root zone is strongly acid or very strongly acid.

Most areas of this soil are in cropland or pasture. This soil is well suited to corn, soybeans, hay, small grains, and pasture. Erosion is a moderate hazard. The surface layer crusts after hard rains. Conservation tillage that leaves crop residue on the soil surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Returning organic matter to the soil helps to improve fertility, reduce crusting, and increase water infiltration. Overgrazing and grazing this soil when it is wet increase runoff and erosion. Proper stocking rates, pasture rotation, mowing for weed control, and timely applicaton of lime and fertilizer help to maintain a maximum stand of key forage species.

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

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. Bedrock at a depth of 40 to 72 inches hinders excavation in some areas. This soil is better suited to houses without basements than houses with basements. Placing septic tank absorption fields in suitable fill material and using an absorption field that is larger than normal will increase the absorption of effluent. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action.

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

WeC—Wellston silt loam, 8 to 15 percent slopes. This deep, well drained, strongly sloping soil is on ridgetops and hillsides. Most areas are irregularly shaped or narrow and long and range from 3 to 35 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil is about 37 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is strong brown, firm silty clay loam; and the lower part is yellowish brown and strong brown, firm silty clay loam and shaly silty clay loam. Weathered shale bedrock is at a depth of about 44 inches.

Included with this soil in mapping are small areas of the moderately well drained Coolville and Tilsit soils in less sloping areas. Also included are small areas of the moderately well drained Wharton soils on the edge of ridgetops and upper part of hillsides. The included soils make up about 15 percent of most mapped areas.

Permeability is moderate in this Wellston soil, and runoff is rapid. The root zone is deep. The available water capacity is moderate. The potential frost action is high. In unlimed areas, the root zone is strongly acid or very strongly acid.

This soil is moderately well suited to corn, soybeans, and small grains. The hazard of erosion is severe. The surface layer crusts after hard rains. If conservation practices are used, this soil can be used for cultivated crops and small grains about half the time. Good management includes use of no-tillage, conservation tillage that leaves crop residue on the soil surface, contour stripcropping, cover crops, and grasses and legumes in the cropping system.

Most areas of this Wellston soil are used for hay and pasture, for which the soil is well suited. If the soil is overgrazed or plowed for seedbed preparation, the hazard of erosion is severe. Reseeding by the trash mulch or no-till seeding methods or with cover crops or companion crops reduces the risk of erosion in pastures.

Many areas are used for woodland. This soil is well suited to trees. Mechanical tree planting and mowing to reduce plant competition are possible on this soil.

This soil is well suited as a site for buildings and moderately well suited to septic tank absorption fields. The slope and the hard bedrock at a depth of 40 to 72 inches are the major limitations to those uses. This soil is better suited to houses without basements than to houses with basements. Land shaping is needed in some areas. Driveways should be located across the slope to reduce erosion and the angle of incline. Distribution lines of septic tank absorption fields should be laid out across the slope to reduce seepage to the surface. Septic tank absorption fields should be placed in suitable fill material to improve filtration of effluent. Sites for local roads can be improved by using a suitable base material to reduce damage from frost action. If this soil is used as a construction site, erosion is a hazard; therefore, a protective plant cover should be kept on the site as much as possible.

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

WhC—Wharton silt loam, 8 to 15 percent slopes. This deep, moderately well drained, strongly sloping soil is on ridgetops and hillsides. Most areas are long and narrow and 4 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 40 inches thick. The upper part is strong brown, friable silt loam; and the lower part is strong brown, mottled, firm clay loam and silty clay loam. Weathered siltstone bedrock is at a depth of about 46 inches.

Included with this soil in mapping are small areas of the well drained Rigley soils, on knolls, and the moderately deep Rarden soils, in narrow strips on ridgetops and hillsides. Also included are small areas of the less sloping Tilsit soils that have a fragipan. The included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in this Wharton soil. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Unless the soil is limed, the root zone is strongly acid to extremely acid. The root zone is deep, and the available water capacity is moderate. Runoff is rapid.

This soil is used for pasture and hay. It is well suited to hay and pasture and moderately well suited to corn, soybeans, and small grains. It can be cropped successfully, but cropping systems should include hay or pasture. Erosion is a serious hazard, especially where the slopes are long. Using conservation tillage that leaves crop residue on the soil surface, using cover crops, and tilling at the proper moisture content reduce erosion, improve tilth, and maintain the organic matter content. When the soil is wet, grazing compacts the surface, reduces the quality of vegetative cover for erosion control, and lowers forage production.

This soil is used for woodland, and it is well suited to woodland. Mechanical tree planting and mowing to reduce plant competition are possible on this soil.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of seasonal wetness, it is better suited to houses without basements than to houses with basements. Drains at the base of footings and exterior wall coatings commonly are used to help keep basements dry. Backfilling along foundations with a material having low shrink-swell potential will reduce damage from the shrinking and swelling of the soil. A protective plant cover should be maintained on a site as much as possible during construction to reduce erosion. Damage to local roads and streets from frost action and the low strength of the soil can be reduced by using artificial drainage and replacing the surface layer and subsoil with a suitable base material. The distribution lines in septic tank absorption fields should be laid out across the slope to reduce seepage to the soil surface. Using perimeter drains around septic tank absorption fields will lower the seasonal high water table.

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

WhD—Wharton silt loam, 15 to 25 percent slopes. This deep, moderately steep, moderately well drained soil is on hillsides. Most areas are long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is brown, dark brown, and strong brown, friable and firm silt loam and channery silt loam; and the lower part is strong brown and yellowish brown, mottled, firm clay loam. Weathered, soft shale bedrock is at a depth of about 50 inches.

Included with this soil in mapping are small areas of well drained Clymer and Rigley soils on the upper part of slopes. Also included, on hillsides, are narrow strips of Rarden soils that have more clay in the subsoil than the Wharton soil. The included soils make up about 15 percent of most mapped areas.

Permeability is slow or moderately slow in this Wharton soil. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. Unless the soil is limed, the root zone is strongly acid to extremely acid. The root zone is deep, and the available water capacity is moderate. Runoff is very rapid.

Many areas are used for pasture. This soil is poorly suited to corn and small grains and moderately well suited to hay and pasture. The erosion hazard is severe if the soil is cultivated, plowed for seedbed preparation, or overgrazed. The cropping system should include meadow crops most of the time. Conservation tillage that leaves crop residue on the soil surface, winter cover crops, and grassed waterways are used to maintain tilth and reduce runoff and erosion. During pasture seeding, the use of cover crops, companion crops, or no-till seeding helps to reduce erosion. Proper stocking rates and pasture rotation prevent overgrazing and reduce erosion.

Many areas are used for woodland. This soil is well suited to woodland. Locating logging roads and skid trails on or near the contour will reduce erosion and the equipment limitation. Using water bars or other erosion control practices will also reduce soil loss by erosion. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate on south- and west-facing slopes.

This soil is poorly suited as a site for buildings and generally unsuited to septic tank absorption fields. If buildings with basements are constructed on areas of this soil, drains at the base of footings and exterior wall coatings help keep the basements dry. If this soil is used as a construction site, a vegetative cover should be maintained on the site as much as possible to help reduce erosion. Most local roads require considerable excavation, and cuts and fills are subject to slippage. On sites for local roads and streets, artificial drainage and a suitable base material will reduce damage resulting from frost action in the soil and from the low strength of the soil.

The land capability classification is IVe. The woodland ordination symbol is 2r on the north aspect and 3r on the south aspect.

WtB—Wyatt silt loam, 3 to 8 percent slopes. This deep, gently sloping, moderately well drained soil is on knolls and on side slopes adjacent to drainageways in preglacial valleys. Most areas are irregularly shaped and 3 to 35 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 yellowish brown, firm silty clay with mottles below a depth of about 15 inches; and the lower part is yellowish brown and dark yellowish brown, mottled, firm and very firm clay. The substratum to a depth of about 63 inches is brown, mottled, very firm clay. In eroded areas, the surface layer is silty clay loam and the surface layer and subsoil are thinner. In some areas, the subsoil and substratum have less clay.

Included with this soil in mapping are small areas, on flats and along drainageways, of the somewhat poorly drained Doles soils that have a fragipan. Also included are small areas of the moderately well drained Omulga soils on the less sloping parts of the map unit. The included soils make up about 15 percent of most mapped areas.

In this Wyatt soil, permeability is slow or very slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The available water capacity is moderate, and runoff is medium. The shrink-swell potential is high. Unless the soil is limed, the root zone is very strongly acid to slightly acid.

Most areas of this soil are used for cropland or pasture. This soil is moderately well suited to corn, soybeans, and wheat and is well suited to hay and pasture. It can be used for continuous row crops and small grains under optimum management. Using contour cultivation and conservation tillage that leaves crop residue on the soil surface, planting cover crops, and incorporating crop residue into the soil help to control erosion, improve tilth, and maintain organic matter content. Random subsurface drainage is needed in wet-weather seeps and in inclusions of wetter soils. Hard clods and a crusty surface form if the soil is cultivated when it is soft and sticky because of wetness. Grazing when the soil is wet compacts the surface, reduces the quality of the plant cover for erosion control, and lowers forage production.

This soil is moderately well suited to woodland. Machine planting of tree seedlings is practical on this soil. The species selected for planting should be tolerant of a high clay content in the subsoil. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of the seasonal wetness and the high shrink-swell potential, the soil is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around walls and foundations should be backfilled with a material having low shrink-swell potential to reduce damage from the shrinking and swelling of the soil. For houses with basements, drains at the base of footings and exterior wall coatings commonly are used to keep the basement dry. On sites for local roads and streets, artificial drainage and a suitable base material will prevent damage from the low strength of the soil, frost action, and shrinking and swelling of the soil. The slow or very slow permeability and seasonal wetness are severe limitations for septic tank absorption fields; however, these limitations can be partly overcome by using an absorption area that is larger than normal and by using perimeter drains around the absorption field.

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

WyC2—Wyatt silty clay loam, 8 to 15 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on knolls and side slopes in preglacial valleys. Erosion has removed part of the original surface layer, and the present surface layer is a mixture of the original surface layer and the subsoil material. Most areas are irregularly shaped or long and narrow and 3 to 65 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown and brown, firm silty clay and clay; and the lower part is yellowish brown and dark yellowish brown, mottled, firm clay. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm clay. In some slightly eroded areas, the surface layer is silt loam. A few areas have less clay in the subsoil and substratum.

Included with this soil in mapping are small areas of the less sloping Omulga soils having less clay in the subsoil. Also included are small areas of the somewhat poorly drained Doles soils in drainageways. The included soils make up about 15 percent of most mapped areas.

In this Wyatt soil, permeability is slow or very slow. Runoff is rapid. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The available water capacity is moderate. The shrink-swell potential is high. Unless the soil is limed, the root zone is very strongly acid to slightly acid.

Most areas of this soil are used for pasture or cropland. This soil is moderately well suited to hay and pasture and poorly suited to corn and soybeans. It can be cropped if the cropping system includes a high proportion of hay or pasture. Erosion is a serious hazard, especially if the slopes are long. Random subsurface drainage is needed in the included areas of wetter soils. This soil forms hard clods and a crust on the surface if it is cultivated when it is soft and sticky because of wetness. Using conservation tillage that leaves crop residue on the soil surface and cover crops and tilling at the proper moisture content reduce erosion, improve tilth, and maintain the organic matter content of the soil. Proper stocking rates, rotation of pasture, deferment of grazing, and restricted grazing during wet periods help to keep the soil and the pasture in good condition.

This soil is moderately well suited to woodland. Species selected for planting should be tolerant of a high clay content in the subsoil. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is moderately well suited as a site for buildings and poorly suited to septic tank absorption fields. Because of the seasonal wetness and the high shrink-swell potential, it is better suited to houses without basements than to houses with basements. Foundations and footings should be designed to prevent structural damage from the shrinking and swelling of the soil. Excavations around walls and foundations should be backfilled with a material having low shrink-swell potential to reduce damage from the shrinking and swelling of the soil. If houses with basements are constructed on this soil, drains at the base of footings and exterior wall coatings commonly are needed to help keep the basements dry. If a vegetative cover is kept on the site as much as possible during construction, erosion will be reduced. Sites for local roads and streets can be improved by using artificial drainage and a suitable base material to reduce damage from low soil strength, frost action, and the shrinking and swelling of the soil. The distribution lines in septic tank absorption fields should be laid out across the slope to reduce seepage to the soil surface. The slow or very slow permeability and the seasonal wetness are limitations for septic tank absorption fields; however, they can be partly overcome by increasing the size of the absorption field and using perimeter drains around the field.

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

WyD2—Wyatt silty clay loam, 15 to 25 percent slopes, eroded. This deep, moderately steep, moderately well drained soil is on hillsides and knolls in preglacial valleys. Erosion has removed part of the original surface layer, and the present surface layer is a mixture of the original surface layer and the subsoil material. Most areas are long and narrow or irregularly shaped and 3 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is about 32 inches thick. The upper part is yellowish brown, firm silty clay and clay; and the lower part is dark yellowish brown and brown, mottled, firm clay. The substratum to a depth of about 60 inches is dark brown, mottled, very firm clay. In some slightly eroded areas, the surface layer is silt loam.

Included with this soil in mapping, in the less sloping areas, are small areas of the well drained Allegheny soils on the lower part of slopes and the Omulga soils with less clay in the subsoil. Also included are small areas of the well drained Richland soils on the upper part of the slopes. The included soils make up about 15 percent of most mapped areas.

Permeability is slow or very slow in this Wyatt soil, and runoff is very rapid. A seasonal high water table is between depths of 18 and 36 inches during extended wet periods. The available water capacity is moderate. The shrink-swell potential is high. Unless the soil is limed, the root zone is very strongly acid to slightly acid.

Many areas are used for pasture and hay, for which the soil is poorly suited. This soil is generally unsuited to row crops. The erosion hazard is severe if the soil is cultivated, plowed for seedbed preparation, or overgrazed. Using no-till or trash mulch seeding methods, planting cover crops, and using grassed waterways maintain tilth and reduce runoff and erosion. A permanent plant cover is the best means of controlling erosion. Proper stocking rates, rotation of pasture, deferment of grazing, and restricted grazing during wet periods help to keep the soil and the pasture in good condition.

