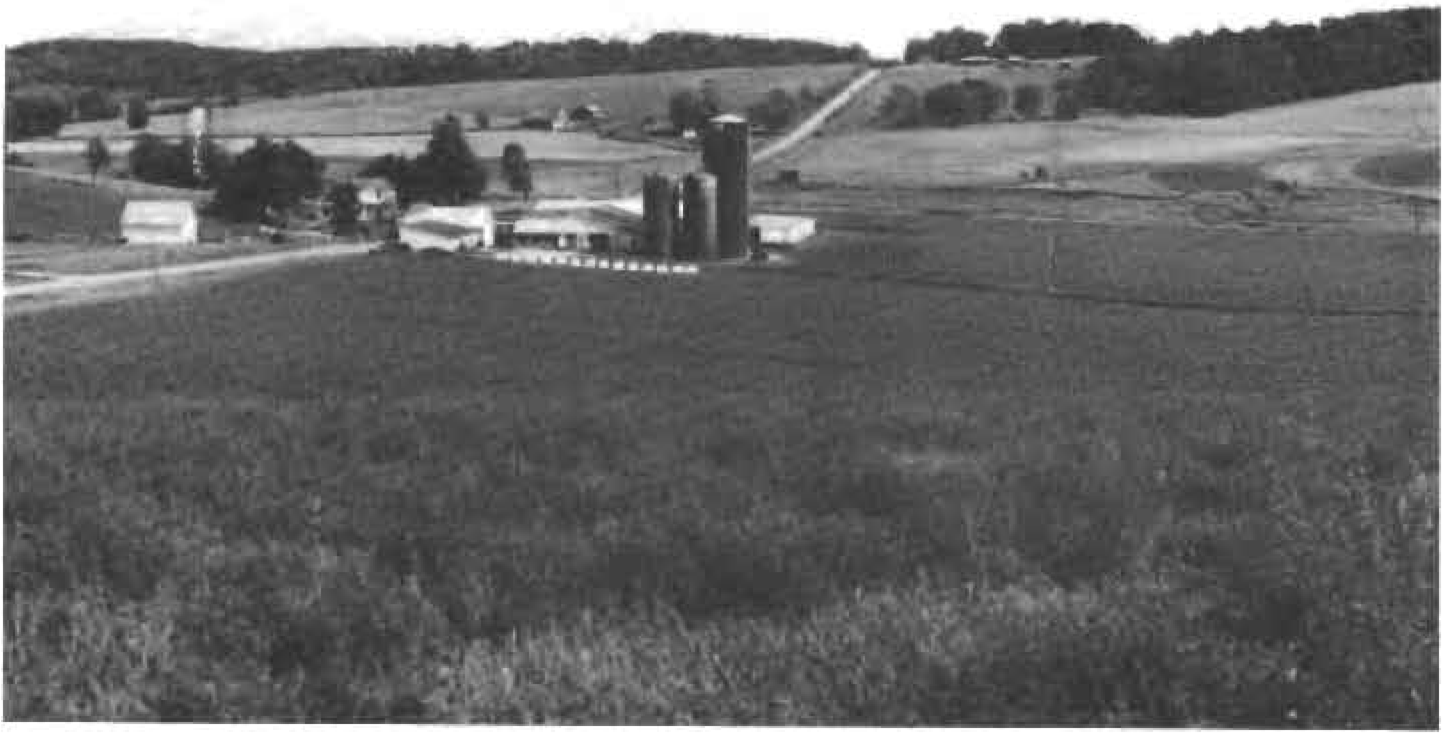
United States
Department of
Agriculture

Soil
Conservation
Service

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

Soil Survey of Licking County, Ohio



How To Use This Soil Survey

General Soil Map

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

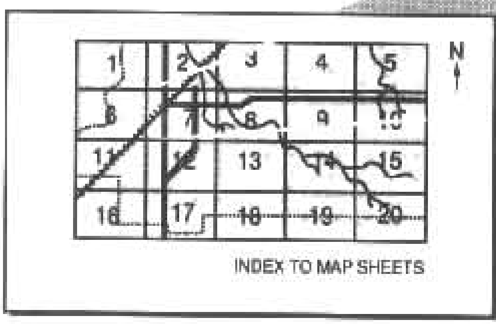
To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

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

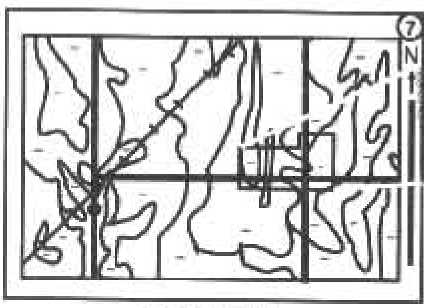
MAP SHEET

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

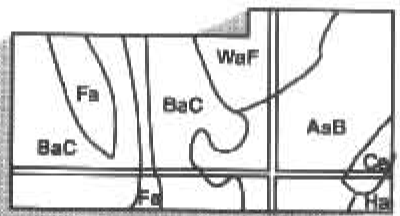


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Licking County Soil and Water Conservation District. The survey was materially aided by the Licking County Board of Commissioners.

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

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

Cover: Typical area of the Homewood-Brownsville-Coshocton association in Licking County. Hay and feed grains are grown for livestock in this area.

Contents

Issued May 1992

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Licking 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 ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are moderately deep 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.

Joseph C. Branco
State Conservationist
Soil Conservation Service

Soil Survey of
Licking County, Ohio

By Robert J. Parkinson, Michael L. Wigginton, and Paul C. Jenny, Soil Conservation Service

Fieldwork by Robert J. Parkinson, Michael L. Wigginton, Paul C. Jenny, Niles A. McLoda, and Mark A. Johnson, Soil Conservation Service

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

Licking County is in the central part of Ohio (fig. 1). It has a total area of 438,976 acres, or 685 square miles. Newark, the county seat, is near the center of the county. In 1980, the population of the county was 120,981 and that of the city of Newark was 41,200.

About two-thirds of the land in Licking County is used for farming *(5)*. The rest is used as woodland or is developed for urban, industrial, residential, or other uses. The acreage of agricultural land is increasingly being converted to nonfarm uses, especially in the Newark-Heath area and in the western part of the county. This development is mainly on prime farmland.

This survey updates the soil survey of Licking County published in 1938 *(26)*. It provides additional information and has larger maps, which show the soils in more detail.

Figure 1.—Location of Licking County in Ohio.

General Nature of the County

This section gives general information about the county. It describes climate; physiography, relief, and drainage; bedrock geology; glacial geology; natural vegetation; agriculture; natural resources; history; and transportation facilities *(25)*.

Climate

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

Licking County typically has cold winters and hot, humid summers. Precipitation in the winter, mainly in the form of snow, and rains early in the spring commonly result in a good accumulation of soil moisture by spring. Severe drought in summer is rare on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Newark, Ohio, for the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 30 degrees F and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Newark on February 3, 1951, is -26 degrees. In summer, the average temperature is 72 degrees and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 103 degrees.

Growing degree days, shown in table 1, 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.

Of the total annual precipitation, about 23.5 inches, or nearly 60 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 20 inches. The heaviest 1-day rainfall during the period of record was 4.16 inches at Newark on September 14, 1979. Thunderstorms occur on about 42 days each year.

The average seasonal snowfall is about 26 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 19 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

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

Tornadoes and severe thunderstorms occur occasionally. These storms are generally local in extent and of short duration and cause damage in scattered areas.

Physiography, Relief, and Drainage

Licking County is in two physiographic provinces. The eastern third is part of the Allegheny Plateau Province, and the rest is on the eastern edge of the glaciated section of the Central Lowlands Province *(19)*.

The highest elevation in the county is about 1,360 feet above sea level. It is in an area in Liberty Township. The lowest elevation is about 740 feet above sea level. It is in an area in Hanover Township where the Licking River leaves the county.

In many areas in the far western part of the county and in the southern part west of Buckeye Lake, the soils generally are nearly level and gently sloping. The natural surface drainage pattern is weakly expressed. Runoff commonly ponds in swales or depressions because few of the major streams in these areas have tributaries.

Relief throughout the west-central part of the county is gently undulating and rolling on moraines and moderately steep to very steep along dissected valleys and on bedrock-controlled hills northeast of Granville, in the Welsh Hills area. The eastern part of the county, or the plateau section, has hilly topography with local relief of about 200 feet between ridgetops and flood plains. Hillsides are relatively long, ridgetops are relatively broad to narrow, and flood plains are relatively narrow.

The Licking River is the principal stream in the county. It forms at the confluence of the North Fork of the Licking River, the South Fork of the Licking River, and Raccoon Creek at Newark (fig. 2). The Licking River flows into Dillon Lake, which is in Muskingum County.

Most of Licking County is drained by the Licking River and its tributaries. The northeastern part, however, is drained by Wakatomika Creek, and the southeastern part is drained by tributaries of Jonathan Creek. These streams are in the Muskingum River drainage basin. Part of western Licking County is drained by tributaries of Big Walnut Creek and Little Walnut Creek, which are part of the Scioto River drainage basin. Several tributaries of Big Walnut Creek, such as Duncan Run and the North Fork, East Fork, and South Fork of Rattlesnake Creek, flow into the Hoover Reservoir, which is in Delaware County.

Major changes in the drainage pattern occurred during the periods of glaciation. Preglacial drainage of Licking County was by two large Teays-stage rivers and their tributaries, which generally flowed southwest into the principal Teays River. The preglacial drainage system was obliterated by the ice as the Teays-stage valleys were filled with glacial drift.

As it advanced, the glacial ice generally gouged the surface by grinding rocks and stones and it dammed rivers. Drainage diversions are common in areas in the eastern part of the county where outlets were blocked by either glacial drift or ice. The ponded water established a new drainage course by overflowing a former divide. Licking Gorge is an example of a drainage diversion that formed during the Illinoian Glaciation.

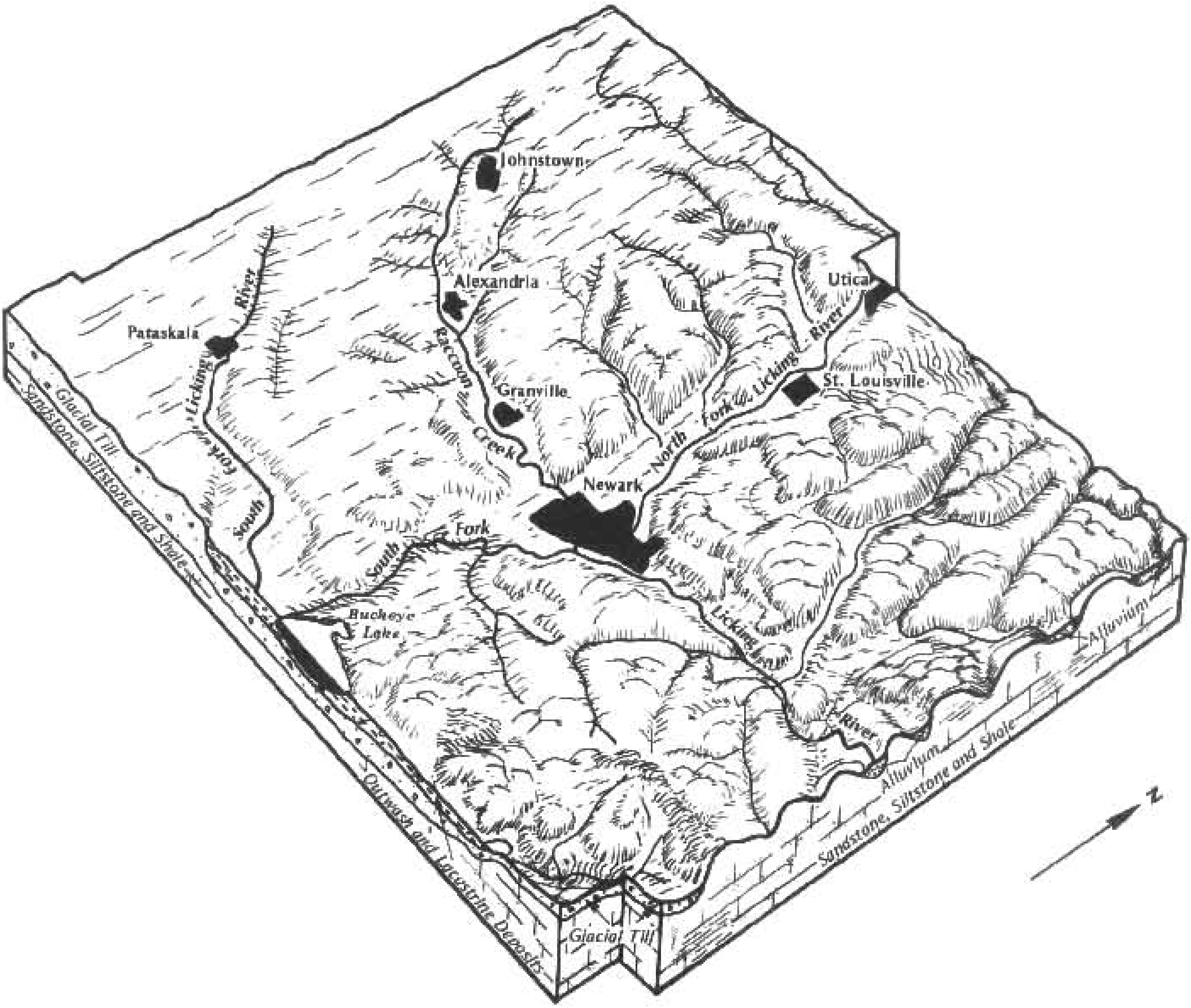


Figure 2.—Drainage, relief, and parent material in Licking County, Ohio.

Bedrock Geology

Licking County is underlain by sedimentary rocks, such as sandstone, siltstone, and shale. These rocks are horizontally bedded and dip slightly to the east. The bedrock in the Central Lowlands Province is of Mississippian age. It is mainly the Cuyahoga Formation. The bedrock on the Allegheny Plateau consists of the Mississippian-age Logan Formation and the Pennsylvanian-age Pottsville and Allegheny Groups, which include the Harrison Formation, Vanport Limestone, and other rocks *(11)*. Two geological features are the Blackhand Gorge, which formed in the Blackhand Sandstone of the Cuyahoga Formation, and the bright colored flint deposits in the Vanport Limestone at Flint Ridge.

The hills on the western edge of the Allegheny Plateau are underlain dominantly by siltstone and fine grained sandstone of the Logan Formation (fig. 3). These bedrock formations dip slightly to the southeast and change from surface to subsurface positions from west to east.

Glacial Geology

Continental glaciers that spread over much of the northern United States advanced through Licking County at least twice during the Pleistocene *(10)*. The earlier glaciation, the Illinoian Glaciation, covered much of the county but did not cover the eastern part. The later glaciation, the Wisconsinan Glaciation, did not advance so far to the east. The Illinoian Glaciation is estimated to have taken place between 132,000 and 302,000 years ago and the Wisconsinan Glaciation about 20,000 years ago *(9, 12)*.

Huge loads of debris consisting of boulders, cobbles, pebbles, sand, silt, and clay were deposited as glacial drift when the glacial ice melted. The mantle of drift in the glaciated part of the county ranges from a few inches to more than 100 feet in thickness. In some areas, drift was not deposited or the deposits have been removed by erosion.

The drift ice was derived from the bedrock over which the glaciers passed. Most of the material was of local origin, although many rocks and other material were carried hundreds of miles by the ice. The drift in this county originated from local sandstone and shale; from the limestone, dolomite, and shale in central and northern Ohio; and from the granite, quartzite, and other crystalline rocks on the Canadian highlands. The proportions of these different rocks varied, but most of the drift had enough limestone, dolomite, and their weathered products to be calcareous. The boulders and other erratics in the county are nearly all granite, quartzite, or other rocks that are resistant to weathering.

In many areas a ground moraine formed when the ice was melting more rapidly than it was advancing. Debris was deposited at the base of the ice as the ice retreated. The drift in the ground moraine is fairly uniform in thickness, and the surface relief coincides generally with the relief of the underlying bedrock. As a result, the ground moraine in the Central Lowlands Province is smooth and is characterized by little topographic expression. Most of the glacial drift on the Allegheny Plateau tends to follow the topography of the underlying bedrock surface.

End moraines formed in areas where the rate at which the ice melted was about equal to its rate of advance. Debris was carried forward to the edge and deposited along the ice front. These moraines are belts of hummocky or rolling topography. Most of them are continuous along the former ice front, but in some areas they are broken or isolated as a result of stream dissection.

Ground moraines and end moraines consist of a compact mass of mixed sand, silt, clay, pebbles, cobbles, and a few boulders. This mass is known as glacial till. Irregular and commonly unpredictable lenses or pockets of sorted sand, silt, clay, or gravel can occur, especially in some areas on end moraines. Unweathered or unoxidized till is gray because of unoxidized minerals. When this till becomes oxidized, its color changes to yellowish brown. As till weathers, the carbonates are leached.

Figure 3.—Thinly bedded siltstone and sandstone of the Logan Formation in an area on the western edge of the Allegheny Plateau. Brownsville soils formed in material weathered from these rocks.

While the glaciers covered this survey area, periods of relatively warm weather caused some debris-filled ice to melt. As the meltwater poured from the glaciers, a system of streams and rivers formed. Temporary lakes formed where the flow was hindered or outlets were blocked. The meltwater carried large quantities of rock material. The cobblestones, pebbles, and coarser sands were deposited by swift water, the finer sands by the more slowly moving water, and the silts and clays by the quiet waters in temporary lakes or ponded areas. Deposits of material laid down by streams flowing from the glaciers are known as glaciofluvial deposits. Deposits laid down in quiet waters or temporary lakes are known as lacustrine deposits.

Outwash sand and gravel have been deposited in the major valleys through which the meltwater from both the Illinoian and Wisconsinan glaciers flowed. Where the Wisconsinan glacier overran the earlier Illinoian deposits, the Illinoian formations were destroyed or covered. If the two kinds of outwash are in the same valley, the Illinoian deposits are in notably higher positions on the landscape than the Wisconsinan deposits. Three separate levels of Wisconsinan outwash terraces have been identified *(10)*. The outwash gravel consists of limestone, sandstone, and some crystalline pebbles. The Illinoian outwash is typically weathered and leached to a considerably greater depth because it is older.

The main deposit of Wisconsinan outwash in the county is in the large valleys along the Licking River and its main tributaries. The Wisconsinan outwash in the eastern and southern parts of the county has more sandstone and less limestone than that elsewhere.

Illinoian outwash is on the high terraces along the Licking River between Newark and Boston. Another major terrace remnant is in the Newton Chapel area, in Newton Township.

Scattered lacustrine deposits are in many nearly level, basinlike areas throughout the area of Wisconsinan drift. The lacustrine material consists of stratified clay, silt, and fine sand deposited in lakes or ponded water. The largest area of lacustrine deposits of Wisconsinan age is in the Buckeye Lake area.

Other glaciofluvial deposits in the county are on kames and kame terraces. Kames are prominent moundlike knolls or hills made up of sorted sediments that were deposited in crevasses in the ice or on the surface of stagnant ice. The hills in the northwestern corner of Hartford Township are examples of kames.

Kame terraces are ice-contact deposits in areas where stratified glacial drift was deposited by meltwater between a valley side and the glacier. The area of high fill along the north side of Licking Valley in Madison Township is an example of a kame terrace.

Some areas on prominent hills were covered by Wisconsinan or Illinoian ice but do not have a mantle of glacial drift. These areas may have been covered by clean ice, which would have carried little debris, or the drift that was deposited may have been completely eroded. Widely scattered glacial erratics are in some of these areas.

Natural Vegetation

Licking County was dominantly forested at the time of settlement. The western half of the county was beech forest, the northwest corner was mixed mesophytic forest, and the southeast corner was mixed oak forest. Elm-ash swamp forests were in the south-central part of the county and in scattered areas in the western half.

The county also had a few small areas of prairie. Bowling Green Prairie, a series of prairies 4 miles below Newark, extended for 1 mile or more along the Licking River. Cranberry Prairie, or Worthen Prairie, in Washington Township was actually a swamp. Cherry Valley Prairie was 1 mile west of Newark. Little Bowling Green Prairie was in an area in Bowling Green Township between the National Road and the Perry County line, and Plum Prairie was in an area in McKean Township along Brushy Fork *(15)*.

Cranberry Island, in Buckeye Lake, is a small bog that supports sphagnum moss and other wetland plants. It is a relict of a boreal forest that was in the survey area during the retreat of the last glacier thousands of years ago.

Agriculture

Agriculture is a primary industry and the primary land use in the county. In 1984, the county had 1,540 farms, which made up about 268,000 acres *(5)*. The average farm size was 174 acres. In that year, corn was grown on about 63,000 acres; soybeans on 49,600 acres; wheat on 13,000 acres; and hay on 27,000 acres. Most of the farmed areas are in the western half of the county. The farmed areas in the hilly eastern part are used mainly as pasture or hayland, but some areas are used as cropland.

In 1984, the income derived from farm products in the county was about 94 million dollars *(14)*. About 73 percent of the income was derived from the sale of livestock and livestock products and 27 percent from the sale of grain crops, hay, nursery crops, vegetables, and fruit. In order of economic importance, the chief farm products in 1984 were poultry and eggs, soybeans, corn, dairy products, cattle and calves, hogs, greenhouse and nursery plants, wheat, oats, and hay *(14)*.

Natural Resources

The natural resources in Licking County include water, sand and gravel deposits, oil and natural gas, and some layers of bedrock.

Licking County has a good supply of surface water and ground water. Adequate supplies of ground water for farm and domestic needs are available in most areas throughout the county, but an adequate supply should be established before rural buildings are constructed. The main source of water for the city of Newark is the North Fork of the Licking River.

The quality and quantity of ground water are largely determined by the type of aquifer that supplies the water. The largest amount of ground water is supplied by outwash deposits in the valleys along the North and South Forks of the Licking River and along Raccoon Creek. Pumping rates of 100 to 500 gallons per minute are common in these areas. Pumping rates of 5 to 25 gallons per minute are common in most of the other areas in the county *(7, 13)*.

In the western part of the county, many wells must be drilled through thick deposits of glacial drift in order to reach the underlying Mississippian-age bedrock. In these areas water is sometimes obtained from thin, discontinuous layers of sand and gravel in the till deposits. Pumping rates in these wells are generally 5 gallons per minute or less.

In the central and eastern parts of the county, most of the ground water is obtained from the Pennsylvanian and Mississippian systems of bedrock. Water-bearing strata include the Pottsville and Allegheny Formations in the Pennsylvanian bedrock and the Logan and Cuyahoga Formations and Berea Sandstone in the Mississippian bedrock.

Sand and gravel are mined mainly from the major outwash terraces along the Licking River and its major tributaries. They also are mined from kames in scattered areas throughout the glaciated part of the county, from some terraces along the smaller streams, and from some creekbeds.

Shallow wells in the Berea Sandstone of the Mississippian bedrock system and deeper wells in the "Clinton" sands of the Silurian system produce oil and gas. Brine wells supply Newark with salt for ice and snow control in winter. Brine also is used in some nearby areas to reduce the extent of road dust in summer.

Rock quarries in the county have provided some building stone for local use. One quarry near Hanover furnishes sandy shale of the Vinton member of the Logan Formation. The shale is used in the manufacture of tile and bricks.

Scattered areas in the southeastern part of the county have been surface mined for deposits of low-sulfur coal in the Pottsville Formation.

History

At one time Indians inhabited the area now known as Licking County. Flint Ridge, in Hopewell Township, was a major source of flint for arrowheads and other implements used by the Indians. Some large prehistoric earthworks are preserved in the Newark area.

The first settlers in the survey area arrived from New England, New Jersey, Pennsylvania, Virginia, Wales, and Germany shortly after the Wayne Treaty of 1795. Emigrants who had sympathized with the American Revolution and were forced to abandon their homes in British provinces settled on the Refugee Tract, 100,000 acres of land that Congress set aside in southern Licking, Fairfield, and Perry Counties.

Licking County was formed from a part of Fairfield County on March 1, 1808. It was named after the Licking River, the principal stream of the county *(15)*.

John Chapman, the legendary Johnny Appleseed, periodically traveled about the county between 1803 and 1820. He established apple orchards for the new settlers.

Ground breaking for the Ohio Canal took place at Licking Summit, which is just outside Newark, on July 4, 1825 *(15)*. In 1852, the first railroad in the county was extended to Newark.

The population of Licking County was 11,861 in 1820 and 40,050 in 1880 *(15)*. It was 59,962 in 1930 and 120,981 in 1980 *(25)*. The area of highest population is in the center of the county, in the cities of Newark and Heath. The population of this area was about 78,600 in 1980.

Transportation Facilities

Licking County has a well developed network of roads, including 13 state highways, 2 U.S. highways, and Interstate Highway 70, which crosses the county from east to west. The county is served by one east-west railroad. A branch extends north to Butler. Another line extends east from Newark to Zanesville. Air transportation is available at the Licking County Airport, the smaller Buckeye Valley Airport, and the nearby Port Columbus International Airport.

How This Survey Was Made

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

The soils in the survey area occur in an orderly pattern that is related to the geology, 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 a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-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, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

Map Unit Composition

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

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

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

Survey Procedures

The general procedures followed in making this survey are described in the "National Soils Handbook" of the Soil Conservation Service. The soil survey of Licking County published in 1938 *(26)*, other published literature, especially material dealing with the geology and soils of the county, and soil survey maps of individual farms made from 1944 to 1977 for conservation planning were among the references used at the start of the survey.

Before the fieldwork began, a general reconnaissance of the major soils and landforms of the entire county was made by car. Soil map units were delineated on aerial photographs taken in 1976 at a scale of 1:38,000 and enlarged to a scale of 1:15,840. Before an area was mapped, the aerial photography and United States Geological Survey topographic maps at a scale of 1:24,000 were used to study the landscape and its topography. In areas that have significant relief, preliminary boundaries of slopes and landforms were stereoscopically plotted on the aerial photo base map. Surface drainage was mapped in the field through the use of aerial photo patterns where applicable.

As they mapped the county, soil scientists traversed the landscape on foot to examine the soils and relate them to the landscape. They used hand augers and spades to examine the soils to a depth of about 4 to 6 feet or to bedrock within a depth of 6 feet.

Most of the traverses were made at intervals of about 200 to 500 yards, depending on the landscape and soil pattern *(16)*. Soil examinations along the traverses were made at selected spots typical of the area being depicted on the maps. In most areas these observations were made at intervals of 100 to 500 yards. Observations of the more shallow soils were made at closer intervals. Such items as landforms, vegetation, and exposed soil profiles were observed in road cuts, along pipelines, and in windthrow pits.

On the maps, the soil scientists depicted areas on the landscape that have different land use patterns and management concerns. The boundaries between these areas were determined on the basis of soil examinations, aerial photo interpretation, and other observations in the field. Cultural features were recorded from visual observations.

At the beginning of the survey, sample areas were selected to represent the major landforms in the county. These preliminary study areas were intensively mapped, and extensive field observations were made of the soils and composition of map units. As the survey progressed, notes were made on field observations, transects to study map unit composition were made, and soil samples were taken. The typical pedons were studied in pits. These pits were dug mostly by hand, but a few were dug with a backhoe.

After completion of the soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs during map finishing.

Samples of some of the most extensive soils in the county were taken for chemical analysis, physical analysis, and engineering properties. The chemical and physical analyses were made by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The results of the analyses are stored in a computerized data file at the laboratory. The analysis of engineering properties was made by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section, Columbus, Ohio. A description of the laboratory procedures and results can be obtained on request from these laboratories. The results of laboratory analyses also can be obtained from the Soil Conservation Service, State Office, Columbus, Ohio, and the Ohio Department of Natural Resources, Division of Soil and Water Conservation, Columbus, Ohio.

General Soil Map Units

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

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

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

Some soil boundaries and soil names in this survey do not fully match those in previously published surveys of adjoining counties. Differences are the result of changes and refinements of series concepts and application of the latest soil classification system.

Soil Descriptions

Nearly Level to Sloping Soils Formed in Glacial Till

These soils make up about 33 percent of the county. They are deep, nearly level to sloping, moderately well drained to very poorly drained soils on till plains. They formed in glacial till. They are used mainly as cropland or pasture. Some areas are used for woodland or urban development. Seasonal wetness, moderately slow or slow permeability, and ponding are the major limitations affecting cropland and nonfarm uses in nearly level and gently sloping areas. The slope and the hazard of erosion are limitations in some areas.