Many areas are in woodland. This soil is moderately well suited to woodland. The species selected for planting should be tolerant of a high clay content in the subsoil. Logging roads and skid trails should be laid out on the contour so that equipment can be used easily and excessive erosion can be prevented. Using water bars or other erosion control practices will also reduce erosion. Using seedlings that have been transplanted once or mulching will reduce the seedling mortality rate. The windthrow hazard can be reduced by harvesting techniques such as evencutting.

This soil is poorly suited as a site for buildings and generally unsuited to septic tank absorption fields because of the slope, seasonal wetness, high shrink-swell potential, and slow or very slow permeability. If buildings with basements are constructed in areas of this soil, drains at the base of footings and exterior wall coatings are needed to keep the basements dry. Excavations around walls and foundations should be backfilled with a material having low shrink-swell potential to reduce damage from the shrinking and swelling of the soil. If this soil is used as a construction site, erosion is a hazard; therefore, a plant cover should be maintained on the site as much as possible. Most local roads require considerable excavation and may be subject to slippage.

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

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short and long range needs for food and fiber. The supply of high quality farmland is limited and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our Nation's prime farmland with wisdom and foresight.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods. 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 may now be in crops, pasture, woodland, or other land, but not urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It also has a favorable temperature and growing season and acceptable acidity or alkalinity. It has few or no rocks and is permeable to water and air. Prime farmland 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. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

About 10,000 acres, or nearly 4 percent of Jackson County, meets the soil requirements for prime farmland. Most of this acreage is used for crops. Areas are mainly in map units 5 and 6 of the general soil map.

A recent trend in land use in some parts of the county has been the loss of some prime farmlands to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

Soil map units that make up prime farmland in Jackson County are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Soils that have limitations such as a high water table may qualify as prime farmland if this limitation is overcome by such measures as drainage. In table 5, the measures needed to overcome the limitations, if any, are shown in parentheses after the map unit name. Onsite evaluation is necessary to see if these limitations have 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 and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

J. B. Meredith, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967, nearly 44,000 acres in the survey area was used for crop production, according to the Conservation Needs Inventory (*7*). Of this total, about 5,800 acres was used for row crops, primarily corn; 2,500 acres was used for close-growing crops, mainly wheat and oats; and 21,000 acres was used for hayland and rotation hay and pastureland. The remaining 14,700 acres was used for fruit and vegetable production or was temporarily out of production.

Yearly fluctuations occur in the acreage devoted to row crops and hay production. This variation reflects the greater profit potential of cash grain over livestock during periods of low cattle prices. Higher cattle prices increase the acreage devoted to forage production.

Many soils in the county need lime or fertilizer, or both. Their phosphorus content is especially low. The amounts needed depend on the natural level of lime and plant nutrients in the soil, on the needs of the crop, and on the yields desired. Only general suggestions for applications of lime and fertilizer are given in this publication.

Most of the soils of Jackson County do not have a high content of organic matter, and to build up the content to a high level is not economically feasible. It is important, however, to maintain or increase the organic matter content of the soils by adding barnyard manure, returning plant residue to the soil, and growing sod crops, cover crops, and green manure crops.

Tillage tends to break down soil structure. It should be kept to the minimum necessary to prepare seedbeds and to control weeds. Maintaining the organic matter content of the plow layer helps to retain structure. Some of the soils in the county have a silt loam surface layer which is likely to form a hard crust after a heavy rain. Such soils as Omulga, Doles, Tilsit, and Wellston soils are subject to crusting. On these soils, tillage should be limited to that needed for aeration of the soil and establishment of plants.

The soils in Jackson County are dominantly well drained or moderately well drained; however, somewhat poorly drained, poorly drained, and very poorly drained soils are on flood plains and level parts of valley floors. On wet soils, such as Piopolis, Orrville, and Doles soils, the yields of cultivated crops can be increased by open-ditch or subsurface drainage. Subsurface drains are costly to install, but they generally provide better drainage than open ditches. Although soils that have a fragipan, such as Doles and Omulga, are difficult to drain, they generally can be drained if the tile is installed immediately above this hard, dense layer instead of in it. The depth to the fragipan will determine the feasibility of subsurface drainage. Open-ditch drainage is more effective if the ditches intercept the water as it moves horizontally on top of the fragipan. Some soils receive runoff from the adjacent uplands. Some others receive water from seeps and springs in the nearby hillsides. All can be drained if suitable outlets can be located, but in Jackson County outlets are hard to locate or maintain in some areas.

All the gently sloping and steeper soils that are cultivated are subject to erosion. The erodibility of a soil depends in part on its physical properties. For example, a Rarden silt loam is more susceptible to erosion than Brownsville channery silt loam, assuming that both soils have comparable slope and vegetative cover. The hazard of erosion on all soils increases as the slope increases. It also becomes more severe over time if the protective plant cover has been removed. For example, a soil in a cultivated area is more susceptible to erosion than one in a wooded area.

Runoff and erosion occur mostly while a cultivated crop is growing or soon after one has been harvested. On such easily eroded soils as Omulga silt loam, 3 to 8 percent slopes, a cropping system that helps to control runoff and erosion is needed along with other erosion control practices. As used here, a cropping system refers to the sequence of crops grown, in combination with management practices, including no-tillage, minimum tillage, mulch planting, using crop residue, growing cover crops and green manure crops, and applying lime and fertilizer. No-till planting with chemical weed control is a common practice in corn production (fig. 13). This is a good erosion control practice on the more sloping soils and on the wetter soils that have good artificial drainage.

Other erosion control practices are cultivating on the contour, terracing, contour stripcropping, diverting runoff, and using grassed waterways. The effectiveness of a particular combination of these measures differs from one soil to another, but different combinations can be equally effective on the same soil. The local representative of the Soil Conservation Service can assist in planning an effective combination of practices.

Approximately 21 percent of the land area in Jackson County is used for hayland or pasture. The pasture and hay plants commonly grown are red clover, bluegrass,

Figure 13.—No-till corn on Piopolis silt loam, frequently flooded.

Ladino clover, orchardgrass, tall fescue, timothy, and bromegrass.

The ability of a pasture to produce forage and protect the soils is influenced by the number of livestock, the length of time they graze, and the available water. Practices that contribute to good pasture management include the use of proper planting rates to maintain key forage species, pasture rotation and deferred grazing, limiting grazing to the proper season, mowing for weed control, application of appropriate amounts of lime and fertilizer, and strategically locating ample water supplies.

Erosion control is a major need because many of the soils used for pasture are moderately steep or steep.

Control of erosion is particularly important during seeding. Mulch seeding or use of a small grain as a companion crop can help to prevent further erosion. On already established pastures that need reseeding, no-till seeding with chemical weed control is a practice that can minimize soil erosion.

The need for lime and fertilizer on pasture and hayland should be determined by soil tests and by the requirements of the crop.

Soil compaction, caused by grazing when the soils are wet, can greatly reduce the vigor of pasture plants. Compaction is particularly a hazard on Wyatt, Rarden, Wharton, and Tygart soils.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The 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. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Woodland is the major land use in Jackson County, making up 53 percent of the county's acreage. Nearly all the forest land is privately owned; some of the timberland is public land, mostly in State parks and State forests. Very little is Federal land. The woodland acreage consists of various sized tracts, with the most extensive wooded areas located in the northwest corner of the county.

Jackson County is located in the central hardwood forest region, where many different timber types predominate, but most common is the oak-hickory type. Even though the hardwood forest types are the most numerous, native conifers are also much in evidence, especially on scattered small tracts on the Clymer and Rigley soils. Most of the woodland occurs on steep and very steep soils that formed from material weathered from underlying sandstone, siltstone, and shale bedrock.

Heavy cutting of the timber and poor logging practices occurred in the past, resulting in severe erosion in some areas. Erosion is most evident on logging roads where erosion control practices were not used.

Besides being subject to poor logging practices, a lot of the woodland has been grazed. Grazing increases erosion, kills young trees, damages roots, and adversely affects leaf litter. It also compacts the soil and reduces the tree's growth rate.

Despite all this, the amount of forest in the county is increasing. Fields that are marginal or unsuited to cropland or pastures are being abandoned and are gradually reverting to woodland. This shift in land use has been brought about largely because of current agricultural trends.

Through good management techniques and proper erosion control, the level of production in the county's woodland can increase substantially.

Soils differ greatly in productivity for woodland. The factors influencing tree growth are almost the same as those influencing production of annual crops and pasture—steepness of slope, ponding, wetness, rock fragments in the soil, clayey textures in the subsoil, the presence of a fragipan, and limited rooting depth. The major difference is that tree roots utilize more of the soil, especially around rock fragments in the lower part of the soil. The direction of exposure, or aspect, and the position of the soil on the landscape are also important. Other properties to be considered in evaluating a soil for woodland are the degree of past erosion, the acidity, and the natural fertility.

Aspect is the direction 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 (*5*). Trees grow better on north aspects because of less exposure to the prevailing winds and the sun and because of more abundant soil moisture. Some of the factors that make south aspects less productive are higher soil temperature as a result of more direct sunrays, higher evaporation by prevailing winds, earlier melting of snow, and a greater degree of freezing and thawing.

The position of the soil on the slope also determines the moisture supply available for tree growth. Soil moisture increases as elevation decreases on the slope partly due to seepage downslope. On the lower part of slopes the soils are generally deeper than on the upper part, the loss of soil moisture by evaporation is less, and the soil temperature is somewhat lower.

Steepness of slope is an important factor in woodland management. Equipment use is severely limited on very steep slopes. As the 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 more porous surface layer and exposes the subsoil, which commonly is less porous, and thereby increases runoff and lowers the water-intake rate. Both tree growth and natural reseeding are adversely affected by erosion.

The Division of Forestry, Ohio Department of Natural Resources, can provide information about managing woodland.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for 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 local offices of the Soil Conservation Service, Ohio Department of Natural Resources, Division of Forestry, or the Cooperative Extension Service or from a nursery.

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

Wildlife are among Jackson County's major natural resources. The most common species are the white-tailed deer, ruffed grouse, fox squirrel, gray squirrel, skunk, opossum, red fox, gray fox, raccoon, muskrat, beaver, cottontail, bobwhite quail, mourning dove, and a variety of songbirds.

The soils in the county are favorable for wildlife habitat development if the habitat is managed properly and if soil erosion is held to the minimum. Wildlife use field borders, fence rows, hedgerows, ponds, woodlots, cropland, and idle fields of brush (mostly crabapple, sassafras, and Virginia pine) that were once farmed. Where food, water, or cover is lacking or in short supply, it can be provided by planting food patches, planting trees and shrubs for food and cover, leaving crop residue on the surface, building brush piles, constructing ponds, clearcutting small plots in woodlands, and ensuring timely harvesting of hay and other crops.

In some areas, the most suitable land use is wildlife habitat. For example, within the county are extensive acreages of various types of wetlands. This land is best suited to muskrats, beavers, fish, ducks, and other wildlife.

For more information on managing or improving wildlife habitat, contact the Division of Wildlife, Ohio Department of Natural Resources, the County Agricultural Extension Service, or the Soil Conservation Service.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 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, reed canarygrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and shallow ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, Soil Material for reconstruction of strip mined land, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology;

(6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and 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.

Soil Material for Reconstruction of Strip Mined Land

Lawrence A. Tornes, assistant state soil scientist, Soil Conservation Service, and Alexander Ritchie, Jr., soil survey coordinator, Ohio Department of Natural Resources, Division of Soil and Water Conservation, helped prepare this section.

Table 15 gives information about the soils as a source of material for reclaiming areas drastically disturbed by surface mining.

The surface layer, subsoil, and substratum of the soils are rated good, fair, or poor, according to their erodibility and stability and their suitability as a medium for plant growth. The ratings only apply to that part of the soil within a depth of about 5 feet.

The interpretations in table 15 cannot be used for quarry, pit, dredge, and surface mine operations that require an off-site source of soil reconstruction material. The interpretations for daily cover for sanitary landfill in table 13 should be used to evaluate the material used in restoration of these operations.

A rating of *good* in table 15 means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated *fair* can be vegetated and stabilized by modifying one or more properties. Topdressing with better material or application of soil amendments may be necessary for satisfactory performance. Material rated *poor* has such severe problems that revegetation and stabilization are very difficult and costly. Topdressing with better material is necessary to establish and maintain vegetation.

Soil texture and coarse fragments influence soil structure and consistence, water intake rate, runoff, fertility, workability, and trafficability. They also influence a soil's available water capacity and erodibility by wind or water. Loamy and silty soils that are free of coarse fragments are the best reconstruction material. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are droughty and subject to soil blowing.

Rock fragments influence the ease of excavation, stockpiling, respreading, and suitability for the final use of the land. A certain amount of rock fragments can be tolerated, depending upon the size of the fragments and the intended use of the reclaimed area. If the size of rock fragments exceeds 10 inches, the problems are more severe.

Vegetation is difficult to establish on soils that are extremely acid or alkaline. Materials that are extremely acid or have the potential of becoming extremely acid upon oxidation are difficult and expensive to vegetate, and they contribute to poor quality of water, both in runoff or in ground water. Materials high in pyrite and marcasite without offsetting bases have high potential acidity. Laboratory tests may be needed to properly identify those materials.

Excessive amounts of substances that restrict plant growth, such as sodium, salt, sulfur, copper, and nickel, create problems in establishing vegetation and thereby influence erosion and the stability of the surface. Other substances, such as selenium, boron, and arsenic, get into the food chain and are toxic to animals that eat the vegetation. Of all these substances, only sodium and salt were considered in the ratings. Soil horizons relatively high in toxic substances are rated poor. Laboratory tests are needed to properly identify toxic substances.

The interpretations in table 15 do not cover all the soil features required in planning soil reconstruction, for example, slope, thickness of material, ease of excavation, potential slippage hazard, and soil moisture regime. Slope of the original soil may influence the method of stripping and stockpiling of reconstruction material but may have little effect on the final contour and, therefore, on the stability and productivity of the reconstructed soil. Therefore, slope was not a criterion in making the interpretations.