1. Bennington-Pewamo-Centerburg Association

Nearly level and gently sloping, somewhat poorly drained, very poorly drained, and moderately well drained soils; on till plains

This association is mainly on a ground moraine that is characterized by relatively broad flats, low knolls, and ridges interspersed with shallow swales. Where unvegetated, the soils have a striking mottled pattern of light and dark colors. Slopes range from 0 to 6 percent.

This association makes up about 12 percent of the county. It is about 45 percent Bennington soils, 30 percent Pewamo soils, 15 percent Centerburg soils, and 10 percent soils of minor extent.

Bennington soils are deep, nearly level and gently sloping, and somewhat poorly drained. They are on broad flats and low knolls. Permeability is slow. These soils have a perched seasonal high water table between depths of 12 and 30 inches during extended wet periods. They formed in glacial till. Typically, they have a surface layer of dark grayish brown silt loam. The subsoil is yellowish brown and dark yellowish brown, mottled silt loam, silty clay loam, clay loam, and loam.

Pewamo soils are deep, nearly level, and very poorly drained. They are on broad flats, in depressions, and along drainageways. Permeability is moderately slow. These soils have a seasonal high water table near or above the surface and are subject to ponding after periods of heavy rain. They formed in glacial till. Typically, they have a surface layer of very dark grayish brown silty clay loam. The subsoil is multicolored, mottled silty clay loam.

Centerburg soils are deep, gently sloping, and moderately well drained. They are on knolls and ridges. Permeability is moderately slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. These soils formed in glacial till. Typically, the surface layer is brown silt loam. The subsoil is yellowish brown and dark yellowish brown silt loam, silty clay loam, and clay loam. It is mottled in the middle and lower parts.

Minor in this association are seeps and springs on some side slopes and Shoals and Sloan soils on narrow flood plains. Shoals and Sloan soils formed in recent alluvium.

Most areas of this association are used as cropland. Some areas are pastured or wooded. A few areas are being developed for urban uses. The soils are well suited to grain crops, hay, pasture, and trees. They are poorly suited or moderately suited to buildings and septic tank absorption fields.

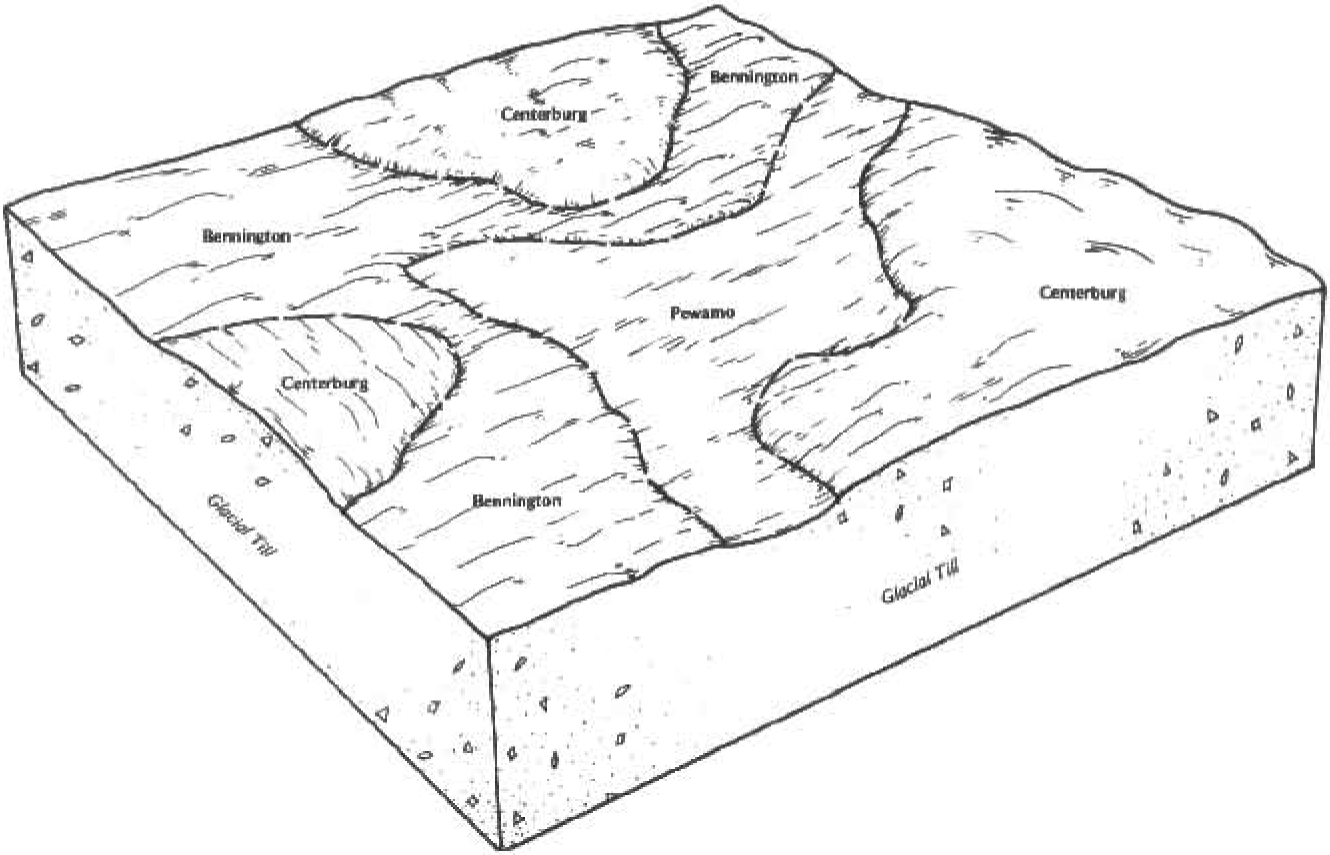


Figure 4.—Typical pattern of soils and parent material in the Centerburg-Bennington-Pewamo association.

Seasonal wetness, ponding, and slow or moderately slow permeability are the main limitations affecting farming and nonfarm uses. Surface and subsurface drains are commonly used to remove excess water in areas of the Bennington and Pewamo soils. Surface crusting after hard rains is a management concern in cultivated areas of the Bennington and Centerburg soils. Maintaining tilth is a management concern if these soils are worked when they are too wet. Controlling erosion in areas of the gently sloping Bennington and Centerburg soils also is a management concern. Properly landscaping building sites helps to keep surface water away from foundations.

2. Centerburg-Bennington-Pewamo Association

Nearly level to sloping, moderately well drained, somewhat poorly drained, and very poorly drained soils; on till plains

This association is in undulating areas on end moraines interspersed with small areas of ground moraines. Slopes range from 0 to 12 percent (fig. 4).

This association makes up about 21 percent of the county. It is about 40 percent Centerburg soils, 30 percent Bennington soils, 15 percent Pewamo soils, and 15 percent soils of minor extent.

Centerburg soils are deep, gently sloping and sloping, and moderately well drained. They are on knolls, on ridges, and on side slopes along drainageways. Permeability is moderately slow. These soils have a perched seasonal high water table between depths of 18 and 36 inches during extended wet periods. They formed in glacial till. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown and dark yellowish brown silt loam, silty clay loam, and clay loam. It is mottled in the middle and lower parts.

Bennington soils are deep, nearly level and gently sloping, and somewhat poorly drained. They are on flats and low knolls. Permeability is slow. These soils have a perched seasonal high water table between depths of 12 and 30 inches during extended wet periods. They formed in glacial till. Typically, they have a surface layer of dark grayish brown silt loam. The subsoil is yellowish brown and dark yellowish brown, mottled silt loam, silty clay loam, clay loam, and loam.

Pewamo soils are deep, nearly level, and very poorly drained. They are on broad flats, in depressions, and along drainageways. Permeability is moderately slow. These soils have a seasonal high water table near or above the surface and are subject to ponding after periods of heavy rain. They formed in glacial till. Typically, they have a surface layer of very dark grayish brown silty clay loam. The subsoil is multicolored, mottled silty clay loam.

Minor in this association are seeps and springs on some side slopes and the somewhat poorly drained Shoals soils on narrow flood plains along small streams.

Most areas of this association are used as cropland. Some areas are pastured or wooded. The soils are well suited or moderately well suited to grain crops. They are well suited to hay, pasture, and trees. They are moderately suited or poorly suited to buildings and septic tank absorption fields.

Seasonal wetness and the hazard of erosion are the major limitations affecting cropland. Surface and subsurface drains are commonly used to remove excess water in areas of the Bennington and Pewamo soils where adequate outlets are available. A system of conservation tillage that leaves crop residue on the surface and crop rotations that include grasses and legumes help to control erosion. Surface crusting after heavy rain is a management concern in cultivated areas of the Centerburg and Bennington soils. Maintaining tilth is a management concern if these soils are worked when they are too wet. Seasonal wetness, ponding, and slow or moderately slow permeability are the main limitations affecting homesites and septic tank absorption fields. Properly landscaping building sites helps to keep surface water away from foundations and helps to control erosion. Because of the better natural drainage, the Centerburg soils are somewhat better suited to some urban uses than the Bennington and Pewamo soils.

Gently Sloping to Very Steep Soils Formed in Glacial Till, Colluvium, and Residuum

These soils make up about 20 percent of the county. They are deep, gently sloping to very steep, well drained and moderately well drained soils on glaciated and unglaciated uplands. They formed in Wisconsinan glacial till, colluvium, and material weathered from siltstone and fine grained sandstone. The gently sloping to moderately steep soils are used mainly as cropland or pasture. The steep and very steep soils are used mainly as woodland. The hazard of erosion, the slope, moderately slow permeability, seasonal droughtiness, seasonal wetness, and the depth to bedrock are the major management concerns.

3. Centerburg-Amanda Association

Gently sloping to very steep, moderately well drained and well drained soils; on dissected parts of till plains

This association consists of gently sloping and sloping soils in undulating areas and interfluves and sloping to very steep soils in dissected areas along drainageways. Slopes range from 2 to 50 percent.

This association makes up about 15 percent of the county. It is about 45 percent Centerburg soils, 30 percent Amanda soils, and 25 percent soils of minor extent.

Centerburg soils are deep, gently sloping and sloping, and moderately well drained. They are on knolls, on ridges, and on side slopes along drainageways. Permeability is moderately slow. These soils have a perched seasonal high water table between depths of 18 and 36 inches during extended wet periods. They formed in glacial till. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown and dark yellowish brown silt loam, silty clay loam, and clay loam. It is mottled in the middle and lower parts.

Amanda soils are deep, gently sloping to very steep, and well drained. They are on knolls, on ridges, and on side slopes along drainageways. Permeability is moderately slow. A perched seasonal high water table is below a depth of 48 inches during extended wet periods. These soils formed in glacial till. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown silty clay loam and clay loam. It is mottled in the lower part.

Some of the minor soils in this association are the somewhat poorly drained Bennington soils on flats and in undulating areas, the somewhat poorly drained Shoals soils on narrow flood plains, and Ockley soils on narrow terrace remnants. Ockley soils have sand and gravel in the substratum.

The gently sloping to moderately steep soils in this association are used mainly as cropland or pasture. In some areas they are wooded. Most of the steep and very steep soils also are wooded. They are well suited to woodland. The less sloping soils are well suited to cropland and pasture, and the moderately steep soils are poorly suited or moderately suited. The gently sloping and sloping soils are moderately suited or well suited to buildings and moderately suited to septic tank absorption fields. The moderately steep and steep soils are poorly suited to buildings. They are poorly suited or generally unsuited to septic tank absorption fields. The very steep soils are generally unsuited to urban uses.

Controlling erosion and improving tilth are the main management concerns in farmed areas. The slope also is a major concern. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion and improve tilth. The slope, seasonal wetness, and moderately slow permeability are limitations on sites for buildings and septic tank absorption fields. Construction sites should be protected against erosion.

4. Brownsville-Mechanicsburg-Amanda Association

Gently sloping to very steep, well drained soils; on glaciated and unglaciated uplands

This association is on narrow to broad ridgetops and on foot slopes and hillsides. The topography commonly ranges from undulating to hilly. Streams are small, and flood plains are relatively narrow. Slopes range from 2 to 70 percent.

This association makes up about 5 percent of the county. It is about 35 percent Brownsville soils, 20 percent Mechanicsburg soils, 20 percent Amanda soils, and 25 percent soils of minor extent.

Brownsville soils are deep and are sloping to very steep. They are on ridgetops and hillsides. Permeability is moderate or moderately rapid. These soils formed in colluvium and residuum derived from siltstone and fine grained sandstone. Typically, they have a surface layer of very dark grayish brown channery silt loam. The subsurface layer is brown channery silt loam. The subsoil is yellowish brown channery silt loam, very channery silt loam, and very channery loam.

Mechanicsburg soils are deep and are gently sloping to steep. They are on ridgetops and hillsides. Permeability is moderate. These soils formed in glacial till and in the underlying material weathered from fine grained sandstone and siltstone. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown silt loam and loam, and the lower part is yellowish brown channery loam and very channery silt loam.

Amanda soils are deep and are gently sloping to very steep. They are on knolls, on ridges, and on side slopes along drainageways. Permeability is moderately slow. A perched seasonal high water table is below a depth of 48 inches during extended wet periods. These soils formed in glacial till. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown silty clay loam and clay loam. It is mottled in the lower part.

Some of the minor soils in this association are Ockley soils on terraces, the somewhat poorly drained Shoals soils on narrow flood plains, and Amanda Variant soils on foot slopes. Ockley soils have sand and gravel in the substratum. Amanda Variant soils have more silt and less clay in the upper part than the major soils.

Most areas of this association are used for pasture or cash-grain farming. The less sloping soils are commonly used as cropland, and the steeper soils are pastured or wooded. The less sloping soils are well suited or moderately suited to grain crops, hay, pasture, and most urban uses. The steeper soils are generally unsuited or poorly suited to most of these uses. The major soils are well suited or moderately suited to woodland.

The main limitations affecting farming and building site development are the slope and the hazard of erosion. Droughtiness in the Brownsville and Mechanicsburg soils also is a management concern during extended dry periods. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and improve tilth. The slope of all the major soils, the moderately slow permeability in the Amanda soils, and the depth to bedrock in the Brownsville and Mechanicsburg soils are limitations on sites for septic tank absorption fields. Effluent that enters cracks in the underlying bedrock can move a considerable distance and pollute ground water. Construction sites should be protected against erosion wherever possible.

Gently Sloping to Very Steep Soils Formed in Loess, Glacial Till, Colluvium, and Residuum

These soils make up about 9 percent of the county. They are deep, gently sloping to very steep, well drained and moderately well drained soils on glaciated and unglaciated uplands. They formed in a variety of parent materials, including loess, Illinoian glacial till, and colluvium and residuum derived from sandstone, siltstone, and shale. The major land uses are farming in the less sloping areas and woodland in the steeper areas. The hazard of erosion, the slope, slow or moderately slow permeability, and seasonal wetness are the major management concerns.

5. Homewood-Brownsville-Coshocton Association

Gently sloping to very steep, well drained and moderately well drained soils; on glaciated and unglaciated uplands

This association is on ridgetops, foot slopes, and hillsides. The topography commonly ranges from undulating to hilly. Streams are small, and flood plains are relatively narrow. Slopes range from 2 to 70 percent.

This association makes up about 7 percent of the county. It is about 30 percent Homewood soils, 25 percent Brownsville soils, 10 percent Coshocton soils, and 35 percent soils of minor extent.

Homewood soils are deep, gently sloping to steep, and well drained and moderately well drained. They generally are on undulating till plains and dissected side slopes along narrow valleys. In some areas they are at the base of prominent hillsides. They have a fragipan in the lower part of the subsoil. Permeability is moderate above the fragipan and slow in the fragipan. A perched seasonal high water table is between depths of 30 and 48 inches during extended wet periods. These soils formed in glacial till. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown and strong brown clay loam.

Brownsville soils are deep, sloping to very steep, and well drained. They are on ridgetops and hillsides. Permeability is moderate or moderately rapid. These soils formed in colluvium and residuum derived from siltstone and fine grained sandstone. Typically, they have a surface layer of very dark grayish brown channery silt loam. The subsurface layer is brown channery silt loam. The subsoil is yellowish brown channery silt loam, very channery silt loam, and very channery loam.

Coshocton soils are deep, gently sloping to steep, and moderately well drained. They are on ridgetops and hillsides. Permeability is moderately slow or slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. These soils formed in colluvium and residuum derived from shale and siltstone. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown, strong brown, and light yellowish brown silt loam and silty clay loam in the upper part and light brownish gray and brown silty clay and silty clay loam in the lower part. It is mottled below a depth of about 15 inches.

Some of the minor soils in this association are Chili and Glenford soils on terraces, Mechanicsburg and Rigley soils on hillsides and ridgetops, and the somewhat poorly drained Orrville soils on narrow flood plains. Chili soils have sand and gravel in the lower part. Glenford soils have less sand and a lower content of coarse fragments in the subsoil than the major soils. Mechanicsburg soils have a lower content of coarse fragments in the subsoil than the Brownsville soils and a higher content of coarse fragments in the lower part than the Homewood and Coshocton soils. Rigley soils have more sand in the subsoil than the major soils.

The gently sloping to moderately steep soils are used mainly as cropland or pasture, and the steep and very steep soils generally are wooded (fig. 5). The less sloping soils are well suited or moderately suited to cropland, hay, and pasture and are moderately suited or poorly suited to buildings and septic tank absorption fields. The steeper soils are generally unsuited to these uses. The major soils are well suited or moderately suited to trees.

The slope and the hazard of erosion are the major limitations affecting most land uses. Seasonal wetness and slow or moderately slow permeability are additional limitations in areas of the Homewood and Coshocton soils. The Brownsville soils are droughty during extended dry periods. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion and improve tilth. Construction sites should be protected against erosion wherever possible.

6. Cincinnati-Homewood-Coshocton Association

Gently sloping to steep, well drained and moderately well drained soils; on glaciated and unglaciated uplands

This association is on ridgetops, foot slopes, and hillsides. The topography commonly ranges from undulating to hilly. Streams are small, and flood plains are relatively narrow. Slopes range from 2 to 25 percent.

This association makes up about 2 percent of the county. It is about 25 percent Cincinnati soils, 25 percent Homewood soils, 15 percent Coshocton soils, and 35 percent soils of minor extent.

Cincinnati soils are deep, gently sloping and sloping, and well drained. They are on knolls, ridges, and side slopes. They have a fragipan in the middle part of the subsoil. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. A perched seasonal high water table is between depths of 30 and 48 inches during extended wet periods. These soils formed in loess and in the underlying glacial till. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is strong brown silt loam, and the lower part is yellowish brown, mottled loam and clay loam.

Homewood soils are deep, gently sloping to steep, and well drained and moderately well drained. They generally are on side slopes along narrow valleys. In some areas they are at the base of prominent hillsides. They have a fragipan in the lower part of the subsoil. Permeability is moderate above the fragipan and slow in the fragipan. A perched seasonal high water table is between depths of 30 and 48 inches during extended wet periods. These soils formed in glacial till. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown and strong brown clay loam.

Coshocton soils are deep, gently sloping to steep,

Figure 5.—Typical land use pattern in the Homewood-Brownsville-Coshocton association. Cropland, pasture, and woodland are the dominant land uses.

and moderately well drained. They are on ridgetops and hillsides. Permeability is moderately slow or slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. These soils formed in colluvium and residuum derived from shale and siltstone. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown, strong brown, and light yellowish brown silt loam and silty clay loam in the upper part and light brownish gray and brown silty clay and silty clay loam in the lower part. It is mottled below a depth of about 15 inches.

Some of the minor soils in this association are Glenford and Mentor soils on terraces, Killbuck soils on flood plains, Alford soils on ridgetops, and Brownsville soils on the steeper parts of hillsides. Alford, Glenford, and Mentor soils have more silt in the upper part of the subsoil than the Coshocton and Homewood soils and do not have a fragipan. Killbuck soils are poorly drained. Brownsville soils have a higher content of coarse fragments in the subsoil than the major soils.

Most of the gently sloping to moderately steep soils are used as cropland or pasture. The steep soils are mainly wooded. The less sloping soils are well suited or moderately suited to grain crops and well suited to hay and pasture. They are moderately suited to buildings and poorly suited to septic tank absorption fields. The steeper soils are generally unsuited or poorly suited to grain crops and hay. They are moderately suited to pasture, poorly suited to buildings, and generally unsuited to septic tank absorption fields.

The main limitations affecting most land uses are the slope, the hazard of erosion, seasonal wetness, and slow or moderately slow permeability. Crop rotations that include grasses and legumes, contour stripcropping, and a system of conservation tillage that leaves crop residue on the surface help to control erosion and improve tilth. Construction sites should be protected against erosion wherever possible.

Gently Sloping to Very Steep Soils Formed in Colluvium, Residuum, and Loess

These soils make up about 20 percent of the county. They are deep, gently sloping to very steep, well drained and moderately well drained soils on ridgetops and hillsides. They formed in colluvium and residuum derived from sandstone, siltstone, shale, and flinty limestone. They are used mainly as cropland, pasture, or woodland. The slope, the hazard of erosion, the depth to bedrock, slow or moderately slow permeability, seasonal wetness, stoniness, and seasonal droughtiness are the major management concerns.

7. Brownsville-Coshocton Association

Gently sloping to very steep, well drained and moderately well drained soils; on unglaciated uplands

This association is on ridgetops and hillsides. The maximum difference in local relief commonly is about 200 feet. Streams are small, and flood plains are relatively narrow. Slopes range from 2 to 70 percent.

This association makes up about 13 percent of the county. It is about 45 percent Brownsville soils, 20 percent Coshocton soils, and 35 percent soils of minor extent (fig. 6). The proportion of Coshocton soils is higher near the Muskingum County line than farther west.

Brownsville soils are deep, sloping to very steep, and well drained. They are on ridgetops and hillsides. Permeability is moderate or moderately rapid. These soils formed in colluvium and residuum derived from siltstone and fine grained sandstone. Typically, they have a surface layer of very dark grayish brown channery silt loam. The subsurface layer is brown channery silt loam. The subsoil is yellowish brown channery silt loam, very channery silt loam, and very channery loam.

Coshocton soils are deep, gently sloping to steep, and moderately well drained. They are on ridgetops and hillsides. Permeability is moderately slow or slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. These soils formed in colluvium and residuum derived from shale and siltstone. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown, strong brown, and light yellowish brown silt loam and silty clay loam in the upper part and light brownish gray and brown silty clay and silty clay loam in the lower part. It is mottled below a depth of about 15 inches.

Some of the minor soils in this association are Clarksburg soils on foot slopes, Orrville soils on narrow

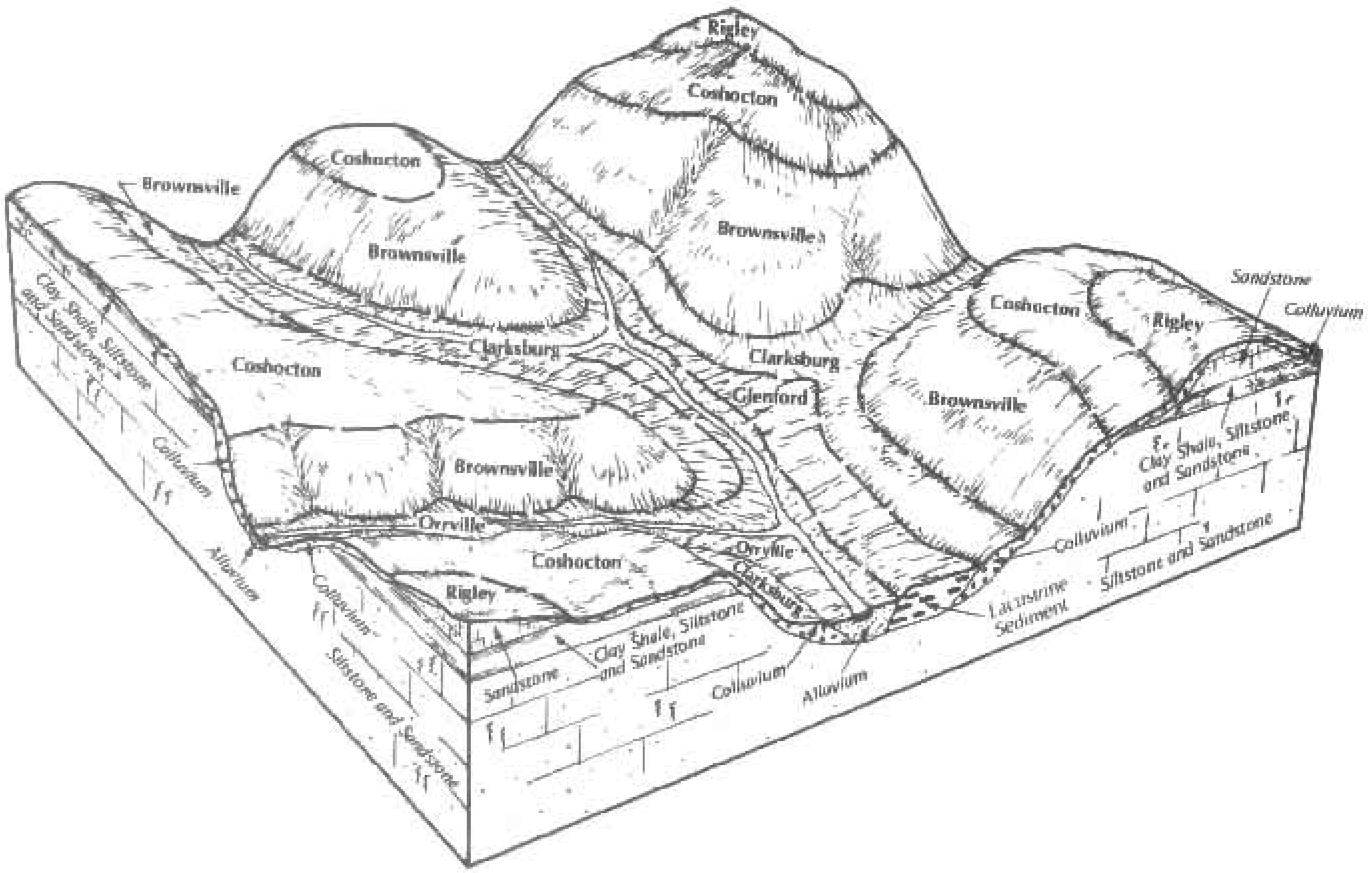


Figure 6.—Typical pattern of soils and parent material in the Brownsville-Coshocton association.

flood plains, Glenford soils on terraces, and Rigley soils on hillsides and ridgetops. Clarksburg soils have a fragipan. Orrville soils are somewhat poorly drained. Glenford soils have a lower content of sand and coarse fragments in the upper part than the major soils, and Rigley soils have more sand in the subsoil.

The less sloping soils on ridgetops are used mainly as cropland or pasture. The hillsides are wooded or are used as pasture. Some areas that were previously farmed support brush or are reverting to woodland. The less sloping soils are well suited or moderately suited to row crops and small grain and well suited to pasture and hay. They are moderately suited to buildings and poorly suited to septic tank absorption fields. The steeper soils are generally unsuited to most uses. They are well suited or moderately suited to woodland.

The main limitations affecting most uses are the slope and the hazard of erosion in both of the major soils and the seasonal wetness and slow or moderately slow permeability in the Coshocton soils. The Brownsville soils are droughty during extended dry periods. Crop rotations that include grasses and legumes, contour stripcropping, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and improve tilth. Construction sites should be protected against erosion wherever possible.

8. Coshocton-Rigley Association

Sloping to very steep, moderately well drained and well drained soils; on unglaciated uplands

This association is on ridgetops and hillsides. The maximum difference in local relief commonly is about 250 feet. Streams are small, and flood plains are relatively narrow. Slopes range from 6 to 35 percent.

This association makes up about 6 percent of the county. It is about 40 percent Coshocton soils, 20 percent Rigley soils, and 40 percent soils of minor extent.

Coshocton soils are deep, sloping to steep, and moderately well drained. They are on ridgetops and hillsides. Permeability is moderately slow or slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. These soils formed in colluvium and residuum derived from shale and siltstone. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown, strong brown, and light yellowish brown silt loam and silty clay loam in the upper part and light brownish gray and brown silty clay and silty clay loam in the lower part. It is mottled below a depth of about 15 inches.

Rigley soils are deep, sloping to very steep, and well drained. They are on ridgetops and hillsides. Permeability is moderately rapid. These soils formed in colluvium and residuum derived from sandstone. Typically, they have a surface layer of very dark grayish brown fine sandy loam. The subsurface layer is brown fine sandy loam. The subsoil is yellowish brown and brownish yellow sandy loam.