The thickness of material suitable for reconstruction and the ease of excavation are important criteria in planning soil reconstruction operations. However, they are so dependent on the method of mining operations that they were not used as criteria in developing the interpretations. Potential slippage hazard is related to soil texture, slope, differential permeability between layers, rainfall, and other factors which were not considered. Soil moisture regime, climate, and weather influence the kind of vegetation to plant and the rate of revegetative growth. They were not used as criteria because the relative rating does not change with variable moisture regimes; that is, the best soil in a moist environment is the best soil in a dry environment.

Furthermore, the soil may be irrigated to establish vegetation.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, 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 wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. 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 wind erosion 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 wind erosion 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 wind erosion 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 wind erosion 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 wind erosion 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 wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter 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 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the 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.

Some soils are assigned to two hydrologic groups to indicate drained and undrained situations. The first letter is the hydrologic group for areas where artificial drainage has been installed, and the second letter is for the undrained condition.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, 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 19 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 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is 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

Samples of many of the soils in Jackson County were analyzed by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The data obtained on most samples include those on particle size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations.

These data were used in the classification and correlation of these soils and in evaluating their behavior under various land uses. Seven of the profiles were selected as representative for the respective series and are described in this survey. These series and their laboratory identification numbers are: Brownsville (JK-6), Wharton (JK-9), Omulga (JK-13), Rigley (JK-14), Wyatt (JK-16), Ernest (JK-17), and Rarden (JK-19).

In addition to the Jackson County data, data are also available from nearby counties in southern Ohio. All of these data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Engineering Index Test Data

Some of the soils in Jackson County were analyzed for engineering properties by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. Engineering test data are also available from nearby counties that have many of the same soils. These data are on file at the Department of Agronomy, Ohio State University, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*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 among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

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 Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

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 Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

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 Hapludults.

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."

Allegheny Series

The Allegheny series consists of deep, well drained soils on stream terraces and on side slopes of high, dissected terraces. These soils formed in old loamy alluvium derived largely from acid sandstone and shale. Permeability is moderate. Slope ranges from 3 to 25 percent.

Allegheny soils are similar to Clymer, Rigley, and Shelocta soils and commonly are adjacent to Omulga and Wyatt soils. Clymer, Rigley, and Shelocta soils are on uplands and dominantly do not have rounded, coarse fragments in the lower part of the profile. Omulga and

Wyatt soils are moderately well drained soils in valley fills. Omulga soils have a fragipan and have more silt and less sand in the solum, and Wyatt soils have more clay and less sand in the solum.

Typical pedon of Allegheny loam, 15 to 25 percent slopes, about 2 miles north-northeast of Cove, in Liberty Township; 1,400 feet east and 400 feet south of the northwest corner of sec. 33, T. 7 N., R. 19 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many fine roots; 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

BA—7 to 10 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; friable; few fine roots; thin very patchy dark brown (10YR 4/3) organic coatings on vertical faces of peds; 2 percent coarse fragments; slightly acid; clear wavy boundary.

Bt1—10 to 16 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy yellowish brown (10YR 5/4) clay films on vertical and horizontal faces of peds; thin very patchy dark brown (10YR 4/3) organic coatings in old root channels; 4 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—16 to 24 inches; yellowish brown (10YR 5/6) loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin patchy yellowish brown (10YR 5/4) clay films on vertical and horizontal faces of peds; 6 percent sandstone fragments; strongly acid; clear wavy boundary.

Bt3—24 to 32 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin patchy brown (7.5YR 5/4) clay films on vertical and horizontal faces of peds; 10 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—32 to 40 inches; yellowish brown (10YR 5/6) sandy loam; weak medium and coarse subangular blocky structure; friable; thin very patchy brown (7.5YR 5/4) coatings on faces of peds; 4 percent coarse fragments; very strongly acid; clear wavy boundary.

C1—40 to 48 inches; yellowish brown (10YR 5/6) sandy loam; few fine faint light yellowish brown (10YR 6/4) mottles; massive; friable; few fine black (10YR 2/1) concretions (iron and manganese oxides); 6 percent coarse fragments; very strongly acid; gradual wavy boundary.

C2—48 to 56 inches; strong brown (7.5YR 5/6) sandy loam; common medium distinct light yellowish brown (10YR 6/4) mottles; massive; friable; 1 percent coarse fragments; very strongly acid; clear wavy boundary.

C3—56 to 63 inches; strong brown (7.5YR 5/8) sandy loam; few medium distinct very pale brown (10YR 7/3) and few fine distinct light gray (10YR 7/2) mottles; massive; friable; many medium and coarse dark brown (7.5YR 3/2) stains (iron and manganese oxides); 10 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 30 to 60 inches. The content of coarse fragments, mostly rounded sandstone and quartz pebbles, ranges from 0 to 5 percent in the Ap horizon, 0 to 15 percent in the Bt horizon, and 0 to 25 percent in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The upper part of Bt horizon is dominantly loam, clay loam, and sandy clay loam, but in some pedons it is silt loam and silty clay loam with more than 15 percent sand coarser than very fine sand. The BC horizon is dominantly sandy clay loam or sandy loam. Reaction in the BC horizon is strongly acid or very strongly acid. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. Its texture is dominantly sandy loam or sandy clay loam, or a gravelly analog. In some pedons this horizon contains thin layers of loam, loamy sand, or clay loam, or a gravelly analog. Reaction is strongly acid or very strongly acid.

Barkcamp Series

The Barkcamp series consists of deep, well drained soils on mine spoil ridges. These soils formed in extremely acid, partly weathered fine earth material that contains many fragments of sandstone and lesser amounts of shale and coal. Permeability is moderately rapid or rapid. Slope ranges from 8 to 25 percent.

Barkcamp soils commonly are adjacent to Bethesda and Fairpoint soils on similar landscape positions. Bethesda and Fairpoint soils are less acid than the Barkcamp soils and have more clay and less sand throughout. They are in areas where less sandstone bedrock was encountered in mining.

Typical pedon of Barkcamp gravelly loamy sand, 8 to 25 percent slopes, about 0.6 mile east of Pattonsville, in Bloomfield Township; 2,550 feet south and 1,600 feet east of the northwest corner of sec. 3, T. 8 N., R. 17 W.

Ap—0 to 5 inches; yellowish brown (10YR 5/6) gravelly loamy sand, brownish yellow (10YR 6/6) dry; weak medium granular structure; very friable; 15 percent coarse fragments of sandstone and coal; extremely acid; clear wavy boundary.

C1—5 to 14 inches; yellowish brown (10YR 5/6) gravelly loamy sand; single grained; loose; 25 percent coarse fragments mainly of sandstone; extremely acid; gradual wavy boundary.

C2—14 to 25 inches; yellowish brown (10YR 5/6) gravelly loamy sand; single grained; loose; 25 percent coarse fragments of sandstone and coal; extremely acid; gradual wavy boundary.

C3—25 to 40 inches; mixed strong brown (7.5YR 5/8), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) very gravelly sandy loam; massive; very friable; 45 percent coarse fragments of sandstone and coal; extremely acid; clear smooth boundary.

C4—40 to 48 inches; yellowish brown (10YR 5/6) gravelly loamy sand; single grained; loose; 25 percent coarse fragments of sandstone and coal; extremely acid; clear smooth boundary.

C5—48 to 60 inches; brown (10YR 5/3) gravelly loamy sand; single grained; loose; 30 percent coarse fragments of sandstone and coal; extremely acid.

Depth to bedrock is more than 60 inches. The content of coarse fragments ranges from 15 to 25 percent in the Ap horizon and from 25 to 45 percent in the C horizon.

The Ap horizon is 2 to 8 inches thick. It has hue of 10YR or 2.5Y and chroma of 4 to 6. It is dominantly gravelly loamy sand, but in some pedons it is gravelly sandy loam. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 8. It is gravelly or very gravelly loamy sand or sandy loam.

Bethesda Series

The Bethesda series consists of deep, well drained, moderately slowly permeable soils on mine spoil ridges. These soils formed in partly weathered fine earth material that contains many fragments of shale, sandstone, and siltstone. Slope ranges from 0 to 40 percent.

Bethesda soils commonly are adjacent to Barkcamp and Fairpoint soils on similar landscape positions. In areas of the Barkcamp soils the bedrock encountered in mining is more acid than that encountered in areas of Bethesda soils; the Barkcamp soils, therefore, are more acid throughout. Fairpoint soils are in areas where less acid bedrock was encountered in mining, and these soils are less acid throughout. They have been reclaimed.

Typical pedon of Bethesda shaly clay loam, 8 to 25 percent slopes, about 0.4 mile southeast of Middleton, in Milton Township; 650 feet east and 1,900 feet south of the northwest corner of sec. 22, T. 9 N., R. 17 W.

Ap—0 to 5 inches; yellowish brown (10YR 5/6) shaly clay loam, very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; firm; common medium and few coarse roots; specks of pinkish gray (7.5YR 7/2), yellowish red (5YR 5/8), and reddish yellow (5YR 7/6); 25 percent coarse fragments of shale and coal; extremely acid; clear wavy boundary.

C1—5 to 24 inches; mixed 50 percent yellowish brown (10YR 5/4), 30 percent light brown (7.5YR 6/4), and 20 percent brown (7.5YR 4/4) very shaly clay loam; massive; firm; few medium roots; 40 percent coarse fragments of sandstone, shale, and coal; extremely acid; gradual wavy boundary.

C2—24 to 39 inches; mixed 50 percent yellowish brown (10YR 5/6), 30 percent brown (7.5YR 4/4), and 20 percent reddish yellow (7.5YR 6/6) very shaly clay loam; massive; firm; 50 percent fragments of shale, sandstone, and coal; extremely acid; diffuse wavy boundary.

C3—39 to 64 inches; mixed 45 percent yellowish brown (10YR 5/6), 30 percent strong brown (7.5YR 5/6), and 25 percent light gray (10YR 6/1) very shaly clay loam; massive; firm; 40 percent fragments of coal, shale, and sandstone; extremely acid.

Thickness of the Ap horizon ranges from 0 to 6 inches. The content of coarse fragments ranges from 15 to 35 percent in the A horizon and from 35 to 80 percent in the C horizon. Reaction is extremely acid to strongly acid throughout the soil.

The Ap horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 8. It is dominantly shaly clay loam, but in some pedons it is channery clay loam. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 8. It is very channery, extremely channery, very shaly, or extremely shaly analogs of clay loam, silty clay loam, or loam.

Brownsville Series

The Brownsville series consists of deep, well drained soils on uplands. These soils formed in colluvium and residuum from sandstone and siltstone. Permeability is moderate or moderately rapid. Slope ranges from 15 to 60 percent.

Brownsville soils commonly are adjacent to Clymer, Rarden, Rigley, Shelocta, and Wharton soils on side slopes and ridgetops. Clymer, Rarden, Rigley, Shelocta, and Wharton soils have fewer coarse fragments throughout the soil than the Brownsville soils. Clymer and Rigley soils have more sand in the subsoil. Rarden and Wharton soils are moderately well drained and have more clay in the subsoil.

Typical pedon of Brownsville channery silt loam in an area of Brownsville-Shelocta association, steep, about 1.1 miles north-northwest of Leo, in Jackson Township; about 400 feet north and 1,550 feet west of the southeast corner of sec. 14, T. 8 N., R. 19 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) channery silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine and common medium roots; 35 percent coarse fragments; very strongly acid; abrupt smooth boundary.

EB—3 to 7 inches; brown (10YR 4/3) channery silt loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; very dark grayish brown (10YR 3/2) organic stains on vertical faces of peds; 30 percent coarse fragments; very strongly acid; abrupt wavy boundary.

Bw1—7 to 14 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine and medium subangular blocky structure; friable; few fine and medium roots; thin patchy yellowish brown (10YR 5/4) silt coatings on vertical faces of peds; 45 percent coarse fragments; strongly acid; clear wavy boundary.

Bw2—14 to 22 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine and medium subangular blocky structure; friable; few fine and medium roots; thin patchy yellowish brown (10YR 5/4) silt coatings on vertical faces of peds; 55 percent coarse fragments; strongly acid; clear wavy boundary.

Bw3—22 to 30 inches; yellowish brown (10YR 5/4) very channery silt loam; weak coarse subangular blocky structure; friable; few fine and medium roots; thin patchy yellowish brown (10YR 5/4) silt coatings on vertical faces of peds; 40 percent coarse fragments; very strongly acid; gradual wavy boundary.

BC—30 to 37 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine subangular blocky structure; friable; thin very patchy very pale brown (10YR 7/4) silt coatings on vertical faces of peds; 40 percent coarse fragments; very strongly acid; abrupt wavy boundary.

C—37 to 45 inches; brownish yellow (10YR 6/6) extremely channery silt loam; massive; friable; 70 percent coarse fragments; very strongly acid; abrupt irregular boundary.

R—45 to 48 inches; fine grained sandstone.

The thickness of the solum ranges from 24 to 49 inches. Depth to bedrock ranges from 40 to 72 inches. The content of coarse fragments ranges from 15 to 35 percent in the A horizon, 25 to 60 percent in the B horizon, and 50 to 90 percent in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly channery silt loam, but in some pedons it is silt loam. Reaction ranges from strongly acid to extremely acid. Some pedons have an E horizon. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is channery or very channery silt loam or loam. Reaction ranges from strongly acid to extremely acid. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is very channery or extremely channery silt loam or loam.

Clymer Series

The Clymer series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in residuum and colluvium from sandstone. Slope ranges from 3 to 40 percent.

Clymer soils are similar to Allegheny and Shelocta soils and commonly are adjacent to Rarden, Rigley, Shelocta, and Wharton soils. Allegheny soils dominantly have rounded coarse fragments in the lower part of the soil. Rarden, Rigley, Shelocta, and Wharton soils commonly are on side slopes and ridgetops. Rarden and Wharton soils are moderately well drained. Rarden soils also have more clay in the solum than the Clymer soils. Shelocta and Wharton soils contain more silt and less sand in the solum. Rigley soils contain less clay in the solum.