Some of the minor soils in this association are Glenford and Mentor soils on terraces, Brownsville soils on the lower parts of hillsides, and Orrville soils on narrow flood plains. Glenford and Mentor soils have a lower content of sand and coarse fragments in the upper part than the major soils. Brownsville soils have a higher content of coarse fragments throughout than the major soils. Orrville soils are somewhat poorly drained.

The less sloping soils on ridgetops are used mainly as cropland or pasture. The steeper soils are wooded. Many previously farmed areas are reverting to woodland or support brush. The less sloping soils on ridgetops are moderately suited or poorly suited to row crops, small grain, buildings, and septic tank absorption fields. They are well suited or moderately suited to hay, pasture, and trees. The steeper soils are generally unsuited to most uses. They are well suited or moderately suited to woodland.

The main limitations affecting most uses are the slope and the hazard of erosion in both of the major soils, droughtiness in the Rigley soils, and seasonal wetness and slow or moderately slow permeability in the Coshocton soils. Crop rotations that include grasses and legumes, contour stripcropping, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and improve tilth. Construction sites should be protected against erosion wherever possible.

9. Guernsey-Mertz-Coshocton Association

Gently sloping to very steep, moderately well drained and well drained soils; on unglaciated uplands

This association is on relatively broad ridgetops and moderately steep to very steep side slopes. It is on the Flint Ridge, a major prehistoric Indian quarry site. Slopes range from 2 to 35 percent.

This association makes up about 1 percent of the county. It is about 25 percent Guernsey soils, 15 percent Mertz soils, 15 percent Coshocton soils, and 45 percent soils of minor extent.

Guernsey soils are deep, gently sloping to moderately steep, and moderately well drained. They are on ridgetops and hillsides. Permeability is slow or moderately slow. A perched seasonal high water table is between depths of 24 and 42 inches. These soils formed in a thin mantle of loess and in the underlying material weathered from shale and siltstone. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown silt loam and silty clay loam in the upper part, brownish yellow silty clay in the next part, and light brownish gray and yellowish brown silty clay loam in the lower part. It is mottled below a depth of about 11 inches.

Mertz soils are deep, gently sloping to very steep, and well drained. They are on ridgetops and side slopes. Permeability is moderately slow. These soils formed in material weathered from flinty limestone and are very stony. Typically, they have a surface layer of very dark grayish brown very cherty silt loam. The subsurface layer is brown very cherty silt loam. The subsoil is yellowish brown, strong brown, and yellowish red very cherty silt loam and red and strong brown very cherty silty clay loam.

Coshocton soils are deep, gently sloping to moderately steep, and moderately well drained. They are on ridgetops and hillsides. Permeability is moderately slow or slow. A perched seasonal high water table is between depths of 18 and 36 inches during extended wet periods. These soils formed in colluvium and residuum derived from shale and siltstone. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown, strong brown, and light yellowish brown silt loam and silty clay loam in the upper part and light brownish gray and brown silty clay and silty clay loam in the lower part. It is mottled below a depth of about 15 inches.

Some of the minor soils in this association are Alford and Frankstown Variant soils on ridgetops, Rigley soils on hillsides, and Orrville soils on narrow flood plains. Alford soils have a lower content of sand and coarse fragments in the upper part than the major soils. Frankstown Variant soils are moderately deep over bedrock. Rigley soils have more sand in the subsoil than the major soils. Orrville soils are somewhat poorly drained.

The less sloping soils are used as cropland, pasture, or woodland. The steeper soils are used mainly as woodland. The less sloping Guernsey and Coshocton soils are well suited or moderately suited to grain crops. They are well suited to hay, pasture, and trees. They are moderately suited to buildings and poorly suited to septic tank absorption fields. The Mertz soils are generally unsuited to cropland and pasture and are well suited to trees. The less sloping Mertz soils are well suited to buildings and moderately suited to septic tank absorption fields. The steeper Mertz soils are poorly suited or generally unsuited to urban uses.

The slope and the hazard of erosion in all of the major soils, stoniness and droughtiness in the Mertz soils, and the seasonal wetness and slow or moderately slow permeability in the Guernsey and Coshocton soils are the major management concerns. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, conserve moisture, and improve tilth. Construction sites should be protected against erosion wherever possible.

Nearly Level to Very Steep Soils Formed in Loess and Glacial Outwash

These soils make up about 2 percent of the county. They are deep, well drained, nearly level to very steep soils on Illinoian glacial outwash terraces and kames. They formed in loess and glacial outwash. They are used mainly as cropland, pasture, or woodland. The slope and the hazard of erosion are the main management concerns.

10. Alford-Negley-Parke Association

Nearly level to very steep, well drained soils; on outwash terraces and kames

This association generally is on broad, nearly level and undulating, high Illinoian glacial outwash terraces and on steep and very steep, dissected side slopes. In some areas it is on kames. Streams are small, and flood plains are narrow. Slopes range from 0 to 70 percent.

This association makes up about 2 percent of the county. It is about 35 percent Alford soils, 25 percent Negley soils, 20 percent Parke soils, and 20 percent soils of minor extent.

Alford soils are deep and are nearly level to sloping. They are on broad terraces. Permeability is moderate. These soils formed in loess. Typically, they have a surface layer of brown silt loam. The subsoil is yellowish brown silt loam and silty clay loam. It is mottled below a depth of about 30 inches.

Negley soils are deep and are sloping to very steep. They are on kames and outwash terraces. Permeability is moderate or moderately rapid. These soils formed in glacial outwash. Typically, they have a surface layer of brown loam. The subsoil is yellowish brown, strong brown, and yellowish red loam, clay loam, and gravelly clay loam.

Parke soils are deep and sloping. They are on relatively narrow side slopes between the less sloping Alford soils and the steeper Negley soils. Permeability is moderate. These soils formed in loess and in the underlying glacial outwash. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is strong brown silt loam and silty clay loam, and the lower part is strong brown loam and reddish brown gravelly sandy loam.

Minor in this association are Fitchville soils on slack-water terraces along small streams and Orrville soils on narrow flood plains. The minor soils are somewhat poorly drained.

The less sloping soils in this association are used as cropland. Some areas are pastured, and a few areas are wooded. The steeper soils generally are wooded. The less sloping soils are well suited or moderately suited to most uses. The steeper soils are poorly suited or generally unsuited to most uses. They are well suited to woodland.

The slope and the hazard of erosion are the major management concerns. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion and improve tilth. Construction sites should be protected against erosion wherever possible.

Nearly Level to Moderately Steep Soils Formed in Loess, Glacial Outwash, Alluvium, and Lacustrine Sediment

These soils make up about 16 percent of the county. They are deep, nearly level to moderately steep, well drained to very poorly drained soils on flood plains, lake plains, and outwash and slack-water terraces. They formed in loess, glacial outwash, alluvium, or lacustrine sediment. They are used mainly as cropland or for residential, commercial, or industrial development. Wetness and the hazards of flooding and erosion are the main management concerns. Droughtiness, the slope, moderately slow permeability, and ponding are additional concerns.

11. Ockley-Stonelick-Shoals Association

Nearly level to sloping, well drained and somewhat poorly drained soils; on outwash terraces and flood plains

This association is on broad outwash terrace benches and flood plains. Short, narrow slope breaks are between the benches and flood plains. Slopes range from 0 to 12 percent.

This association makes up about 11 percent of the county. It is about 35 percent Ockley soils, 15 percent Stonelick soils, 10 percent Shoals soils, and 40 percent soils of minor extent.

Ockley soils are deep, nearly level to sloping, and well drained. They are on broad flats, in slightly undulating areas, and on slope breaks. Permeability is moderate in the subsoil and very rapid in the substratum. These soils formed in a thin mantle of loess and in the underlying glacial outwash. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown silt loam, silty clay loam, and clay loam, and the lower part is brown and dark yellowish brown clay loam, sandy clay loam, and gravelly clay loam.

Stonelick soils are deep, nearly level, and well drained. They are on flood plains and are occasionally flooded. Permeability is moderately rapid. These soils formed in alluvium. Typically, they have a surface layer and subsurface layer of brown loam and a substratum of dark yellowish brown and yellowish brown, stratified fine sandy loam, silt loam, and loamy sand.

Shoals soils are deep, nearly level, and somewhat poorly drained. They are on flood plains and are occasionally flooded. Permeability is moderate. A seasonal high water table is between depths of 6 and 18 inches during extended wet periods. These soils formed in alluvium. Typically, they have a surface layer of dark grayish brown silt loam. The substratum is grayish brown, yellowish brown, and gray, mottled loam, silt loam, silty clay loam, and gravelly loam.

Some of the minor soils in this association are Fitchville, Fox, Sleeth, and Westland soils on terraces and the moderately well drained Medway soils on flood plains. Also of minor extent are areas of Urban land and a few gravel pits. Fitchville soils have more silt and less sand throughout than the major soils. Fox soils are shallower to sand and gravel than the Ockley soils. Sleeth and Westland soils are wetter than the Ockley soils.

Most areas of this association are used as cropland. A few areas are pastured or wooded. Some areas have been developed for industrial, commercial, or residential uses. The nearly level and gently sloping Ockley soils are well suited to grain crops, hay, pasture, trees, and some specialty crops. They also are well suited to buildings and septic tank absorption fields. The sloping Ockley soils are moderately suited to grain crops and to buildings and septic tank absorption fields. The Shoals and Stonelick soils are well suited to row crops, hay, pasture, and trees. They generally are unsuitable as sites for buildings and septic tank absorption fields.

The slope and the hazard of erosion in areas of the Ockley soils, the hazard of flooding on the Stonelick and Shoals soils, droughtiness in the Stonelick soils, and seasonal wetness in the Shoals soils are the major management concerns. The flooding damages small grain in some areas. Also, the floodwater often deposits sediments on hayland and pasture. Surface crusting after hard rains is a management concern in cultivated areas of the Ockley and Shoals soils. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, minimize crusting, and improve tilth.

12. Luray-Westland-Ockley Association

Nearly level to sloping, very poorly drained and well drained soils; on lake plains and terraces

This association is on low rises on lake plains and outwash terraces. In some cultivated areas, the soils have a pattern of light and dark colors. Slopes range from 0 to 12 percent.

This association makes up about 1 percent of the county. It is about 35 percent Luray soils, 30 percent Westland soils, 20 percent Ockley soils, and 15 percent soils of minor extent.

Luray soils are deep, nearly level, and very poorly drained. They are on flats and in swales on lake plains and terraces along streams. Permeability is moderately slow. These soils have a seasonal high water table near or above the surface and are subject to ponding after periods of heavy rain. They formed in lacustrine deposits. Typically, they have a surface layer of very dark gray silty clay loam. The subsurface layer is black silty clay loam. The subsoil is dark grayish brown and dark gray, mottled silty clay loam and silt loam.

Westland soils are deep, nearly level, and very poorly drained. They are on flats and in depressions on outwash terraces. Permeability is moderate in the subsoil and very rapid in the substratum. These soils have a seasonal high water table near or above the surface and are subject to ponding after periods of heavy rain. They formed in glacial outwash. Typically, they have a surface layer and subsurface layer of black silty clay loam. The subsoil is gray and dark gray, mottled clay loam, loam, and gravelly sandy loam.

Ockley soils are deep, nearly level to sloping, and well drained. They are on low rises and knolls on outwash terraces. Permeability is moderate in the subsoil and very rapid in the substratum. These soils formed in a thin mantle of loess and in the underlying glacial outwash. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown silt loam, silty clay loam, and clay loam, and the lower part is brown and dark yellowish brown clay loam, sandy clay loam, and gravelly clay loam.

Some of the minor soils in this association are the moderately well drained Centerburg and Glenford soils and the somewhat poorly drained Fitchville and Sleeth soils. Centerburg soils are on knolls. Fitchville, Glenford, and Sleeth soils are on flats and slight rises.

Most areas of this association are used as cropland. The soils are well suited or moderately suited to grain crops and well suited to hay, pasture, and trees. The Luray and Westland soils are generally unsuited to buildings and septic tank absorption fields. The Ockley soils are well suited to buildings and well suited or moderately suited to septic tank absorption fields.

Seasonal wetness and ponding are the main limitations affecting cropland, woodland, and nonfarm uses, such as homesite development and septic tank absorption fields. The moderately slow permeability in the Luray soils and the slope and hazard of erosion in areas of the Ockley soils are additional management concerns. Maintaining tilth is a concern if the soils are worked when they are too wet.

13. Algiers-Luray-Mentor Association

Nearly level to moderately steep, somewhat poorly drained, very poorly drained, and well drained soils; on flood plains, lake plains, and terraces

This association is on broad flats interspersed with low rises, knolls, and side slopes. Slopes range from 0 to 18 percent.

This association makes up about 2 percent of the county. It is about 30 percent Algiers soils, 25 percent Luray soils, 10 percent Mentor soils, and 35 percent soils of minor extent.

Algiers soils are deep, nearly level, and somewhat poorly drained. They are on flood plains and are frequently flooded. Permeability is moderate. These soils have a seasonal high water table between depths of 12 and 24 inches during extended wet periods. They formed in recent alluvium over an older buried mineral soil. Typically, they have a surface layer of brown silt loam. The substratum is brown, mottled silt loam. Below the substratum is a buried surface layer of very dark gray silty clay loam. The subsoil is dark gray, mottled silty clay loam.

Luray soils are deep, nearly level, and very poorly drained. They are on flats and in swales on lake plains and terraces along streams. Permeability is moderately slow. These soils have a seasonal high water table near or above the surface and are subject to ponding after periods of heavy rain. They formed in lacustrine deposits. Typically, they have a surface layer of very dark gray silty clay loam. The subsurface layer is black silty clay loam. The subsoil is dark gray and dark grayish brown, mottled silty clay loam and silt loam.

Mentor soils are deep, nearly level to moderately steep, and well drained. They are on low rises, the higher flats, and side slopes on lake plains and terraces. Permeability is moderate. These soils formed in silty material. Typically, they have a surface layer of brown silt loam and a subsoil of yellowish brown silt loam.

Some of the minor soils in this association are Fitchville soils on slight rises, Sebring soils on flats, Ockley soils on slight rises and knolls on the higher terraces and on a few kames, and Wallkill soils on the lower flood plains. Fitchville soils have less sand in the subsoil than the Algiers soils, are better drained than the Luray soils, and are wetter than the Mentor soils. Sebring soils are poorly drained. Ockley soils have more sand and gravel in the substratum than the major soils. Wallkill soils have organic material in the lower part.