Typical pedon of Clymer silt loam, 8 to 15 percent slopes, about 3.5 miles south-southwest of Centerville in Madison Township; about 400 feet south and 700 feet east of the northwest corner of sec. 2, T. 6 N., R. 17 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate fine and medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BA—8 to 11 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; common fine roots; thin brown (10YR 4/3) organic coatings on vertical faces of peds; 2 percent coarse fragments; slightly acid; clear smooth boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; friable; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; thin patchy very pale brown (10YR 7/4) silt coatings on vertical faces of peds; 12 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—15 to 23 inches; strong brown (7.5YR 5/6) channery clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy brown (7.5YR 5/4) clay films on vertical and horizontal faces of peds; thin very patchy very pale brown (10YR 7/4) silt coatings on vertical faces of peds; 15 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—23 to 31 inches; strong brown (7.5YR 5/6) channery clay loam; moderate medium subangular blocky structure; firm; few fine roots; brown (7.5YR 5/4) clay films that are medium continuous on vertical faces of peds and medium patchy on horizontal faces; 15 percent coarse fragments; strongly acid; clear smooth boundary.

Bt4—31 to 35 inches; yellowish brown (10YR 5/6) channery sandy clay loam; moderate medium subangular blocky structure; friable to firm; strong brown (7.5YR 5/6) clay films that are medium patchy on vertical faces of peds and thin very patchy on horizontal faces; 15 percent coarse fragments; strongly acid; clear smooth boundary.

BC—35 to 38 inches; brown (7.5YR 5/4) channery clay loam; weak medium subangular blocky structure; firm; thin very patchy brown (7.5YR 5/4) clay films on faces of peds; 20 percent coarse fragments; strongly acid; clear wavy boundary.

C1—38 to 43 inches; strong brown (7.5YR 5/6) channery sandy clay loam; firm; massive; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

C2—43 to 47 inches; brownish yellow (10YR 6/6) channery sandy clay loam; few fine distinct very pale brown (10YR 7/3) mottles; massive; firm; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

C3—47 to 61 inches; strong brown (7.5YR 5/6) very channery sandy clay loam; common medium distinct very pale brown (10YR 7/3) mottles; firm; 30 percent coarse fragments in the upper part increasing to 50 percent in the lower part; very strongly acid; gradual smooth boundary.

R—61 to 63 inches; hard sandstone bedrock.

Thickness of the solum ranges from 30 to 40 inches. Depth to bedrock is dominantly 46 to 84 inches but ranges from 40 to 84 inches. The content of coarse fragments increases with depth and ranges from 0 to 15 percent in the upper part of the Bt horizon and from 20 to 50 percent in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is silt loam or loam. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. Texture in this horizon is loam, sandy clay loam, clay loam, or sandy loam, or a channery analog. Reaction is strongly acid or very strongly acid. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 or 6. Texture in the C horizon is sandy loam or sandy clay loam, or a channery or very channery analog.

Coolville Series

The Coolville series consists of deep, moderately well drained soils formed in a thin silt mantle and in the underlying clayey residuum weathered from acid shale. These soils are on uplands. Permeability is moderate in the upper part of the soil and slow or very slow in the lower part. Slope ranges from 3 to 8 percent.

Coolville soils are similar to Rarden soils and commonly are adjacent to Rarden, Tilsit, Wellston, and Wharton soils. Rarden soils are on the edges or more sloping parts of ridgetops; and Tilsit, Wellston, and Wharton soils are on the parts of ridgetops where the underlying bedrock is dominantly siltstone and sandstone. Wharton soils are also on side slopes. Rarden soils do not have a silt mantle and are moderately deep to a paralithic contact. Tilsit and Wellston soils have more silt and less clay in the subsoil than the Coolville soils. Also, Tilsit soils have a fragipan. Wharton soils have less clay and more sand and coarse fragments in the subsoil.

Typical pedon of Coolville silt loam, 3 to 8 percent slopes, about 0.9 mile north-northeast of Oakland, in Liberty Township; 1,600 feet north and 1,550 feet west of the southeast corner of sec. 10, T. 7 N., R. 19 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few fine faint yellowish brown (10YR 5/4) mottles; weak fine and medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

BA—5 to 10 inches; yellowish brown (10YR 5/6) silty clay loam; weak medium granular structure; friable; common fine roots; thin patchy brown (10YR 4/3) organic coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—10 to 17 inches; yellowish brown (10YR 5/6) silty clay loam; few medium distinct brown (10YR 4/3) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few medium roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); 2 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt2—17 to 24 inches; yellowish brown (10YR 5/4) silty clay; many medium prominent yellowish red (5YR 4/6) and few fine distinct light brownish gray (10YR 6/1) mottles; moderate medium and coarse subangular blocky structure; firm; few medium roots; medium patchy brown (7.5YR 5/4) clay films on faces of peds; few medium black (10YR 2/1) concretions (iron and manganese oxides); 3 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt3—24 to 29 inches; yellowish brown (10YR 5/4) silty clay; many medium prominent yellowish red (5YR 5/6), few fine prominent red (2.5YR 4/6), and few fine prominent gray (N 5/0) mottles; moderate medium prismatic structure parting to strong medium subangular blocky; firm; few fine roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; 3 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt4—29 to 34 inches; variegated red (2.5YR 4/6) and yellowish brown (10YR 5/4) clay; few fine distinct gray (5YR 5/1) and strong brown (7.5YR 5/6) mottles; strong medium subangular blocky structure; very firm; few fine roots; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

2BC—34 to 42 inches; yellowish brown (10YR 5/4) clay; many fine prominent gray (N 5/0); common fine distinct red (2.5YR 4/6), and common coarse prominent strong brown (7.5YR 5/6) mottles; strong medium subangular blocky structure; very firm; 8

percent coarse fragments; very strongly acid; gradual wavy boundary.

2C1—42 to 49 inches; variegated light brownish gray (2.5Y 6/2), light gray (5Y 6/1), and yellowish brown (10YR 5/6) silty clay; massive parting to platy soft rock fragments; very firm; common medium dark reddish brown (5YR 3/2) stains (iron and manganese oxides) in partings; 5 percent shale fragments; very strongly acid; gradual smooth boundary.

2C2—49 to 60 inches; brown (7.5YR 5/2) shaly silty clay; common coarse prominent yellowish brown (10YR 5/6) and many medium distinct reddish brown (2.5YR 5/4) mottles; massive parting to platy soft rock fragments; very firm; common fine dark brown (7.5YR 3/2) stains (iron and manganese oxides); 20 percent shale fragments; very strongly acid; gradual smooth boundary.

2Cr—60 to 62 inches; variegated gray (5YR 5/1) and yellowish brown (10YR 5/6) thin bedded shale; very firm.

Thickness of the solum ranges from 36 to 60 inches. Depth to a paralithic contact ranges from 40 to 60 inches. Reaction in unlimed areas is strongly acid or very strongly acid throughout the soil. Thickness of the loess mantle ranges from 16 to 24 inches. Coarse fragments are essentially absent in the upper part of the solum, and soft shale fragments make up 2 to 15 percent of the 2Bt horizon and 5 to 25 percent of the BC and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The 2Bt horizon has hue of 10YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay. The 2C horizon has hue of 5YR to 5Y; value of 4 to 6; and chroma of 1 to 6. Texture in this horizon is silty clay loam, silty clay, or clay, or a shaly analog.

Cuba Series

The Cuba series consists of deep, well drained, moderately permeable soils that formed in acid alluvium on flood plains. Slope ranges from 0 to 3 percent.

Cuba soils are similar to Pope soils and commonly are adjacent to Orrville, Piopolis, and Stendal soils on the lower positions on the flood plains. Pope and Orrville soils contain more sand and less silt in the subsoil than the Cuba soils. Orrville and Stendal soils are somewhat poorly drained, and Piopolis soils are poorly drained and very poorly drained. These soils have more gray in the subsoil.

Typical pedon of Cuba silt loam, occasionally flooded, about 2.8 miles southeast of Pattonsville, in Bloomfield Township; 700 feet north and 600 feet east of the southwest corner of sec. 12, T. 8 N., R. 17 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/4) dry; weak medium granular structure; friable; common medium and fine roots; strongly acid; clear smooth boundary.

Bw1—8 to 16 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; strongly acid; clear smooth boundary.

Bw2—16 to 25 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; few fine roots; very strongly acid; gradual wavy boundary.

Bw3—25 to 34 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; thin patchy pale brown (10YR 6/3) silt coatings on vertical faces of peds; strongly acid; gradual wavy boundary.

C—34 to 60 inches; yellowish brown (10YR 5/4) silt loam; massive with vertical partings; friable; thin strata of loam; medium patchy pale brown (10YR 6/3) coatings in vertical partings; strongly acid.

Thickness of the solum ranges from 20 to 40 inches. The soil is strongly acid or very strongly acid throughout, in unlimed areas.

The Ap horizon has chroma of 2 to 4. The Bw and C horizons have value of 4 or 5 and chroma of 4 to 6. The C horizon is silt loam or loam.

Doles Series

The Doles series consists of deep, somewhat poorly drained, slowly permeable soils in valleys of abandoned, preglacial drainage systems. These soils formed in loess and silty colluvium or in old alluvium. Slope ranges from 0 to 3 percent.

Doles soils commonly are adjacent to Omulga and Wyatt soils on slightly higher positions on the landscape. Omulga and Wyatt soils are moderately well drained and have less gray in the subsoil than the Doles soils. Wyatt soils have more clay in the subsoil and do not have a fragipan.

Typical pedon of Doles silt loam, 0 to 3 percent slopes, about 1.4 miles west-northwest of Rocky Hill, in Franklin Township; 325 feet north and 2,100 feet east of the southwest corner of sec. 12, T. 6 N., R. 18 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

E—8 to 11 inches; light yellowish brown (10YR 6/4) silt loam; common fine distinct light gray (10YR 7/1) and few medium distinct yellowish brown (10YR 5/4) mottles; weak medium and thick platy structure; friable; common fine roots; strongly acid; abrupt wavy boundary.

BE—11 to 15 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light gray (2.5Y 7/2) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; thin patchy light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt1—15 to 22 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy dark yellowish brown (10YR 4/4) clay films and continuous light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt2—22 to 29 inches; light yellowish brown (10YR 6/4) silt loam; common fine and medium distinct light gray (2.5Y 7/2) and common medium faint yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin patchy dark yellowish brown (10YR 4/4) clay films and continuous light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Bt3—29 to 35 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light gray (2.5Y 7/2) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin patchy dark yellowish brown (10YR 4/4) clay films and continuous light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

Btxg—35 to 50 inches; light brownish gray (10YR 6/2) silty clay loam; common medium faint light gray (10YR 6/1) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure; very firm and brittle; medium continuous light gray (10YR 7/2) coatings and medium patchy light brownish gray (10YR 6/2) clay films on faces of peds and in voids; very strongly acid; gradual wavy boundary.

Btx—50 to 60 inches; yellowish brown (10YR 5/6) silt loam; few medium faint strong brown (7.5YR 5/6) and many medium distinct light gray (10YR 7/1) mottles; moderate very coarse prismatic structure; very firm and brittle; medium patchy light gray (10YR 7/2) silt coatings and thin patchy light brownish gray (10YR 6/2) clay films on faces of peds and in voids; very strongly acid; clear wavy boundary.

BCg—60 to 71 inches; gray (10YR 6/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure; firm; thin patchy light brownish gray silt coatings on faces of peds; strongly acid.

Thickness of the solum ranges from 52 to 95 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. The Bt horizon has hue of 10YR, value of 4 to 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, value of 4 to 6, and chroma of 2 to 6. It is silt loam or silty clay loam and strongly acid or very strongly acid. The BC horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is silt loam or silty clay loam and is strongly acid or very strongly acid.

Ernest Series

The Ernest series consists of deep, moderately well drained soils on foot slopes, at the head of drainageways, and on high, concave saddles of uplands. These soils formed in colluvium from shale, siltstone, and sandstone. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. Slope ranges from 8 to 25 percent.

Ernest soils are similar to Omulga and Tilsit soils and commonly are adjacent to Clymer, Omulga, and Wharton soils. Omulga and Tilsit soils have more silt and less sand in the subsoil than the Ernest soils. Omulga soils are in valleys of abandoned preglacial drainage systems. Clymer and Wharton soils are on hillsides and ridgetops. They do not have a fragipan.

Typical pedon of Ernest silt loam, 8 to 15 percent slopes, about 1.9 miles southwest of Mabee Corner, in Hamilton Township; 650 feet south and 2,175 feet west of the northeast corner of sec. 28, T. 5 N., R. 19 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine and medium roots; 3 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—8 to 13 inches; strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; firm; few fine roots; 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt1—13 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; thin patchy very pale brown (10YR 7/4) silt coatings on vertical faces of peds; 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—20 to 25 inches; yellowish brown (10YR 5/6) shaly silt loam; common fine distinct light gray (10YR 7/2) and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; thin patchy very pale brown (10YR 7/4) silt coatings on vertical faces of peds; 15 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—25 to 31 inches; yellowish brown (10YR 5/6) shaly silt loam; few fine distinct light gray (10YR 7/1) and common coarse distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; thin patchy white (10YR 8/2) silt coatings on vertical faces of peds; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

Btx1—31 to 42 inches; yellowish brown (10YR 5/6) shaly loam; common fine distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure; very firm and brittle; thin patchy brown (7.5YR 5/4) clay films on vertical faces of peds; thin patchy light gray (10YR 7/2) silt coatings on vertical faces of peds; few fine distinct black (10YR 2/1) concretions (iron and manganese oxides); 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

Btx2—42 to 48 inches; yellowish brown (10YR 5/6) shaly loam; common fine distinct light gray (10YR 7/2) mottles; moderate very coarse prismatic structure; very firm and brittle; thin patchy brown (7.5YR 5/4) clay films on vertical faces of peds; thin patchy light yellowish brown (10YR 6/4) silt coatings on vertical faces of peds; few fine and medium very dark grayish brown (10YR 3/2) concretions and stains (iron and manganese oxides); 20 percent coarse fragments; very strongly acid; gradual wavy boundary.