Most areas of this association are used as cropland. The nearly level and gently sloping soils are well suited to row crops, hay, and pasture. The sloping and moderately steep soils are poorly suited or moderately suited to cropland. All of the major soils are well suited to trees. The Algiers and Luray soils and the more sloping Mentor soils are poorly suited or generally unsuited to buildings and septic tank absorption fields, but the less sloping Mentor soils are well suited.

The main limitations affecting most uses are flooding and seasonal wetness in areas of the Algiers soils, the seasonal wetness, moderately slow permeability, and ponding in areas of the Luray soils, and the slope and hazard of erosion in areas of the Mentor soils. Maintaining tilth is a management concern if the soils are worked when they are too wet. Crop rotations that include grasses and legumes, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface help to control erosion, minimize crusting, and improve tilth.

14. Glenford-Fitchville-Orrville Association

Nearly level and gently sloping, moderately well drained and somewhat poorly drained soils; on slack-water terraces, lake plains, and flood plains

This association is on broad flats and slight rises on flood plains, lake plains, and slack-water terraces. Slopes range from 0 to 6 percent.

This association makes up about 2 percent of the county. It is about 25 percent Glenford soils, 20 percent Fitchville soils, 15 percent Orrville soils, and 40 percent soils of minor extent.

Glenford soils are deep, nearly level and gently sloping, and moderately well drained. They are on terraces. Permeability is moderately slow. These soils have a seasonal high water table between depths of 24 and 42 inches during extended wet periods. They formed in silty lakebed sediment. Typically, they have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown silt loam, and the lower part is yellowish brown, mottled silt loam and silty clay loam.

Fitchville soils are deep, nearly level and gently sloping, and somewhat poorly drained. They are on terrace flats. Permeability is moderately slow. A seasonal high water table is between depths of 12 and 30 inches during extended wet periods. These soils formed in silty lakebed sediment. Typically, they have a surface layer of dark grayish brown silt loam. The subsoil is brown and yellowish brown, mottled silt loam and silty clay loam.

Orrville soils are deep, nearly level, and somewhat poorly drained. They are on flood plains and are occasionally flooded. Permeability is moderate. A seasonal high water table is between depths of 12 and 30 inches during extended wet periods. These soils formed in alluvium. Typically, they have a surface layer of dark grayish brown silt loam. The subsoil is dark gray, brown, and yellowish brown, mottled silt loam and loam.

Some of the minor soils in this association are the poorly drained Killbuck and Melvin and well drained Tioga soils on flood plains and the well drained Chili soils on terraces.

Most areas of this association are used as cropland. Some areas are used for hay and pasture or are wooded. The soils are well suited to row crops, hay, pasture, and woodland. The Glenford soils are moderately suited to most urban uses, but the Fitchville soils are poorly suited and the Orrville soils are generally unsuited.

The seasonal wetness of all the major soils and the hazard of flooding on the Orrville soils are the major management concerns. The hazard of erosion and moderately slow permeability in areas of the Glenford and Fitchville soils are additional concerns.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, 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, Amanda silt loam, 6 to 12 percent slopes, eroded, is a phase of the Amanda series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Rigley-Coshocton complex, 18 to 25 percent slopes, is an example.

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

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

Some soil boundaries and soil names in this survey do not fully match those in previously published surveys of adjoining counties. Most differences result from a better knowledge of soils or from modification and refinement of series concepts. Some differences result from variations in the dominance of different soils in map units consisting of soils of two or more series and from variations in the range in slope allowed in the map units in different surveys.

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

Soil Descriptions

AfA—Alford silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on wide flats on Illinoian outwash terraces. Most areas are irregularly shaped and are 20 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches of strong brown, friable silt loam and firm silty clay loam. The substratum to a depth of about 60 inches is brown, friable silt loam. In places the slope is 2 to 4 percent. In a few areas the substratum is loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils in slight depressions along natural drainageways or at the base of the steeper slopes. These soils make up about 10 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Runoff is slow. Tilth is good. The root zone is deep.

Most areas are used for row crops, small grain, or hay. Some areas are used as pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. It warms and dries early in spring and thus is well suited to early spring tilling and planting. In tilled areas a surface crust forms after hard rains. Including grasses and legumes in the crop rotation, returning crop residue to the soil, and applying a system of conservation tillage that leaves crop residue on the surface minimize crusting.

This soil is well suited to pasture and hay. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Deferment of grazing during excessively wet periods minimizes compaction and helps to prevent damage to the pasture.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields, but a moderate shrink-swell potential is a limitation on sites for buildings. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Properly landscaping building sites and septic tank absorption fields results in good surface drainage.

The land capability classification is I. The woodland ordination symbol is 5A.

AfB—Alford silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is mainly on low rises on wide Illinoian outwash terraces. It also is on the narrow, convex tops of ridges in the uplands. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches of yellowish brown, friable silt loam and firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the slope is 0 to 2 percent or 6 to 9 percent. In a few areas the lower part of the subsoil or the substratum is loam or gravelly loam.

Included with this soil in mapping are small areas of Parke soils on slope breaks on outwash terraces, small areas of Cincinnati and Keene soils in the same positions on uplands as the Alford soil, and small areas of somewhat poorly drained soils in slight depressions. Parke soils contain more sand in the lower part than the Alford soil. Cincinnati soils have a fragipan. Keene soils are moderately well drained. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Runoff is medium. Tilth is good. The root zone is deep.

Most areas are used as cropland or pasture. A few areas are wooded. Nursery stock is produced in a few areas.

This soil is well suited to corn, soybeans, and small grain. It warms and dries early in spring and thus is well suited to tilling and planting early in spring. The hazard of erosion is moderate if the soil is tilled. A surface crust forms in tilled areas after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including meadow crops in the crop rotation, and returning crop residue to the soil help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a moderate hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Deferment of grazing during excessively wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields, but a moderate shrink-swell potential is a limitation on sites for buildings. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIe. The woodland ordination symbol is 5A.

AfC2—Alford silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on narrow ridgetops and on side slopes. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and convex and commonly are 150 to 450 feet long. Most areas are long and narrow and are 10 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is strong brown, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the slope is 12 to 18 percent. In a few areas the lower part of the subsoil or the substratum is loam or gravelly loam.

Included with this soil in mapping are small areas of Cincinnati and Keene soils. These soils are in the same landscape positions as the Alford soil. Cincinnati soils have a fragipan. Keene soils are moderately well drained. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Runoff is rapid. Tilth is good. The root zone is deep.

Most areas are used for hay or pasture. Some areas are used for row crops, small grain, or woodland.

This soil is moderately suited to corn, small grain, and occasionally grown soybeans. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. Crop rotations that include hay and cover crops, contour stripcropping, grassed waterways, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and surface crusting. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. If properly managed, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. If the pasture is plowed during seedbed preparation or is overgrazed, however, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope and a moderate shrink-swell potential, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

AhB—Alford-Urban land complex, 2 to 6 percent slopes. This map unit consists of a deep, gently sloping, well drained Alford soil and areas of Urban land on Illinoian outwash terraces. Areas occur as long, narrow bands that are 10 to 50 acres in size. Most are about 45 percent Alford silt loam and 35 percent Urban land. The Alford soil and Urban land occur as areas so intricately mixed that separating them in mapping was not practical.

Typically, the Alford soil has a surface layer of brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches of yellowish brown, friable silt loam and firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the soil has been altered radically. Some of the low areas have been filled or leveled during construction, and other small areas have been built up or smoothed.

The Urban land is covered by buildings and pavement. The buildings are mainly residential or commercial.

Included with the Alford soil and Urban land in mapping are some areas where the slope is 9 to 12 percent. Also included are narrow strips of Parke soils on slope breaks and along drainageways. These soils contain less silt in the lower part than the Alford soil. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Alford soil. Available water capacity is high. Runoff is medium. Tilth is good. The root zone is deep.

The Alford soil is used for lawns, gardens, or parks. It is well suited to lawns, vegetable and flower gardens, trees, and shrubs. The included areas that have been cut and filled are not well suited to lawns and gardens. The exposed subsoil and substratum in these areas are sticky when wet and hard when dry and vary in reaction. Adding organic material to the soil improves tilth.

The Alford soil is well suited to building site development and septic tank absorption fields, but a moderate shrink-swell potential is a limitation on sites for buildings. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The Alford soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

Ak—Algiers silt loam, frequently flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 10 to more than 100 acres in size.

Typically, the upper 28 inches is recent alluvium, which is brown, friable silt loam. The alluvium is mottled below a depth of about 10 inches. It is underlain by a very poorly drained buried soil. The buried surface layer is very dark gray, mottled, friable silty clay loam about 16 inches thick. The buried subsoil to a depth of about 60 inches is dark gray, mottled, firm silty clay loam. In some areas the alluvium is less than 20 or more than 36 inches deep over the buried soil. In places the soil is poorly drained.

Included with this soil in mapping are small areas of the very poorly drained Sloan soils in depressions and high water channels. Also included are the somewhat poorly drained Shoals soils on narrow flood plains and in low areas on wide flood plains and the very poorly drained Luray soils along the edges of some mapped areas. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Algiers soil. Available water capacity is high. Runoff is very slow. The seasonal high water table is at a depth of 12 to 24 inches during extended wet periods. Tilth is good. In drained areas the root zone is deep.

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

If drained, this soil is well suited to corn and soybeans. It generally is unsuited to small grain because of the flooding. The wetness and the flooding are the main limitations. Surface and subsurface drains commonly are used to lower the seasonal high water table in areas where suitable outlets are available. In tilled areas a surface crust forms after hard rains. Returning crop residue to the soil minimizes crusting. Tilling and harvesting at the optimum moisture content help to prevent excessive crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage. The forage species that can withstand some wetness should be selected for planting.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding and the seasonal wetness.

The land capability classification is IIw. The woodland ordination symbol is 4A.

AmB2—Amanda silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on low knolls and ridges on Wisconsinan till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are dominantly 4 to 6 percent. Most areas are irregularly shaped and are 4 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 36 inches of yellowish brown, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is brown and yellowish brown, calcareous, firm loam glacial till. In some areas the slope is 6 to 9 percent. In other areas the soil is less eroded. In some places it is moderately well drained. In other places the substratum has pockets or lenses of sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington soils on the more nearly level parts of the landscape. These soils make up about 10 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is at a depth of more than 48 inches during extended wet periods. Tilth is good. The root zone generally is deep, but in some areas it is restricted to the part of the profile above compact glacial till.

Most areas are used for row crops. Some areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is moderate. A surface crust forms after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including grasses and legumes in the crop rotation, returning crop residue to the soil, and establishing grassed waterways help to control erosion and minimize crusting. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring, but compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate. No-till seeding helps to control erosion.

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

This soil is well suited to building site development, but the slight seasonal wetness and a moderate shrink-swell potential are limitations. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is moderately suited to septic tank absorption fields. The moderately slow permeability is a limitation. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

The land capability classification is IIe. The woodland ordination symbol is 5A.

AmC2—Amanda silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on knolls and ridges and on dissected side slopes on Wisconsinan till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 400 feet long. Most areas are irregular in shape and are 4 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 39 inches of yellowish brown, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous, firm loam glacial till. In some areas the soil is moderately well drained. In other areas the subsoil is thinner. In some places the slope is 12 to 18 percent. In other places the substratum has pockets or lenses of moderately permeable material. In a few areas the soil is less eroded.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils on narrow flood plains and small areas of severely eroded soils on the upper part of the slopes. The severely eroded soils have a surface layer of clay loam in which tilth is fair. They have a shallower root zone and a lower available water capacity than the Amanda soil. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate. Runoff is rapid in cultivated areas. The seasonal high water table is at a depth of more than 48 inches during extended wet periods. Tilth is good. The root zone generally is deep, but in some areas it is restricted to the part of the profile above compact glacial till.

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

This soil is moderately suited to corn, soybeans, and small grain grown in rotation with meadow crops. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains, and the soil becomes cloddy if tilled when too wet. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations, contour stripcropping, and grassed waterways help to control erosion and minimize crusting. The soil is well suited to conservation tillage systems, including no-till farming. Tillage during optimum moisture conditions minimizes compaction.

This soil is well suited to pasture and hay. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. If the pasture is plowed during seedbed preparation or is overgrazed, however, erosion is a severe hazard. No-till seeding helps to control erosion. Deferment of grazing during excessively wet periods helps to keep the pasture in good condition.

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

Because of the slope, the slight seasonal wetness, the moderately slow permeability, and a moderate shrink-swell potential, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is well suited to ponds (fig. 7).

The land capability classification is IIIe. The woodland ordination symbol is 5A.

AmD2—Amanda silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is mainly on dissected side slopes along drainageways and on some knolls on Wisconsinan till plains. In a few areas it is on kames. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 350 feet long. Most areas are long and narrow and are 4 to 25 acres in size. Some areas on knolls are oval.

Typically, the surface layer is brown, friable silt loam

Figure 7.—A pond in an area of Amanda silt loam, 6 to 12 percent slopes, eroded.

about 7 inches thick. The subsoil is about 34 inches of yellowish brown, firm silty clay loam, clay loam, and loam. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous, firm loam glacial till. In some places the slope is 18 to 25 percent. In other places the subsoil is thinner. In some areas the soil is moderately well drained. In other areas the substratum has pockets or lenses of stratified gravelly loam to very gravelly loamy sand. In a few areas the surface layer is gravelly silt loam or gravelly loam.

Included with this soil in mapping are strips of the somewhat poorly drained Shoals soils on narrow flood plains, some seeps and springs, and small areas of severely eroded soils on the upper part of the slopes. The severely eroded soils have a surface layer of clay loam in which tilth is fair. They have a shallower root zone and a lower available water capacity than the Amanda soil. Inclusions make up about 20 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate. Runoff is very rapid in cultivated areas. The seasonal high water table is at a depth of more than 48 inches during extended wet periods. Tilth is good. The root zone generally is deep, but in some areas it is restricted to the part of the profile above compact glacial till.

Most areas are used for hay, pasture, or woodland. Some areas are used for row crops or small grain.

This soil is poorly suited to row crops. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, contour stripcropping, and grassed waterways help to control erosion and surface crusting. The good drainage favors no-till farming.

This soil is moderately suited to hay and pasture (fig. 8). If properly managed, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. No-till seeding also helps to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope and the moderately slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting, filling, or land shaping. Enlarging the absorption area improves the capacity of septic tank absorption fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 5R.

AmE—Amanda silt loam, 18 to 25 percent slopes. This deep, steep, well drained soil is on dissected side slopes along drainageways and on a few knolls on Wisconsinan till plains. Slopes are smooth and commonly are 100 to 300 feet long. Most areas are long and narrow and are 4 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 37 inches of yellowish brown, firm clay loam and loam. The substratum to a depth of about 60 inches is brown, calcareous, firm loam glacial till. In some places the slope is 25 to 30 percent. In other places the subsoil is thinner. In some

Figure 8.—A pastured area of Amanda silt loam, 12 to 18 percent slopes, eroded.

areas the soil is moderately well drained or has pockets or lenses of moderately permeable material in the substratum.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils on narrow flood plains and small areas of severely eroded soils on the upper part of the slopes. The severely eroded soils have a surface layer of clay loam. They have a subsoil that is thinner than that of the Amanda soil. Also included are some springs and seeps. Inclusions make up about 20 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate. Runoff is very rapid. The seasonal high water table is at a depth of more than 48 inches during extended wet periods. Tilth is good. The root zone is deep.

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

This soil generally is unsuited to cultivated crops because of the slope and a very severe hazard of erosion. The slope limits the use of farming equipment.

Because of the slope, this soil is only moderately suited to pasture and is poorly suited to hay. If properly managed, it is well suited to grazing in winter and early in spring. If the pasture is tilled during reseeding, the hazard of erosion is very severe. No-till seeding helps to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope and the moderately slow permeability, this soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is VIe. The woodland ordination symbol is 5R.

AmF—Amanda silt loam, 25 to 50 percent slopes. This deep, very steep, well drained soil is on dissected side slopes along drainageways on Wisconsinan till plains. Slopes are smooth and commonly are 50 to 250 feet long. Most areas are long and narrow and are 2 to 25 acres in size.

Typically, the surface layer is very dark brown, friable silt loam about 2 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil is about 36 inches of yellowish brown, firm clay loam and loam. The substratum to a depth of about 60 inches is brown, calcareous, firm loam glacial till. In some areas the slope is 20 to 25 percent or more than 50 percent. In other areas the soil is moderately well drained. In some places the subsoil is thinner. In other places the substratum has pockets or lenses of moderately permeable material.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals soils on narrow flood plains and small areas of severely eroded soils on the upper part of the slopes. The severely eroded soils have a surface layer of clay loam. They have a subsoil that is thinner than that of the Amanda soil. Also included are some springs and seeps. Inclusions make up about 15 percent of most areas.

Permeability is moderately slow in the Amanda soil. Available water capacity is moderate. Runoff is very rapid. The seasonal high water table is at a depth of more than 48 inches during extended wet periods. Tilth is good. The root zone is deep.

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

Because of the slope and a very severe hazard of erosion, this soil generally is unsuited to cultivated crops and hay and is poorly suited to pasture. The slope limits the use of most farm machinery. No-till seeding helps to control erosion in pastured areas.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

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

The land capability classification is VIIe. The woodland ordination symbol is 5R.

AvC2—Amanda Variant silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on foot slopes at the base of the steeper hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 250 feet long. Most areas are long, narrow, and winding and are 15 to 35 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 46 inches thick. The upper part is strong brown, friable silt loam, and the lower part is yellowish brown, firm loam. The substratum to a depth of about 80 inches is yellowish brown, firm loam. In some areas the subsoil or substratum has a higher content of thin, flat stones. In other areas the silty mantle is thicker. In places the soil is moderately well drained.

Included with this soil in mapping are small areas of soils in which the substratum has pockets or lenses of stratified fine sand to gravelly sand. These soils are in the same landscape positions as the Amanda Variant soil. Also included are small areas of Brownsville soils on the upper part of the foot slopes. These soils have a higher content of rock fragments throughout than the Amanda Variant soil. Also included are some small seeps and springs. Inclusions make up about 20 percent of most areas.

Permeability is moderate in the Amanda Variant soil. Available water capacity is high. Runoff is rapid. The root zone is deep.

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

This soil is moderately suited to corn, small grain, and occasionally grown soybeans. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. Crop rotations that include meadow and cover crops, contour stripcropping, grassed waterways, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting. The soil is well suited to conservation tillage systems, including no-till farming.

This soil is well suited to hay and pasture. If properly managed, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. If the pasture is plowed during seedbed preparation or is overgrazed, however, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Overgrazing and grazing when the soil is too wet cause compaction, poor tilth, and a decreased rate of water infiltration.

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

Because of the slope, a moderate shrink-swell potential, and the moderate permeability, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent. Sloughing is a hazard in the included soils having a substratum that has pockets or lenses of sand or gravel. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

AvD2—Amanda Variant silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is on foot slopes at the base of the steeper hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 150 to 250 feet long. Most areas are long, narrow, and winding and are 20 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 53 inches thick. The upper part is strong brown, brown, and yellowish brown, friable silt loam, and the lower part is yellowish brown, firm clay loam. The substratum to a depth of about 80 inches is yellowish brown, firm loam. In some areas the subsoil or substratum has a higher content of thin, flat stones. In other areas the soil is moderately well drained. In places the slope is 18 to 25 percent.

Included with this soil in mapping are small areas of soils in which the substratum has pockets or lenses of stratified fine sand to gravelly sand. These soils are in the same landscape positions as the Amanda Variant soil. Also included are small areas of Brownsville soils on the upper part of the foot slopes and some small seeps and springs. Brownsville soils have a higher content of rock fragments throughout than the Amanda Variant soil. Inclusions make up about 20 percent of most areas.

Permeability is moderate in the Amanda Variant soil. Available water capacity is high. Runoff is very rapid in cultivated areas. Tilth is good. The root zone is deep.

Most areas are used for hay or pasture. Some areas are wooded. A few areas are used for row crops or small grain.

This soil is poorly suited to row crops. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, a crop rotation that includes hay and cover crops, contour stripcropping, and grassed waterways help to control erosion and minimize crusting. The good drainage favors conservation tillage systems, including no-till farming.

This soil is moderately suited to hay and pasture. If properly managed, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. If the pasture is plowed during seedbed preparation or is overgrazed, however, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Overgrazing or grazing when the soil is too wet causes compaction and increases the hazard of erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope, a moderate shrink-swell potential, and the moderate permeability, this soil is poorly suited to building site development and septic tank absorption fields. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting and filling. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Sloughing is a hazard in the included soils in which the substratum has pockets or lenses of sand or gravel. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 5R.

BeA—Bennington silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on flats and low rises and in slight swales on Wisconsinan till plains. Most areas are irregularly shaped and are 5 to 50 acres in size. A few areas are more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 26 inches of yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is brown, mottled, calcareous, firm loam glacial till. In some areas the slope is 2 to 4 percent. In a few areas the soil is poorly drained. In places the subsoil has less clay.

Included with this soil in mapping are small areas of the moderately well drained Centerburg soils on low knolls and the very poorly drained Pewamo soils along drainageways and in closed depressions. Included soils make up about 20 percent of most areas.

Permeability is slow in the Bennington soil. Available water capacity is moderate. Runoff is slow. The seasonal high water table is perched at a depth of 12 to 30 inches during extended wet periods. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

Most areas are used as cropland or pasture. Some areas are wooded, especially if they are not drained.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. It delays planting and limits the number of crops that can be grown. Surface drains commonly are used to remove excess surface water and provide outlets for subsurface drains. A subsurface drainage system commonly is used to lower the seasonal high water table. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The species that can withstand some wetness, such as alsike clover, should be selected for planting.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is poorly suited to dwellings and septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and septic tank absorption fields results in good surface drainage.

The land capability classification is IIw. The woodland ordination symbol is 4A.

BeB—Bennington silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on low knolls and rises on Wisconsinan till plains. Slopes commonly are 2 to 4 percent but range from 2 to 6 percent. Most areas are irregularly shaped and are 5 to 75 acres in size. A few areas are more than 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, mottled, friable silt loam and firm and very firm silty clay loam, and the lower part is yellowish brown and dark yellowish brown, mottled, very firm clay loam and firm loam. The substratum to a depth of about 80 inches is brown, mottled, calcareous, firm loam glacial till. In some areas the slope is 0 to 2 percent or 6 to 9 percent. In places the upper part of the subsoil is loam.

Included with this soil in mapping are small areas of the moderately well drained Centerburg soils on knolls and ridges and the very poorly drained Pewamo soils in depressions and along drainageways. Included soils make up about 20 percent of most areas.

Permeability is slow in the Bennington soil. Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is perched at a depth of 12 to 30 inches during extended wet periods. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

Most areas are used as cropland or pasture. Some areas are wooded, especially if they are not drained.

If drained, this soil is well suited to corn, soybeans, and small grain. The hazard of erosion and the seasonal wetness are the main management concerns. In tilled areas the hazard of erosion is moderate. Establishing grassed waterways, including meadow crops in the crop rotation, and returning crop residue to the soil help to control erosion. No-till farming or another system of conservation tillage that leaves crop residue on the surface also helps to control erosion in adequately drained areas. A drainage system helps to remove excess water. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate. No-till seeding helps to control erosion. The species that can withstand some wetness, such as alsike clover, should be selected for planting.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the slow permeability. The higher parts of knolls are the best building sites. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and septic tank absorption fields results in good surface drainage.

This soil is well suited to ponds (fig. 9).

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

BfA—Bennington-Urban land complex, 0 to 3 percent slopes. This map unit consists of a deep, nearly level, somewhat poorly drained Bennington soil and areas of Urban land on flats and low rises on Wisconsinan till plains. Areas commonly have straight boundaries with distinct corners and are 15 to 50 acres in size. Most are about 45 percent Bennington silt loam and 35 percent Urban land. The Bennington soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Bennington soil has a surface layer of dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 26 inches of yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of about 80 inches is brown, mottled, calcareous, firm loam glacial till. In places the soil has been altered radically. Some of the low areas have been filled or leveled during construction, and other small areas have been built up or smoothed.

The Urban land is covered by buildings and pavement. The buildings are mainly single-family houses or apartment buildings, but some are industrial or commercial.

Included with the Bennington soil and the Urban land in mapping are narrow strips of the very poorly drained Pewamo soils in depressions and along drainageways and small areas of the moderately well drained Centerburg soils on low knolls and ridges. Included soils make up about 20 percent of most areas.

Most areas have been drained by sewer systems, gutters, and subsurface drains. Undrained areas of the Bennington soil have a perched seasonal high water table at a depth of 12 to 30 inches during extended wet periods. Permeability is slow in this soil. Available water capacity is moderate. Runoff is slow. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

The Bennington soil is used for lawns or gardens. If drained, it is well suited to most vegetables, flowers, trees, and shrubs. Water-tolerant plants grow well in undrained areas. The perennial plants selected for planting in drained areas should be those that can withstand some wetness. The included spots that have been cut and filled are not well suited to lawns and gardens. In the exposed subsoil and substratum in

Figure 9.—A pond in an area of Bennington silt loam, 2 to 6 percent slopes.

these spots, tilth is very poor and reaction varies. The exposed material is sticky when wet and hard when dry. Adding organic material to the soil improves tilth.

The Bennington soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness and the slow permeability. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent. In some areas sanitary facilities are connected to central sewage treatment facilities.

The Bennington soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

BgB—Berks channery silt loam, 2 to 6 percent slopes. This moderately steep, gently sloping, moderately deep, well drained soil is on narrow, unglaciated ridgetops. Most areas are irregularly shaped and are 5 to 15 acres in size. A few areas are long and narrow.

Typically, the surface layer is brown, friable channery silt loam about 7 inches thick. The subsoil is about 18 inches of yellowish brown, friable very channery and extremely channery silt loam. Thinly bedded, rippable, fine grained sandstone bedrock is at a depth of about 25 inches. In some areas the slope is 6 to 9 percent. In other areas the upper part of the soil has fewer coarse fragments.

Included with this soil in mapping are areas of the deep Mechanicsburg soils and small areas of soils that have bedrock within a depth of 20 inches. These soils are in the same landscape positions as the Berks soil. They make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil. Available water capacity is very low. Runoff is medium in cultivated areas. Tilth is good. The root zone generally is moderately deep. It commmonly is restricted to the part of the profile above the bedrock.

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

This soil is moderately suited to corn and small grain. It dries and warms early in spring and thus is well suited to tilling and planting early in spring. The hazard of erosion and droughtiness are the main management concerns. No-till farming or another system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. The surface layer can be tilled throughout a fairly wide range of moisture conditions. Because of the moderate or moderately rapid permeability and the bedrock at a depth of 20 to 40 inches, small, frequent applications of a small amount of fertilizer and lime are more effective than one application of a large amount.

This soil is well suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. It dries and warms early in spring. Drought reduces forage production late in summer.

This soil is only moderately suited to trees because of the very low available water capacity. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

Because of the bedrock at a depth of 20 to 40 inches, this soil is only moderately suited to building site development and generally is unsuited to septic tank absorption fields. The bedrock commonly is rippable. The filtration of effluent is inadequate in septic tank absorption fields. Effluent that enters cracks in the underlying bedrock can move considerable distances and pollute ground water. Onsite investigation is necessary to determine the suitability of an alternative system. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

BgD—Berks channery silt loam, 12 to 18 percent slopes. This moderately deep, moderately steep, well drained soil is in narrow bands on unglaciated hillsides and on the higher parts of unglaciated ridgetops. Slopes are smooth and commonly are 100 to 200 feet long. Most areas on hillsides are long, narrow, and winding and range from 5 to 20 acres in size. Areas on ridgetops are oval and range from 3 to 15 acres in size.

Typically, the surface layer is brown, friable channery silt loam about 6 inches thick. The subsoil is about 18 inches of yellowish brown, friable very channery and extremely channery silt loam. Fine grained sandstone and shale bedrock is at a depth of about 24 inches. In some areas the slope is 9 to 12 percent. In other areas it is more than 18 percent.

Included with this soil in mapping are small areas of soils that have bedrock within a depth of 20 inches. These soils are in the same landscape positions as the Berks soil. They make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Berks soil. Available water capacity is very low. Runoff is very rapid. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the bedrock.

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

Because of the hazard of erosion, the slope, and droughtiness, this soil is poorly suited to corn and small grain. In tilled areas the hazard of erosion is very severe. The soil dries and warms early in spring and thus is well suited to tilling and planting early in spring. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, and contour stripcropping conserve moisture and help to control erosion. Grassed waterways also help to control erosion. Because of the moderate or moderately rapid permeability and the bedrock at a depth of 20 to 40 inches, frequent applications of a small amount of fertilizer are more effective than one application of a large amount.