Btx3—48 to 62 inches; yellowish brown (10YR 5/6) shaly silt loam; common medium distinct light gray (10YR 7/2) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure; very firm and brittle; thin patchy brown (7.5YR 5/4) clay films on vertical faces of peds; 15 percent coarse fragments; very strongly acid; clear wavy boundary.

C—62 to 70 inches; yellowish brown (10YR 5/6) loam; common medium distinct light brownish gray (10YR 6/2) and few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; thin patchy light gray (10YR 7/2) silt coatings in partings; 12 percent coarse fragments; very strongly acid.

Thickness of the solum ranges from 45 to 72 inches. Depth to the fragipan ranges from 24 to 36 inches. The content of coarse fragments ranges from 0 to 10 percent in the A horizon, 5 to 25 percent in the Bt horizon, and 5 to 20 percent in the Btx and C horizons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam, or a shaly analog. Reaction in the Bt horizon is strongly acid or very strongly acid. The Btx horizon has hue of 10YR, value of 5, and chroma of 4 to 6. It is loam, silt loam, or clay loam or a shaly or channery analog. Reaction in the Btx horizon is strongly acid or very strongly acid. The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, loam, silt loam, or clay loam or a shaly or channery analog. Reaction in the C horizon is strongly acid or very strongly acid.

Fairpoint Series

The Fairpoint series consists of deep, well drained, moderately slowly permeable soils on mine spoil ridges and benches. These soils formed in partly weathered fine earth material that contains fragments of shale, sandstone, and siltstone. Slope ranges from 0 to 25 percent.

Fairpoint soils commonly are adjacent to Bethesda, Clymer, Rarden, and Wharton soils. In areas of Bethesda soils more acid bedrock was encountered during mining, and the soils are more acid throughout. They have not been reclaimed. Clymer, Rarden, and Wharton soils are in unmined areas and have fewer coarse fragments throughout. They have an argillic horizon.

Typical pedon of Fairpoint silty clay loam, 8 to 25 percent slopes, about 0.7 mile south-southwest of Pyro, in Madison Township; about 2,700 feet north and 2,800 feet east of the southwest corner of sec. 17, T. 7 N., R. 17 W.

Ap—0 to 3 inches; yellowish brown (10YR 5/4) silty clay loam, very pale brown (10YR 7/3) dry; weak medium granular structure; firm; common fine roots; 10 percent coarse fragments of shale; a few fragments of sandstone; slightly acid; abrupt smooth boundary.

C1—3 to 12 inches; mixed 60 percent yellowish brown (10YR 5/6) and 40 percent grayish brown (2.5YR 5/2) shaly silty clay loam; massive; firm; few fine roots; 25 percent coarse fragments of shale, sandstone, and siltstone; medium acid; abrupt wavy boundary.

C2—12 to 20 inches; mixed 60 percent grayish brown (2.5Y 5/2) and 40 percent yellowish brown (10YR 5/4) very channery silty clay loam; massive; firm; few fine roots; 50 percent coarse fragments of sandstone and shale; slightly acid; clear wavy boundary.

C3—20 to 60 inches; mixed 70 percent grayish brown (2.5Y 5/2) and 30 percent yellowish brown (10YR 5/4) very channery silty clay loam; massive; firm; 55 percent coarse fragments of sandstone and shale; a few fragments of coal; neutral.

Reaction in these soils ranges from medium acid to neutral. The content of coarse fragments, mainly shale and sandstone, ranges from 5 to 15 percent in the A horizon and from 20 to 75 percent in the C horizon.

The Ap horizon has hue of 10YR or 2.5YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silty clay loam but is silt loam or clay loam in some pedons. The C horizon has hue of 7.5YR to 5Y or is neutral; and it has value of 4 to 6 and chroma of 0 to 8. Texture in this horizon is a shaly, very shaly, extremely shaly, channery, very channery, or extremely channery analog of silty clay loam, clay loam, or loam.

Omulga Series

The Omulga series consists of deep, moderately well drained soils that formed in loess, colluvium, or old alluvium and, in most areas, the underlying lacustrine sediments. These soils are in valleys of abandoned preglacial drainage systems. Permeability is moderate above the fragipan and slow in the fragipan. Slope ranges from 0 to 15 percent.

Omulga soils commonly are adjacent to Allegheny, Doles, and Wyatt soils and are similar to Ernest and Tilsit soils. Allegheny and Wyatt soils are on side slopes above or below Omulga soils. They do not have a fragipan. Doles soils are somewhat poorly drained soils in slightly lower lying areas. They have more gray colors in the subsoil than the Omulga soils. Ernest soils have more sand and less silt above the fragipan. Tilsit soils have a lower base saturation in the lower part of the solum. They formed in residuum from shale, siltstone, and sandstone.

Typical pedon of Omulga silt loam, 0 to 3 percent slopes, about 2 miles southwest of Petersburg, in Scioto Township; about 600 feet south and 1,400 feet west of the northeast corner of sec. 30, T. 6 N., R. 19 W.

Ap—0 to 11 inches; dark brown (10YR 4/3) silt loam; pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; one percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—11 to 17 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; thin very patchy yellowish brown (10YR 5/6) clay films on faces of peds; one percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—17 to 22 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure parting to weak medium platy; friable; few fine roots; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; thick continuous light yellowish brown (10YR 6/4) silt coatings on vertical faces of peds; one percent coarse fragments; very strongly acid; gradual wavy boundary.

B/E—22 to 27 inches; yellowish brown (10YR 5/6) silt loam (Btx); few medium faint strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium platy; very firm; some brittleness; medium patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very thick continuous pale brown (10YR 6/3) silt coatings on vertical faces of peds make up 10 to 15 percent of the volume (E); one percent coarse fragments; extremely acid; clear wavy boundary.

Btx1—27 to 38 inches; yellowish brown (10YR 5/6) silt loam; moderate very coarse prismatic structure parting to moderate medium platy; very firm, brittle; medium patchy yellowish brown (10YR 5/6) clay films on faces of peds; thick continuous light brownish gray (10YR 6/2) silt coatings on vertical faces of peds; yellowish brown (10YR 5/8) rind between the coating and ped interior; one percent coarse fragments; extremely acid; gradual smooth boundary.

Btx2—38 to 49 inches; yellowish brown (10YR 5/6) silt loam; moderate very coarse prismatic structure; very firm, brittle; medium patchy yellowish brown (10YR 5/6) clay films on faces of peds; thick continuous light brownish gray (10YR 6/2) silt coatings on vertical faces of peds; yellowish brown (10YR 5/8) rind between the coating and ped interior; one percent coarse fragments; very strongly acid; gradual smooth boundary.

B't1—49 to 65 inches; yellowish brown (10YR 5/6) silty clay loam; moderate very coarse prismatic structure parting to weak fine subangular blocky; very firm; thin very patchy yellowish brown (10YR 5/6) clay films on faces of peds; thick continuous light brownish gray (10YR 6/2) silt coatings on vertical faces of peds; one percent coarse fragments; very strongly acid; gradual smooth boundary.

2B't2—65 to 71 inches; yellowish brown (10YR 5/4) clay; weak coarse prismatic structure; very firm; very strongly acid; gradual smooth boundary.

2BC—71 to 79 inches; yellowish brown (10YR 5/6) sandy clay loam; weak coarse prismatic structure; firm; very strongly acid; gradual smooth boundary.

2C—79 to 85 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; very strongly acid.

The thickness of the solum ranges from 50 to 100 inches. Content of gravel ranges from 0 to 5 percent above the fragipan, from 0 to 10 percent in the Btx and B't horizons, and from 0 to 15 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It commonly is very strongly acid to medium acid, but it ranges to neutral where limed. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam and strongly acid to extremely acid. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is silt loam or silty clay loam and is strongly acid to extremely acid. The B't horizon has colors similar to those in the Btx horizon. It is silt loam, silty clay loam, clay loam, clay, or loam. The B't, BC, and C horizons below a depth of 60 inches are stratified in layers which range from sandy loam to clay. These horizons are very strongly acid to medium acid.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in alluvium. Permeability is moderate. Slope ranges from 0 to 3 percent.

Orrville soils commonly are adjacent to Omulga, Piopolis, and Pope soils and are similar to Stendal soils. Omulga soils are moderately well drained soils in valleys of abandoned preglacial drainage systems. They have a fragipan. Piopolis soils are on lower positions on the flood plains than the Orrville soils, and Pope soils are on higher positions. Piopolis soils are very poorly drained soils that have more gray colors in the subsoil than Orrville soils. Pope soils are well drained and have less gray in the subsoil. Stendal soils have more silt and less sand in the subsoil and are on flood plains and low stream terraces.

Typical pedon of Orrville silt loam, frequently flooded, about 2.8 miles south of Centerville, in Madison Township; about 1,000 feet south and 410 feet west of the northeast corner of sec. 1, T. 6 N., R. 17 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; moderate fine and medium granular structure; friable; many fine roots; few fine very dark grayish brown (10YR 3/2) concretions and stains (iron and manganese oxides); 3 percent gravel; slightly acid; abrupt smooth boundary.

Bw—10 to 15 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light gray (10YR 7/2) mottles; weak medium subangular blocky structure; friable; few fine roots; few fine dark brown (7.5YR 3/2) concretions (iron and manganese oxides); 2 percent gravel; slightly acid; clear wavy boundary.

Bg1—15 to 28 inches; light brownish gray (2.5Y 6/2) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; common medium dark brown (7.5YR 4/4) concretions and stains (iron and manganese oxides); 4 percent gravel; medium acid; clear wavy boundary.

Bg2—28 to 36 inches; light brownish gray (10YR 6/2) loam; many medium and coarse distinct brown (10YR 5/3) and few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; common medium dark brown (7.5YR 4/4) stains (iron and manganese oxides); 3 percent gravel; medium acid; clear wavy boundary.

Cg1—36 to 50 inches; light brownish gray (10YR 6/2) loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; many fine and medium dark brown (7.5YR 4/4) concretions and stains (iron and manganese oxides); 10 percent gravel; strongly acid; clear wavy boundary.

Cg2—50 to 60 inches; light brownish gray (2.5Y 6/2) sandy loam; many medium and coarse prominent strong brown (7.5YR 5/6) mottles; massive; friable; common medium dark brown (7.5YR 4/4) concretions and stains (iron and manganese oxides); 12 percent gravel; medium acid.

Thickness of the solum ranges from 24 to 50 inches. The content of coarse fragments of mainly gravel ranges from 0 to 5 percent in the A horizon and 0 to 15 percent in the B and C horizons.

The Bw and Bg horizons have hue of 10YR to 5Y, value of 5 or 6, and chroma of 2 to 4. They are silt loam or loam. Reaction in these horizons is slightly acid or medium acid. The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 2 to 6. It is commonly stratified with loam, silt loam, or sandy loam and less commonly clay loam. Below a depth of 40 inches, subhorizons of loamy sand are present in some pedons. Reaction is slightly acid to strongly acid.

Piopolis Series

The Piopolis series consists of deep, poorly drained and very poorly drained, slowly permeable soils formed in alluvium on flood plains. Slope ranges from 0 to 3 percent.

Piopolis soils commonly are adjacent to the better drained Cuba, Orrville, Pope, and Stendal soils. Cuba, Orrville, Pope, and Stendal soils are on higher positions on flood plains and low stream terraces. Orrville and Pope soils contain more sand and less silt in the subsoil than Piopolis soils.

Typical pedon of Piopolis silt loam, frequently flooded, about 1.2 miles west-northwest of Clay, in Franklin Township; about 1,400 feet north and 1,225 feet west of the southeast corner of sec. 35, T. 6 N., R. 18 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam; moderate coarse granular structure; friable; many fine roots; common fine dark brown (7.5YR 4/4) concretions and stains (iron and manganese oxides); medium acid; abrupt smooth boundary.

Cg1—7 to 12 inches; gray (5Y 6/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; few fine roots; thin patchy light brownish gray (10YR 6/2) silt coatings on faces of peds; common fine dark brown (7.5YR 4/4) concretions and stains (iron and manganese oxides); strongly acid; clear wavy boundary.

Cg2—12 to 26 inches; gray (5Y 6/1) silty clay loam; common medium distinct yellowish brown (10YR

5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; few fine roots; thin patchy light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; many fine and medium distinct dark brown (7.5YR 4/4) concretions and stains (iron and manganese oxides); strongly acid; clear wavy boundary.

Cg3—26 to 40 inches; gray (10YR 6/1) silty clay loam; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; common fine and medium distinct dark brown (7.5YR 4/4) and very dark grayish brown (10YR 3/2) concretions and stains (iron and manganese oxides); strongly acid; clear wavy boundary.

Cg4—40 to 60 inches; light gray (10YR 7/1) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; many medium distinct dark brown (7.5YR 3/2) concretions and stains (iron and manganese oxides); strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Commonly it is silt loam, but in some pedons it is silty clay loam. The Cg horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2. Reaction is very strongly acid or strongly acid. The Cg horizon below a depth of 40 inches commonly is silt loam or silty clay loam. Thin layers of silty clay or clay loam are in some pedons.

Pope Series

The Pope series consists of deep, well drained soils formed in alluvium on flood plains and low stream terraces. Permeability is moderate or moderately rapid. Slope ranges from 0 to 3 percent.

Pope soils are similar to Cuba soils and commonly are adjacent to Orrville, Piopolis, and Stendal soils. Cuba soils have more silt and clay and less sand in the subsoil than the Pope soils. Orrville and Stendal soils are somewhat poorly drained, and Piopolis soils are poorly drained and very poorly drained. They are in slightly lower positions on the landscape than the Pope soils and have more gray in the subsoil.

Typical pedon of Pope silt loam, frequently flooded, about 1 mile east-northeast of Middleton, in Milton Township; about 1,900 feet north and 1,725 feet west of the southeast corner of sec. 15, T. 9 N., R. 17 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; pale brown (10YR 6/3) dry; weak coarse granular structure; friable; common fine roots; medium acid; gradual wavy boundary.

Bw1—9 to 16 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; common fine roots; medium acid; gradual wavy boundary.

Bw2—16 to 32 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; common fine roots; strongly acid; gradual wavy boundary.

BC—32 to 40 inches; light yellowish brown (10YR 6/4) loam; few fine faint pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; friable; few fine roots; few pebbles; strongly acid; gradual wavy boundary.

C1—40 to 55 inches; dark yellowish brown (10YR 4/4) sandy loam; massive; friable; strongly acid; gradual wavy boundary.

C2—55 to 60 inches; yellowish brown (10YR 5/6) loamy sand; few coarse distinct pale brown (10YR 6/3) mottles; single grained; loose; medium acid.

Thickness of the solum ranges from 30 to 50 inches. If not limed, the A and B horizons are strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is silt loam, sandy loam, or fine sandy loam. The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is silt loam, loam, sandy loam, or fine sandy loam. The C horizon is stratified or unstratified loamy sand, sandy loam, or loam.

Rarden Series

The Rarden series consists of moderately deep, moderately well drained, slowly permeable soils that formed in residuum from acid clay shale on uplands. Slope ranges from 3 to 50 percent.

Rarden soils are similar to Coolville soils and commonly are adjacent to Shelocta soils on side slopes and to Clymer, Rigley, and Wharton soils on side slopes and ridgetops. Coolville soils have a thicker silt mantle and are more than 40 inches deep to bedrock. Clymer, Rigley, Shelocta, and Wharton soils are deep to bedrock and have more sand and less clay in the subsoil. Clymer, Rigley, and Shelocta soils are well drained and do not have gray mottles in the subsoil.

Typical pedon of Rarden silt loam in an area of Rarden-Wharton silt loams, 8 to 15 percent slopes, eroded, about 3 miles southwest of Jackson, in Liberty Township; 1,535 feet west and 1,500 feet south of northeast corner of sec. 35, T. 7 N., R. 19 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam; pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; strongly acid; abrupt smooth boundary.

Bt1—6 to 10 inches; strong brown (7.5YR 5/6) silty clay loam; weak medium subangular blocky structure; firm; many fine roots; thin very patchy brown (7.5YR 5/4) clay films on faces of peds; 2 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—10 to 15 inches; yellowish red (5YR 5/6) silty clay; few fine prominent pinkish gray (7.5YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium patchy strong brown (7.5YR 4/6) clay films on faces of peds; common dark brown (7.5YR 3/2) segregations on faces of peds; 3 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bt3—15 to 22 inches; yellowish red (5YR 4/6) silty clay; common fine prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; medium patchy strong brown (7.5YR 4/6) clay films on faces of peds; dark brown (7.5YR 3/2) stains (iron and manganese oxides) on faces of peds; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—22 to 29 inches; yellowish red (5YR 5/6) silty clay; common medium prominent light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; medium patchy gray (10YR 6/1) silt coatings and medium patchy strong brown (7.5YR 4/6) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—29 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light gray (10YR 7/2) and few fine faint yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; 10 percent coarse fragments; very strongly acid; gradual wavy boundary.

Cr1—34 to 40 inches; yellowish brown (10YR 5/4) thin bedded, soft shale; firm; light brownish gray (10YR 6/2) coatings in partings; diffuse wavy boundary.

Cr2—40 to 50 inches; yellowish brown (10YR 5/4) thin bedded, soft shale; can be cut with difficulty with a spade.

Solum thickness and depth to a paralithic contact range from 20 to 40 inches. The content of coarse fragments is commonly less than 15 percent throughout the solum, but in some pedons it is as much as 30 percent just above the paralithic contact. The solum is strongly acid or very strongly acid, except for upper horizons in pedons that have been limed.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. Typically it is silt loam, but in some pedons it is silty clay loam. The Bt horizon has dominant hue of 5YR or 2.5YR. Thin subhorizons of 7.5YR hue are in the upper part of many pedons. The Bt horizon has color value of 3 to 7 and chroma of 4 to 8. Texture of the Bt horizon is silty clay or clay, except for a thin subhorizon of silty clay loam in the upper part. The BC horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 4 to 6. Texture is silty clay, clay, or silty clay loam, or a shaly analog.

Richland Series

The Richland series consists of deep, well drained soils formed in loamy colluvial material over clayey lacustrine deposits on foot slopes. Permeability is moderate in the subsoil and slow or very slow in the substratum. Slopes range from 8 to 15 percent.

Richland soils commonly are adjacent to Allegheny, Ernest, Omulga, Shelocta, and Wyatt soils. Allegheny soils are on terraces. Allegheny, Ernest, and Shelocta soils do not have clay or silty clay in the substratum. Ernest soils are on landscape positions similar to those of Richland soils. Ernest and Omulga soils have a fragipan. Omulga and Wyatt soils are on foot slopes and toe slopes. Wyatt soils have more clay in the subsoil. Shelocta soils are on side slopes.

Typical pedon of Richland silt loam, clayey substratum, 8 to 15 percent slopes, about 1.2 miles northwest of Glade, in Scioto Township; 2,350 feet north and 700 feet east of the southwest corner of sec. 1, T. 6 N., R. 20 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; friable; many fine roots; 3 percent coarse fragments; medium acid; abrupt smooth boundary.

BA—5 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; many fine roots; thin very patchy dark brown (10YR 4/3) organic coatings on faces of peds; 5 percent coarse fragments; medium acid; abrupt wavy boundary.

Bt1—10 to 14 inches; yellowish brown (10YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; 8 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—14 to 27 inches; strong brown (7.5YR 5/6) clay loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin patchy brown (7.5YR 4/4) clay films on faces of peds; 12 percent coarse fragments; medium acid; clear wavy boundary.

Bt3—27 to 37 inches; yellowish brown (10YR 5/4) channery clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; thin patchy brown (7.5YR 4/4) clay films on faces of peds; 17 percent coarse fragments; medium acid; gradual wavy boundary.

BC—37 to 44 inches; yellowish brown (10YR 5/4) channery clay loam; common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; 20 percent coarse fragments; strongly acid; abrupt smooth boundary.

2C—44 to 60 inches; brown (10YR 5/3) silty clay; common coarse distinct gray (10YR 6/1) mottles; massive; firm; slightly acid.

Solum thickness ranges from 44 to 50 inches. The content of coarse fragments ranges from 0 to 15 percent in the A horizon and from 5 to 20 percent in the Bt horizon. Unless the soil has been limed, the solum is strongly acid or medium acid. Depth to the 2C horizon ranges from 40 to 60 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Commonly, it is silt loam, but in some pedons it is loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, clay loam, or silty clay loam or a channery or gravelly analog. The C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 or 4. It is silty clay or clay. Reaction in the C horizon ranges from medium acid to neutral.

Rigley Series

The Rigley series consists of deep, well drained, moderately rapidly permeable soils formed in colluvium and residuum from sandstone on uplands. Slope ranges from 8 to 70 percent.

Rigley soils are similar to Allegheny soils and commonly are adjacent to Clymer, Rarden, Shelocta, and Wharton soils. Allegheny, Clymer, Rarden, Shelocta, and Wharton soils have more clay in the subsoil. Clymer, Rarden, and Wharton soils commonly are on side slopes and ridgetops. Shelocta soils are on side slopes. Rarden soils are moderately deep to bedrock.

Typical pedon of Rigley sandy loam, 15 to 25 percent slopes, about 3.1 miles southeast of Middleton, in Milton Township; 2,375 feet south and 2,625 feet west of the northeast corner of sec. 25, T. 9 N., R. 17 W.

A—0 to 3 inches; dark brown (10YR 3/3) sandy loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; many fine and common medium roots; 3 percent sandstone fragments; very strongly acid; abrupt wavy boundary.

E—3 to 7 inches; brown (10YR 5/3) sandy loam; moderate medium and coarse granular structure; friable; common fine and medium roots; thin patchy dark brown (10YR 4/3) organic coatings on vertical faces of peds; thin patchy pale brown (10YR 6/3) coatings on vertical faces of peds; 4 percent sandstone fragments; very strongly acid; clear wavy boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; friable; few fine and medium roots; thin very patchy strong brown (7.5YR 5/6) clay films on vertical faces of peds; thin very patchy light yellowish brown (10YR 6/4) silt coatings on vertical faces of peds; 3 percent sandstone fragments; very strongly acid; clear wavy boundary.

Bt2—13 to 18 inches; strong brown (7.5YR 5/6) sandy loam; moderate fine and medium subangular blocky structure; firm; few fine and medium roots; thin patchy yellowish red (5YR 4/6) clay films on horizontal faces of peds; 3 percent sandstone fragments; very strongly acid; clear wavy boundary.

Bt3—18 to 27 inches; strong brown (7.5YR 5/6) sandy loam; moderate medium subangular blocky structure; firm; few fine and medium roots; thin patchy yellowish red (5YR 4/6) clay films on faces of peds and bridging sand grains; 5 percent sandstone fragments; very strongly acid; gradual wavy boundary.

Bt4—27 to 37 inches; strong brown (7.5YR 5/6) channery sandy loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin patchy reddish brown (5YR 4/4) clay films on faces of peds and bridging sand grains; 15 percent sandstone fragments; very strongly acid; gradual wavy boundary.

BC—37 to 44 inches; strong brown (7.5YR 5/6) channery sandy loam; weak medium and coarse subangular blocky structure; friable; few fine roots; reddish brown (5YR 4/3) clay films bridging sand grains; 25 percent sandstone fragments; very strongly acid; clear wavy boundary.

C—44 to 60 inches; yellowish brown (10YR 5/6) extremely channery sandy loam; massive; friable; 70 percent weakly cemented sandstone fragments; very strongly acid.

The thickness of the solum ranges from 40 to 50 inches. The content of sandstone coarse fragments ranges from 0 to 25 percent in the Bt horizon and from 25 to 70 percent in the C horizon.

The A horizon has hue of 10YR, value of 3 to 6, and chroma of 2 or 3. The A horizon is loam or sandy loam. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. Some pedons do not have an E horizon. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is sandy loam or loam or a channery analog. Reaction in the Bt horizon ranges from strongly acid to extremely acid. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. It is sandy loam or loamy sand, or a channery, very channery, or extremely channery analog. Reaction in the C horizon ranges from strongly acid to extremely acid.

Shelocta Series

The Shelocta series consists of deep, well drained soils on uplands. These soils formed in colluvium from interbedded shale, siltstone, and sandstone. Permeability is moderate. Slope ranges from 25 to 60 percent.

Shelocta soils are similar to Allegheny, Clymer, and Wharton soils and commonly are adjacent to Brownsville, Rarden, and Rigley soils. Brownsville soils are on side slopes, and Rarden and Rigley soils are on side slopes and ridgetops. Allegheny soils dominantly have rounded coarse fragments in the lower part of the profile. Brownsville soils contain more coarse fragments in the solum than the Shelocta soils and do not have an argillic horizon. Clymer soils contain more sand and less silt in the solum. Rarden and Wharton soils are moderately well drained and have gray mottles in the lower part of the subsoil. Rarden soils also contain more clay in the subsoil and are moderately deep to shale bedrock. Rigley soils contain more sand and less clay in the subsoil.

Typical pedon of Shelocta silt loam in an area of Shelocta-Rarden association, steep, about 3.1 miles northeast of Mabee Corner, in Jefferson Township; about 2,400 feet north and 1,450 feet west of the southeast corner of sec. 7, T. 5 N., R. 18 W.

A—0 to 4 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; moderate fine and medium granular structure; friable; many fine and medium roots; 5 percent coarse fragments; strongly acid; abrupt wavy boundary.

E—4 to 9 inches; brown (10YR 5/3) silt loam; moderate medium and coarse granular structure; friable; common fine and medium roots; thin very patchy dark brown (10YR 3/3) organic coatings on vertical faces of peds; 7 percent coarse fragments; strongly acid; clear wavy boundary.

BE—9 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; firm; few fine and medium roots; thin very patchy brown (10YR 4/3) organic coatings in root channels; 8 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—13 to 30 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; 17 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—30 to 40 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; medium patchy strong brown (7.5YR 5/6) clay films on faces of peds; very pale brown (10YR 7/3) weathered rock fragments; 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—40 to 46 inches; yellowish brown (10YR 5/6) shaly silty clay loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin very patchy strong brown (7.5YR 5/6) clay films on faces of peds; 30 percent coarse fragments; strongly acid; clear wavy boundary.

BC—46 to 48 inches; yellowish brown (10YR 5/6) extremely channery silty clay loam; weak coarse subangular blocky structure; firm; thin very patchy strong brown (7.5YR 5/6) clay films on rock fragments; pale brown (10YR 6/3) weathered rock fragments; 70 percent coarse fragments; very strongly acid; abrupt smooth boundary.

R—48 to 50 inches; interbedded hard siltstone with thin layers of shale.

Thickness of the solum ranges from 40 to 60 inches. Depth to hard rock is more than 48 inches. Coarse fragments make up 5 to 35 percent of the Bt horizon and 30 to 70 percent of the C horizon. Reaction is strongly acid or very strongly acid in the A and Bt horizons.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is silt loam, channery silty clay loam, channery silt loam, or shaly silty clay loam.

Skidmore Series

The Skidmore series consists of deep, well drained soils formed in alluvium on flood plains. Permeability is moderately rapid. Slope ranges from 0 to 3 percent.

Skidmore soils commonly are adjacent to Orrville and Pope soils. Orrville soils are somewhat poorly drained and are on slightly lower positions on the flood plains than the Skidmore soils. Pope soils are on the broader flood plains and have fewer coarse fragments in the subsoil.

Typical pedon of Skidmore gravelly loam, frequently flooded, about 1.1 miles north-northwest of Limerick, in Jackson Township; 1,400 feet north and 1,100 feet west of the southeast corner of sec. 30, T. 8 N., R. 19 W.

Ap—0 to 5 inches; brown (10YR 5/3) gravelly loam; pale brown (10YR 6/3) dry; moderate fine and medium granular structure; friable; many fine roots; 15 percent coarse fragments; medium acid; abrupt smooth boundary.

Bw1—5 to 12 inches; yellowish brown (10YR 5/4) gravelly loam; weak medium and coarse subangular blocky structure; friable; few fine roots; brown (10YR 4/3) fillings in root channels; 15 percent coarse fragments; medium acid; clear smooth boundary.

Bw2—12 to 20 inches; strong brown (7.5YR 5/6) very gravelly sandy loam; weak medium subangular blocky structure; very friable; few fine roots; 35 percent coarse fragments; medium acid; clear wavy boundary.

C1—20 to 36 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; massive; very friable; 55 percent coarse fragments; medium acid; gradual wavy boundary.

C2—36 to 60 inches; light yellowish brown (10YR 6/4) extremely gravelly loamy sand; single grained; loose; 60 percent coarse fragments; medium acid.

The solum thickness ranges from 20 to 40 inches. The content of coarse fragments ranges from 15 to 35 percent in the A horizon, from 10 to 35 percent in the upper part of the B horizon, from 35 to 60 percent in the lower part of the B horizon, and from 35 to 70 percent in the C horizon. Depth to bedrock ranges from 40 to more than 100 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loam or sandy loam, or a gravelly or very gravelly analog. Reaction in the Bw horizon is slightly acid or medium acid. The C horizon has hue of 10YR and value and chroma of 4 to 6. It is very gravelly loam, very gravelly sandy loam, extremely gravelly sandy loam, or extremely gravelly loamy sand.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains and low stream terraces. These soils formed in acid, silty alluvium. Slope ranges from 0 to 3 percent.

Stendal soils are similar to Orrville soils and commonly are adjacent to Cuba, Piopolis, and Pope soils. Cuba and Pope soils are well drained and are on slightly higher positions on the flood plains than the Stendal soils. Also, Pope soils have more sand and less silt between depths of 10 and 40 inches. Orrville soils have more sand between depths of 10 and 40 inches. Piopolis soils are poorly drained and very poorly drained soils on the lowest positions on flood plains. They have more gray in the substratum above a depth of 40 inches.

Typical pedon of Stendal silt loam, occasionally flooded, about 2.6 miles southeast of Pattonsville, in Bloomfield Township; 200 feet east and 1,250 feet north of the southwest corner of sec. 12, T. 8 N., R. 17 W.

Ap—0 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium and coarse granular structure; friable; many fine roots; few fine black (10YR 2/1) concretions (iron and manganese oxides); medium acid; abrupt smooth boundary.

C1—12 to 16 inches; brown (10YR 5/3) silty clay loam; common fine and medium faint light gray (10YR 7/2) mottles; massive parting to weak medium subangular blocky structure; friable; few fine roots; thin very patchy pale brown (10YR 6/3) silt coatings on faces of peds; few fine dark brown (7.5YR 4/4) concretions (iron and manganese oxides); strongly acid; clear wavy boundary.

C2—16 to 19 inches; brown (10YR 5/3) silty clay loam; common medium distinct light gray (10YR 7/1) and many medium distinct yellowish brown (10YR 5/6) mottles; massive parting to weak medium and coarse subangular blocky structure; firm; few fine roots; thin patchy pale brown (10YR 6/3) silt coatings on faces of peds; few fine black (10YR 2/1) concretions (iron and manganese oxides); very strongly acid; clear wavy boundary.

Cg1—19 to 46 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and common medium distinct brown (7.5YR 4/4) mottles; massive parting to weak medium subangular blocky structure; firm; few fine roots; many medium and coarse black (10YR 2/1) and dark brown (7.5YR 3/2) concretions (iron and manganese oxides); strongly acid; clear wavy boundary.

Cg2—46 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 4/4) mottles; massive; firm; thin strata of silt loam; few medium dark brown (7.5YR 4/4) concretions (iron and manganese oxides); strongly acid.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The C horizon to a depth of 40 inches or more has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 3. It is silt loam or silty clay loam. Thin strata of loam are below 40 inches in some pedons. The C horizon is strongly acid or very strongly acid.

Tilsit Series

The Tilsit series consists of deep, moderately well drained soils on uplands. These soils formed in loess and in the underlying residuum from shale, siltstone, or fine grained sandstone. Permeability is moderate above the fragipan and slow in the fragipan. Slope ranges from 3 to 8 percent.

Tilsit soils are similar to Ernest and Omulga soils and commonly are adjacent to Clymer, Rarden, Wellston, and Wharton soils. Clymer, Rarden, Wellston, and Wharton soils are on slight rises and on the edges of ridgetops and side slopes. They do not have a fragipan. Clymer and Wellston soils are well drained. Rarden soils contain more clay in the lower part of the profile than the Tilsit soils and are moderately deep to bedrock. Ernest soils contain more sand in the subsoil. Omulga soils are stratified in the lower part of the profile.

Typical pedon of Tilsit silt loam, 3 to 8 percent slopes, about 2.2 miles southeast of Mulga, in Milton Township; 2,400 feet east and 1,625 feet north of the southwest corner of sec. 12, T. 9 N., R. 17 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium and coarse granular structure; friable; common fine and medium roots; slightly acid; abrupt wavy boundary.

BA—10 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; thin patchy dark grayish brown (10YR 4/2) organic coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—16 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; thin patchy brown (7.5YR 5/4) clay films on faces of peds; thin very patchy yellowish brown (10YR 5/4) silt coatings on faces of peds; few fine dark brown (7.5YR 3/2) concretions and stains (iron and manganese oxides); strongly acid; clear wavy boundary.

2Bt2—24 to 29 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct brown (10YR 5/3) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; medium patchy brown (7.5YR 4/4) clay films on faces of peds; medium patchy very pale brown (10YR 7/3) silt coatings on faces of peds; few fine strong brown (7.5YR 5/6) concretions (iron and manganese oxides); 2 percent coarse fragments; strongly acid; clear wavy boundary.

2Btx1—29 to 36 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct light gray (10YR 7/2) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm and brittle; few fine roots; medium patchy brown (7.5YR 4/4) clay films on vertical faces of peds; medium patchy light yellowish brown (10YR 6/4) silt coatings on vertical faces of peds; few fine dark brown (7.5YR 3/2) concretions and stains (iron and manganese oxides); 2 percent coarse fragments; very strongly acid; gradual wavy boundary.

2Btx2—36 to 42 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct gray (10YR 5/1) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure; very firm and brittle; medium patchy brown (7.5YR 4/4) clay films on faces of peds; medium patchy light brownish gray (10YR 6/2) silt coatings on vertical faces of peds; few fine dark brown (7.5YR 3/2) stains and concretions (iron and manganese oxides); 2 percent shale fragments; very strongly acid; gradual wavy boundary.

2Btx3—42 to 51 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to weak medium platy; very firm and brittle; medium patchy brown (7.5YR 5/4) clay films on faces of peds; medium patchy light brownish gray (10YR 6/2) silt coatings on vertical faces of peds; common fine and medium strong brown (7.5YR 5/8) stains (iron and manganese oxides); 2 percent coarse fragments; very strongly acid; clear wavy boundary.

2Btx4—51 to 58 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct gray (10YR 6/1) and common fine distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure; very firm and brittle; medium patchy brown (7.5YR 5/4) clay films on vertical faces of peds; few fine and medium strong brown (7.5YR 5/6) stains (iron and manganese oxides); 5 percent shale fragments; very strongly acid; clear wavy boundary.

2Cr—58 to 60 inches; thin-bedded, rippable shale.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock is more than 40 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. The Btx horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is loam, silt loam, or silty clay loam. Reaction in the Bt horizon is strongly acid or very strongly acid. The C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is silt loam, silty clay loam, sandy clay loam, or clay loam, or a channery or shaly analog.

Tygart Series

The Tygart series consists of deep, somewhat poorly drained, slowly permeable soils. These soils formed in lacustrine sediments or slack water alluvium in valleys of abandoned, preglacial drainage systems. Slope ranges from 0 to 3 percent.

These soils have illitic mineralogy and a higher base saturation than is defined in the range for the Tygart series. These differences, however, do not alter the use or behavior of the soils.

Tygart soils commonly are adjacent to Doles, Omulga, and Wyatt soils on slightly higher positions. Doles and Omulga soils have a fragipan. Wyatt soils are better drained and have less gray in the subsoil than the Tygart soils.

Typical pedon of Tygart silt loam, 0 to 3 percent slopes, about 0.9 mile north-northwest of Camba, in Franklin Township; about 1,350 feet south and 2,300 feet west of the northeast corner of sec. 22, T. 6 N., R. 18 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine roots; few fine distinct dark brown (7.5YR 4/2) concretions and stains (iron and manganese oxides); slightly acid; abrupt smooth boundary.

BE—10 to 14 inches; brown (10YR 5/3) silt loam; common fine distinct light gray (10YR 7/2) mottles; weak fine subangular blocky structure; firm; few fine roots; thin patchy very pale brown (10YR 7/3) silt coatings on vertical faces of peds; very strongly acid; clear wavy boundary.

Bt1—14 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct light gray (10YR 7/2) mottles; moderate medium and fine subangular blocky structure; firm; thin continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—18 to 26 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct light brownish gray (10YR 6/2) and a few fine faint strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—26 to 38 inches; yellowish brown (10YR 5/6) silty clay; many medium distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; thin continuous light brownish gray (2.5Y 6/2) silt coatings on faces of peds; very strongly acid; gradual smooth boundary.

BC—38 to 56 inches; yellowish brown (10YR 5/4) clay; many medium distinct light gray (10YR 6/1) and grayish brown (2.5Y 5/2) mottles; weak coarse prismatic structure; very firm; thin patchy light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; very strongly acid; clear wavy boundary.

Cg—56 to 66 inches; light olive gray (10YR 6/2) clay; many medium and coarse distinct yellowish brown (10YR 5/6) and common medium prominent greenish gray (5GY 5/1) mottles; massive; very firm; few medium black (10YR 2/1) concretions (iron and manganese oxides); strongly acid.

The thickness of the solum ranges from 40 to 60 inches. Reaction in unlimed areas ranges from medium acid to very strongly acid in the upper part of the solum and is strongly acid or very strongly acid in the lower part of the solum and in the substratum.

The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 to 6. It is dominantly silty clay or clay with thin subhorizons of silty clay loam in the upper part. The C horizon has hue of 10YR or 2.5Y, value of 6, and chroma of 1 or 2. It is silty clay or clay.

Wellston Series

The Wellston series consists of deep, well drained moderately permeable soils. These soils formed in loess and in the underlying residuum from siltstone, sandstone, and shale on uplands. Slope ranges from 3 to 15 percent.

Wellston soils commonly are adjacent to Coolville, Rarden, Rigley, and Tilsit soils. Coolville and Rarden soils contain more clay in the subsoil than the Wellston soils. Also, Rarden soils are moderately deep to bedrock. Rarden and Rigley soils are on ridgetops and side slopes. Rigley soils contain more sand and less silt in the upper part of the subsoil. Tilsit soils have a fragipan. Coolville and Tilsit soils are on the flatter parts of ridgetops.

Typical pedon of Wellston silt loam, 3 to 8 percent slopes, about 2.7 miles west of Jackson, in Liberty Township; about 2,300 feet north and 950 feet west of the southeast corner of sec. 26, T. 7 N., R. 19 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; few fine roots; strongly acid; clear smooth boundary.

BE—8 to 12 inches; brown (10YR 5/3) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; strongly acid; clear smooth boundary.

Bt1—12 to 19 inches; yellowish brown (10YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—19 to 25 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt3—25 to 29 inches; yellowish brown (10YR 5/6) loam; many medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt4—29 to 35 inches; light yellowish brown (10YR 6/4) clay loam; many medium distinct yellowish brown (10YR 5/6) and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and coarse subangular blocky structure; firm; thin very patchy yellowish brown (10YR 5/6) clay films on faces of peds; very strongly acid; gradual smooth boundary.

2BC—35 to 42 inches; light yellowish brown (10YR 6/4) clay loam; many medium distinct yellowish brown (10YR 5/6) and few fine distinct gray (10YR 6/1) mottles; weak medium platy structure; firm; 2 percent coarse fragments; very strongly acid; gradual wavy boundary.

2Cr—42 to 56 inches; brownish yellow (10YR 6/6) weathered soft sandstone bedrock; gradual smooth boundary.

2R—56 to 58 inches; hard sandstone.

Thickness of the solum ranges from 34 to 50 inches. Depth to bedrock ranges from 40 to 72 inches. Coarse fragments commonly are absent in the upper part of the solum and make up 0 to 20 percent of the lower part of the solum.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The BE horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly silty clay loam or silt loam and is strongly acid or very strongly acid. The 2Bt and 2BC horizons have hue of 10YR or 7.5YR, value of 4 or 6, and chroma of 3 to 6. They are silty clay loam, clay loam, or loam or a shaly analog. They are strongly acid or very strongly acid.

Wharton Series

The Wharton series consists of deep, moderately well drained, slowly or moderately slowly permeable soils. These soils formed in residuum and colluvium from shale and siltstone on uplands. Slope ranges from 8 to 25 percent.

Wharton soils are similar to Shelocta soils and commonly are adjacent to Clymer, Rarden, Rigley, and Wellston soils on side slopes and ridgetops. Shelocta soils are on side slopes. Clymer, Rigley, and Shelocta soils are well drained and do not have gray mottles in the subsoil. Rarden soils have more clay in the subsoil than the Wharton soils and are moderately deep to bedrock. Wellston soils have a loess mantle.

Typical pedon of Wharton silt loam, 15 to 25 percent slopes, about 3 miles northeast of Beaver, in Liberty Township; 2,375 feet west and 750 feet south of the northeast corner of sec. 25, T. 7 N., R. 20 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam; weak fine and medium granular structure; friable; many fine roots; 5 percent coarse fragments; slightly acid; abrupt wavy boundary.

BA—5 to 10 inches; brown (10YR 4/3) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; many fine roots; 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—10 to 15 inches; dark brown (7.5YR 4/4) channery silt loam; moderate fine and medium subangular blocky structure; friable; many fine roots; thin very patchy dark brown (7.5YR 4/4) clay films on vertical faces of peds; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—15 to 18 inches; strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; firm; common fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; 12 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—18 to 28 inches; strong brown (7.5YR 5/6) clay loam; few fine distinct yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; medium patchy strong brown (7.5YR 5/6) clay films on faces of peds; common fine very dark grayish brown (10YR 3/2) stains (iron and manganese oxides); 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—28 to 36 inches; yellowish brown (10YR 5/6) clay loam; few fine and medium prominent reddish brown (5YR 5/4), common fine distinct gray (10YR 6/1), and few medium distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—36 to 50 inches; yellowish brown (10YR 5/6) clay loam; common coarse prominent yellowish red (5YR 5/6), many medium distinct gray (10YR 6/1), and few medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; 3 percent coarse fragments; very strongly acid; clear smooth boundary.

Cr—50 to 60 inches; light gray (10YR 7/1) and strong brown (7.5YR 5/6) soft shale bedrock.

Thickness of the solum ranges from 30 to 60 inches. Depth to bedrock is more than 40 inches. Coarse fragments make up 0 to 20 percent of the A and Bt horizons. The soil, in unlimed areas, is strongly acid to extremely acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The BA and Bt horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. They are silt loam, clay loam, or silty clay loam, or a shaly or channery analog.

Wyatt Series

The Wyatt series consists of deep, moderately well drained soils in valleys of abandoned, preglacial drainage systems. These soils formed in clayey lacustrine sediments. Permeability is slow or very slow. Slope ranges from 3 to 25 percent.

Wyatt soils commonly are adjacent to Allegheny, Doles, Omulga, Richland, and Tygart soils. Allegheny and Richland soils are on side slopes and foot slopes above the Wyatt soils. Doles, Omulga, and Tygart soils commonly are on flats and side slopes slightly lower on the landscape than the Wyatt soils. Allegheny soils contain less clay in the subsoil and substratum. Doles and Omulga soils have a fragipan. Doles and Tygart soils are somewhat poorly drained and have more gray in the subsoil. Richland soils have more sand and less clay in the subsoil.

Typical pedon of Wyatt silt loam, 3 to 8 percent slopes, about 0.9 mile north-northwest of Camba, in

Franklin Township; about 2,200 feet west and 1,000 feet south of the northeast corner of sec. 22, T. 6 N., R. 18 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/4) silty clay; weak fine angular and subangular blocky structure; firm; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; thin patchy very pale brown (10YR 7/3) silt coatings on vertical faces of peds; very strongly acid; clear wavy boundary.

Bt2—15 to 19 inches; yellowish brown (10YR 5/6) silty clay; few fine distinct pale brown (10YR 6/3) mottles; moderate medium angular and subangular blocky structure; firm; few fine roots; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; thin patchy very pale brown (10YR 7/3) silt coatings on vertical faces of peds; very strongly acid; clear wavy boundary.

Bt3—19 to 32 inches; yellowish brown (10YR 5/4) clay; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt4—32 to 37 inches; dark yellowish brown (10YR 4/4) clay; few fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak medium angular blocky; firm; few fine roots; thin very patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin patchy gray (10YR 6/1) stress surfaces on faces of peds; very strongly acid; clear smooth boundary.

BC—37 to 53 inches; yellowish brown (10YR 5/4) clay; common coarse prominent gray (5Y 6/1) and common fine distinct yellowish brown (10YR 5/8) mottles; weak medium prismatic structure; very firm; very strongly acid; clear smooth boundary.

C—53 to 63 inches; brown (10YR 5/3) clay with thin lenses of silty clay and silty clay loam; few medium distinct gray (5Y 5/1) mottles; massive parting to platy where laminated; very firm; medium acid in the upper part and neutral in the lower part.

Thickness of the solum ranges from 36 to 60 inches. A silty mantle ranging from less than 1 inch to about 12 inches in thickness is in the upper part of the solum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or silty clay loam. Reaction in the Ap horizon commonly is very strongly acid to medium acid but ranges to neutral in limed areas. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. The Bt horizon is dominantly silty clay or clay with thin subhorizons of silty clay loam in the upper part. Reaction is strongly acid or very strongly acid in the upper part of this horizon, and it ranges from very strongly acid to medium acid in the lower part. The BC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is silty clay or clay. Reaction in the BC horizon is very strongly acid to slightly acid. The C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 or 4. It is silty clay or clay and includes thin strata of silty clay loam or silt loam. Reaction in the C horizon is medium acid to mildly alkaline.

Formation of the Soils

This section describes the major factors of soil formation, tells how these factors have affected the soils in Jackson County, and explains some of the processes of soil formation.

Factors of Soil Formation

Soils form through the actions of weathering and biotic activity on rock and unconsolidated soil material that has been deposited or accumulated through geologic activity. The major factors in soil formation are parent material, climate, relief, living organisms, and time.

The physical and chemical composition of the parent material affects the kind of soil that is formed. Climate and living organisms, particularly vegetation, are the active forces in soil formation. Their effect on the parent material is modified by relief and by the length of time the parent material has been acted upon. Relief modifies the effects of climate and vegetation, mainly through its influence on runoff and temperature. Time is needed for a soil to form from parent material; generally, a long period of time is required for distinct soil horizons to develop. The relative importance of each factor differs from place to place. In some places, one factor dominates and determines most of the soil properties, but normally the interaction of all five factors determines what kind of soil forms in any given place.

Parent Material

The soils of Jackson County formed in several kinds of parent material: residuum, colluvium, loess, lacustrine deposits, old alluvium, and recent alluvium. Loess commonly overlies most other parent materials, and in some places colluvium overlies lacustrine deposits.

Residuum from bedrock is the most extensive of the parent materials in the county. Most of the upland soils formed in residuum. In some areas the upper part of the soil formed in a layer of loess, as much as 30 inches thick, that overlies the residuum. Wellston, Coolville, and Tilsit soils are the principal soils that are capped by loess.

The residuum from shale is fine textured. Rarden soils mainly formed in this parent material. The residuum from interbedded shale, siltstone, and sandstone is medium textured or moderately fine textured. Shelocta and Wharton soils formed mainly in this parent material. The residuum from weakly cemented sandstone is moderately fine textured to moderately coarse textured and is the parent material of Clymer and Rigley soils. The residuum from siltstone and sandstone is medium textured. Brownsville soils formed in this parent material.

Colluvium is weathered bedrock and soil material that has accumulated under the influence of gravity on side slopes and foot slopes. Ernest soils formed in colluvium that weathered from shale, siltstone, and small amounts of sandstone and medium textured soil material.

For some of the Jackson County soils, the parent material consists of colluvium and underlying lacustrine deposits. The subsoil part of these soils is in colluvium, and the substratum, or C horizon part, is in the lacustrine deposits. The colluvium, which moved downslope from the moderately steep or steep hillsides, weathered from a mixture of shale, siltstone, and sandstone and some medium textured or moderately fine textured soil material, and the subsoil formed from this material is medium textured or moderately fine textured. The substratum consists of lakebed silts and clays and is fine textured. Richland soils formed in these parent materials.

Some of the Jackson County soils are derived from fine textured lacustrine deposits and a thin loess mantle. In some places the loess mantle has eroded away. The lacustrine deposits are located mainly in the valleys of preglacial streams—the Teays, Marietta, and Hamden Rivers (*10*). The lacustrine sediments were deposited when the outlet of these rivers was blocked. These lacustrine deposits are fine textured. Their layered, silty and clayey characteristics are reflected in the fine textured, plastic subsoil of such soils as Wyatt and Tygart soils.

Some soils formed in loess, colluvium, or old alluvium deposits and underlying stratified lacustrine deposits. Omulga and Doles soils formed in this parent material. These soils are in valleys in the abandoned preglacial Teays River drainage system. Both the old alluvium and the colluvium are derived from weathered acid, shale, siltstone, and sandstone. The colluvium is from higher lying soils and bedrock formations in the county. The old alluvium is from the surface layer of soils and from bedrock outcroppings in unglaciated areas. Soils formed in these materials have a fragipan that occurs in the colluvium or, if the colluvial portion is absent, in the old alluvium. The fragipan commonly is not as well expressed where the colluvium is thinner or has a higher content of clay than normal.

Some soils formed in old loamy alluvium from weathered sandstone and shale. These soils occur on terraces along streams and on side slopes of high dissected terraces. Allegheny soils formed in this material.

Recent alluvium or recent floodwater deposits are the youngest parent material in the county. These materials are still accumulating as fresh sediment is deposited by the overflow of streams. The sediment is derived from the higher lying soils. Pope, Cuba, Skidmore, Orrville, Stendal, and Piopolis soils developed in this parent material.

Climate

The climate in Jackson County is uniform enough that it has not greatly contributed to differences among the soils. It has been favorable for physical change and chemical weathering of parent material and for the activity of living organisms. Rainfall has been adequate to leach out of the subsoil what carbonates may have been in the parent material of many upland and terrace soils. Omulga and Doles soils, for example, have a strongly acid and very strongly acid subsoil because of leaching. Wyatt soils have been leached of carbonates ranging from a moderate to rather deep depth. Tygart soils have been leached of carbonates to a rather deep depth. Frequency of rainfall caused wetting and drying cycles favorable for the translocation of clay minerals and formation of soil structure common in most of the soils in Jackson County.

The range of temperature in the survey area has favored both physical change and chemical weathering of parent material. Freezing and thawing have aided the formation of soil structure. Warm temperatures in the 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 soils.

Relief

Relief can account for formation of different soils from the same kind of parent material. For example, Wyatt and Tygart soils both formed in loess over fine textured lacustrine clay. The moderately well drained Wyatt soils, however, are in the more sloping areas and on the higher positions on the landscape and the somewhat poorly drained Tygart soils are on the nearly level parts of lacustrine terraces.

Living Organisms

All living organisms play a role in soil formation. These include vegetation, animals, bacteria, and fungi.

At the time Jackson County was settled, the vegetation was predominantly hardwood forest: white oak, black oak, chestnut, beech, sugar maple, red oak, yellow poplar, white ash, and elm. Soils that formed in these forested areas are generally acid and moderate or low in natural fertility.

Small animals, insects, earthworms, and burrowing animals make channels in the soil and make the soil more permeable to movement of water. Animals also mix soil materials and contribute organic matter. Worm channels or casts are most common in the surface layer of soils that have been limed or in soils on flood plains, such as Pope, Cuba, and Skidmore soils. Crayfish channels are found in the somewhat poorly drained Stendal and Orrville soils and the poorly drained and very poorly drained Piopolis soils.

The activities of man also affect soil formation: Man plows, plants, and introduces vegetation. He drains some areas, irrigates some, floods some, and adds and removes soil material from others for construction or surface mining. The use of lime and fertilizer neutralizes acid soil and adds bases.

Time

Time is needed for the other soil forming factors to produce their effects. Generally the longer the time that climate and plants and animals act on parent material, the more distinct the horizons of the soil profile. The age of a soil is indicated, to some extent, by the degree of profile development. In many places, factors other than time have been responsible for most of the differences in profile development among the soils. If the parent material weathers slowly, for example, the profile develops slowly.

Most soils in the county are old and have a well developed profile because their parent materials have been in place and subject to the processes of soil formation for a long time. But on the flood plains, deposition of fresh sediment periodically interrupts the soil forming processes. Pope, Cuba, Skidmore, Orrville, Stendal, and Piopolis soils, which do not have well developed profiles, are flood plain soils.

Processes of Soil Formation

Most soils in Jackson County have strongly expressed profile development, because the processes of soil formation produced very distinct changes in the parent material. These are the upland soils on ridgetops and side slopes, the colluvial soils on foot slopes below steep side slopes, and the old alluvial and lacustrine soils of the Teays River system (*10*). In contrast, the soils on the flood plains and on surface mined areas are only slightly modified from the parent material.

All the factors of soil formation act in unison to control the processes that form different layers in the soil. These processes are additions, losses, transfers, and transformations (*8*). Some processes promote differences between the surface layer, subsoil, and substratum, while other processes retard or destroy differences that are already present. The processes are caused by basic chemical and physical interaction, such as oxidation, reduction, hydration, hydrolysis, solution, eluviation (leaching), illuviation (accumulation), and other highly complex phenomena.

In this survey area, the most evident addition to the soil is organic matter in the surface layer. Some organic matter accumulates under woodland vegetation in a thin layer. If the soil is cleared and cultivated, this organic matter is destroyed. Severe erosion can also remove all evidence of this addition to the soil. Other additions are the deposition of sediment or accumulation of nutrients and colloidal matter from sources, such as organic matter, ground water, lime, and fertilizers. Some nutrients move in a cycle from soil to plant and then back to the soil as byproducts of organic matter decomposition. This is true for all soils in the county, except where this cycle is modified by cropping. Alluvial soils, such as Pope, Cuba, Skidmore, Orrville, Stendal, and Piopolis soils, periodically receive sediment from floodwaters.

Leaching of carbonates from calcareous parent material is one of the most significant losses that precede many other chemical changes in the soils. Good examples of soils in the county that have been partly leached of carbonates are the lacustrine soils. Wyatt soils, for example, have carbonates at a depth ranging from 36 to over 100 inches. Tygart soils have carbonates at a depth greater than 66 inches. Most other soils on the uplands and terraces in Jackson County no longer have carbonates present within 5 feet of the surface and are medium acid to very strongly acid in the subsoil. Following the loss of carbonates, alteration of such minerals as biotite and feldspar results in changes of color within the subsoil. Free iron oxides are produced that may be segregated by a fluctuating high water table to produce gray colors and mottling as in Piopolis, Stendal, Tygart, and Orrville soils. Unless the water table is seasonally high within the soil because of a restricting layer or fragipan as in Doles, Omulga, and Tilsit soils, the brownish colors are typical in most soils in the county.

Seasonal wetting and drying of the soil is largely responsible for the transfer of clay from the surface layer to the faces of peds in the subsoil. The fine clays become suspended in percolating water moving through the surface layer and are deposited in the subsoil by drying or by precipitation caused by free carbonates. This transfer of fine clay accounts for patchy or nearly continuous clay films on faces of peds in the subsoil of most of the soils on uplands and terraces and in preglacial valleys in Jackson County.

Transformation of mineral compounds occurs in most soils. The results are most apparent if the formation of layers is not affected by rapid erosion or by accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly layer lattice silicate clays. Most of the layer lattice clays remain in the subsoil.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a 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.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

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.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—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.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

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.

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.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Perimeter drain. Artificial drain placed around the perimeter of a septic tank absorption field to lower the water table; also called 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.

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

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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.

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 (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded and 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

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.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and reduce erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.