This soil is moderately suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a very severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

Because of the very low available water capacity, this soil is only moderately suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment. Mulching and planting seedlings that have been transplanted once reduce the seedling mortality rate.

Because of the slope and the bedrock at a depth of 20 to 40 inches, this soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. The bedrock commonly is rippable. The filtration of effluent is inadequate in septic tank absorption fields. Onsite investigation is necessary to determine the suitability of an alternative system. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

BrC—Brownsville channery silt loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is on unglaciated ridgetops and knolls. Slopes are smooth and commonly are 150 to 300 feet long. Most areas are long and narrow and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable channery silt loam about 7 inches thick. The subsoil is about 35 inches of yellowish brown, friable channery and very channery silt loam. The substratum is yellowish brown, friable very channery silt loam. Thinly bedded siltstone and fine grained sandstone bedrock is at a depth of about 47 inches. In some places, the soil is eroded and the surface layer is very channery silt loam or is stony. In other places the slope is 2 to 6 percent or 12 to 18 percent. In some areas the subsoil or substratum is very channery fine sandy loam. In other areas the surface layer and the upper part of the subsoil have fewer stones. In a few areas the soil is moderately deep over bedrock.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils. These soils are higher on the landscape than the Brownsville soil. Also included are small areas of Mechanicsburg soils, which are in the same landscape positions as the Brownsville soil or are in the lower positions. Mechanicsburg soils have a lower content of rock fragments in the subsoil than the Brownsville soil. Included soils make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Available water capacity is low. Tilth is good. Runoff is rapid in cultivated areas. The root zone is deep.

Most areas are used as hayland, pasture, or woodland or are covered with brush. Some areas are used for row crops or small grain.

This soil is moderately suited to corn and small grain. In tilled areas the hazard of erosion is severe. The soil dries and warms early in spring and thus is suited to tilling and planting early in spring. It is well suited to conservation tillage systems, including no-till farming. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, and contour stripcropping help to control erosion and conserve moisture. Grassed waterways also help to control erosion. Because of the moderate or moderately rapid permeability, frequent applications of a small amount of fertilizer are more effective than one application of a large amount.

This soil is well suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. No-till seeding helps to control erosion and conserves moisture.

Because of the low available water capacity, this soil is only moderately suited to trees. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once. Building logging roads and skid trails on the contour facilitates the use of equipment.

This soil is only moderately suited to building site development because of the slope and the high content of thin, flat stones. Buildings should be designed so that they conform to the natural slope of the land. Most of the stones are small and can be excavated by conventional equipment. The underlying bedrock commonly is rippable. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Depending on the depth to bedrock, this soil is poorly suited or moderately suited to septic tank absorption fields. Where the bedrock is near a depth of 40 inches, the filtration of effluent is inadequate in the absorption fields. Effluent that enters cracks in the underlying bedrock can move considerable distances and pollute ground water. In areas where it is sufficiently deep for adequate filtration, the soil is moderately suited to septic tank absorption fields. Onsite investigation can determine the depth to bedrock. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

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

BrD—Brownsville channery silt loam, 12 to 18 percent slopes. This deep, moderately steep, well drained soil is mainly on unglaciated hillsides. In a few areas it is on knolls and ridgetops. Slopes are smooth and commonly are 150 to 400 feet long. Most areas on hillsides are long and winding and are 10 to 60 acres in size. Areas on knolls commonly are oval and are 6 to 30 acres in size.

Typically, the surface layer is brown, friable channery silt loam about 7 inches thick. The subsoil is about 33 inches of yellowish brown, friable channery and very channery silt loam. The substratum is yellowish brown, friable very channery silt loam. Thinly bedded siltstone and fine grained sandstone bedrock is at a depth of about 50 inches. In some places the slope is 18 to 25 percent or 6 to 12 percent. In other places, the soil is eroded and the surface layer is very channery silt loam or is stony. In some areas the subsoil or substratum is very channery fine sandy loam. In other areas the surface layer and the upper part of the subsoil have fewer stones. In a few areas the soil is moderately deep over bedrock.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the upper part of some hillsides and small areas of Mechanicsburg soils. Mechanicsburg soils have a lower content of rock fragments in the subsoil than the Brownsville soil. They are in landscape positions similar to those of the Brownsville soil. Included soils make up about 25 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Available water capacity is low. Runoff is very rapid in cultivated areas. Tilth is good. The root zone is deep.

Most areas are used as hayland, pasture, or woodland or are covered with brush. Some areas are used for row crops or small grain.

Because of the hazard of erosion, the slope, and droughtiness, this soil is poorly suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is severe. The soil dries and warms early in spring and thus is suited to tilling and planting early in spring. It is well suited to conservation tillage systems, including no-till farming. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, and contour stripcropping help to control erosion and conserve moisture. Grassed waterways also help to control erosion. Because of the moderate or moderately rapid permeability, frequent applications of a small amount of fertilizer are more effective than one application of a large amount.

This soil is moderately suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. No-till seeding helps to control erosion and conserves moisture.

Because of the low available water capacity, this soil is only moderately suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

Because of the slope, this soil is poorly suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. The underlying bedrock commonly is rippable. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is poorly suited to septic tank absorption fields because of the slope and the depth to bedrock. Where the bedrock is closest to the surface, the filtration of effluent is inadequate in the absorption fields. Effluent that enters cracks in the underlying bedrock can move considerable distances and pollute ground water. In areas where the soil is sufficiently deep for adequate filtration, enlarging the absorption area and installing the distribution lines on the contour improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. Onsite investigation can determine the depth to bedrock.

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

BrE—Brownsville channery silt loam, 18 to 25 percent slopes. This deep, steep, well drained soil is mainly on unglaciated hillsides. Slopes are smooth and commonly are 150 to 800 feet long. Most areas are long and winding and are 20 to more than 200 acres in size. Some are oval and are 6 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable channery silt loam about 2 inches thick. The subsurface layer is brown, friable channery silt loam about 4 inches thick. The subsoil is about 35 inches of yellowish brown, friable channery silt loam and very channery loam. The substratum is yellowish brown, mottled, friable very channery silt loam. Fractured siltstone bedrock is at a depth of about 51 inches. In some areas the slope is 25 to 35 percent. In other areas the subsoil or substratum is very channery fine sandy loam. In some places, the soil is eroded and the surface layer is very channery silt loam or is stony. In other places the soil is moderately deep.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the upper part of some hillsides and the moderately well drained Clarksburg soils on some foot slopes. Also included are small areas of Mechanicsburg soils, narrow strips of the somewhat poorly drained Orrville soils on flood plains, and oval areas on hilltops where the slope is 6 to 12 percent. Mechanicsburg soils are in the same landscape positions as the Brownsville soil. They have a lower content of rock fragments in the subsoil than the Brownsville soil. Included soils make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Available water capacity is low. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are used as pasture or woodland or are covered with brush. Only a few areas are used as cropland.

This soil is poorly suited to cultivated crops because of the slope, droughtiness, and a severe hazard of erosion. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, and contour stripcropping help to control erosion and conserve moisture. Grassed waterways also help to control erosion. Because of the moderate or moderately rapid permeability, frequent applications of a small amount of fertilizer are more effective than one application of a large amount.

Because of the slope, this soil is only moderately suited to pasture and is poorly suited to hay. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. No-till seeding helps to control erosion and conserves moisture.

Because of the low available water capacity, this soil is only moderately suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

Erosion is a hazard on access roads to oil and gas wells in areas of this soil. It can be controlled by constructing the roads across the slope, mulching, reseeding, and establishing water bars.

This soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields because of the slope. Buildings should be designed so that they conform to the natural slope of the land. The underlying bedrock commonly is rippable. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

BrF—Brownsville channery silt loam, 25 to 35 percent slopes. This deep, very steep, well drained soil generally is on unglaciated hillsides. In some areas it is on all parts of small hills. Slopes are smooth and commonly are 150 to 400 feet long. In places they are dissected by small drainageways. Most areas on hillsides are long and winding and are 30 to 150 acres in size. Areas on small hills are oval and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable channery silt loam about 4 inches thick. The subsurface layer is brown, friable channery silt loam about 4 inches thick. The subsoil is about 32 inches of yellowish brown, friable very channery and extremely channery loam. The substratum is yellowish brown, friable extremely channery loam. Thinly bedded, fractured siltstone bedrock is at a depth of about 50 inches. In some areas the slope is 18 to 25 percent. In other areas the subsoil or substratum is very channery fine sandy loam. In places the surface layer is stony. In a few areas the soil is moderately deep.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the upper part of some hillsides and small areas of the moderately well drained Clarksburg soils on some foot slopes. Also included are narrow strips of the somewhat poorly drained Orrville soils on flood plains and some areas on hilltops where the slope is 6 to 12 percent. Included soils make up about 20 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Available water capacity is low. Runoff is very rapid. Tilth is good. The root zone is deep.

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

Because of the slope, droughtiness, and a very severe hazard of erosion, this soil generally is unsuited to cultivated crops and is poorly suited to permanent pasture. It generally is too steep for intensive pasture management. Because of the good drainage, it is well suited to grazing in winter and early in spring. Drought retards the growth of forage species during dry periods. Erosion is a very severe hazard unless an adequate plant cover is maintained. No-till seeding conserves moisture and helps to control erosion.

Because of the low available water capacity, this soil is only moderately suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

Erosion is a hazard on access roads to oil and gas wells in areas of this soil. It can be controlled by constructing the roads across the slope, mulching, reseeding, and establishing water bars.

This soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields because of the slope. Buildings should be designed so that they conform to the natural slope of the land. The underlying bedrock commonly is rippable. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

BrG—Brownsville channery silt loam, 35 to 70 percent slopes. This deep, very steep, well drained soil is on unglaciated hillsides. Slopes are smooth and commonly are 200 to 400 feet long. Most areas are long and winding and are 8 to 40 acres in size. A few areas are more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable channery silt loam about 3 inches thick. The subsurface layer is brown, friable channery silt loam about 5 inches thick. The subsoil is about 18 inches of yellowish brown, friable very channery and extremely channery silt loam. The substratum is yellowish brown, friable extremely channery loam. Thinly bedded, fractured siltstone bedrock is at a depth of about 64 inches. In some areas the slope is 30 to 35 percent. In a few areas it is more than 70 percent. In some places the soil is moderately deep. In a few places the surface layer is stony. In some areas the subsoil and substratum have more sand.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the upper part of some hillsides. These soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Brownsville soil. Available water capacity is low. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are wooded. This soil generally is unsuited to cultivated crops, hay, and pasture. Because of the low available water capacity and the slope, it is only moderately suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

This soil generally is unsuited to building site development and septic tank absorption fields because of the slope.

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

Ca—Carlisle muck. This deep, nearly level, very poorly drained soil is in depressions on Wisconsinan till plains, outwash terraces, and lake plains. It receives runoff from the higher adjacent soils and is subject to ponding in fall, winter, and spring. Slopes are 0 to 2 percent. Most areas are oval or irregularly shaped and are 2 to 90 acres in size.

Typically, the surface layer is black, very friable muck about 10 inches thick. Below this to a depth of about 60 inches is dark reddish brown, very friable muck. In some areas the surface layer is recent alluvium of silt loam. In other areas a layer of loamy material is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of the very poorly drained Wallkill soils along the edges of flood plains, small areas of Luray soils along the edges of some depressions, and a few areas of soils that have clayey material within a depth of 40 inches. The upper part of the Wallkill soils is alluvium. Luray soils formed in mineral material. Included soils make up about 20 percent of most areas.

Permeability is moderately slow to moderately rapid in the Carlisle soil. Available water capacity is very high. Runoff is very slow or ponded. Unless the soil is drained, the seasonal high water table is near or above the surface for long periods. It restricts the root zone. Tilth is good. Strength is low, and compressibility is high.

Most areas are used as cropland. Some areas are used as pasture. Undrained areas commonly are wooded or are used as habitat for wetland wildlife.

If drained, this soil is moderately suited to corn and soybeans. It is poorly suited to small grain because of the ponding. Undrained areas are too wet for cultivated crops. Frost is a hazard because of the low position on the landscape. Because the soil is soft and highly compressible, especially when wet, it commonly cannot support narrow-wheeled equipment. Surface and subsurface drains can remove excess water, but subsurface drains can shift out of alignment over time and iron deposits can plug them. In some areas establishing suitable drainage outlets is difficult. The banks of open ditches commonly are unstable and subject to sloughing, and the soil subsides and shrinks after it is drained. During dry periods, fire and soil blowing are hazards. Controlled drainage in areas where the water table can be raised or lowered minimizes subsidence, helps to prevent fires, and helps to control erosion.

This soil is moderately suited to pasture. It is well suited to grasses that can withstand wetness, such as reed canarygrass. Because of the very high available water capacity, forage species generally grow well during long dry periods. Grazing when the soil is wet can cause considerable damage to the pasture.

Because of the prolonged wetness, this soil is only moderately suited to the trees that can withstand wetness. Undrained areas are well suited to habitat for wetland wildlife and support water-tolerant trees, cattails, reeds, and sedges. The species that can withstand wetness should be selected for planting.

Planting seedlings that have been transplanted once minimizes the seedling mortality rate. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to control windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Logging when the soil is frozen or during the drier parts of the year minimizes compaction and the formation of ruts and facilitates the use of equipment.

This soil generally is unsuited to building site development and septic tank absorption fields because of the ponding, subsidence, low strength, and the moderately slow to moderately rapid permeability.

This soil is a potential source of peat.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

CeB—Centerburg silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on low knolls and ridges on Wisconsinan till plains. Areas commonly are irregularly shaped and are 5 to 20 acres in size. A few areas are 20 to 30 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown and dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 80 inches is brown, mottled, firm, calcareous loam glacial till. In some areas the slope is 6 to 12 percent. In other areas the lower part of the subsoil is silt loam. In places the soil is eroded.

Included with this soil in mapping are the very poorly drained Pewamo soils in depressions and the somewhat poorly drained Bennington soils near the base of some slopes and in the more nearly level areas. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Available water capacity is moderate. Runoff is medium in cultivated areas. Tilth is good. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

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

This soil is well suited to corn, soybeans, and small grain. Erosion is a moderate hazard. A surface crust forms in tilled areas after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including meadow crops in the crop rotation, and returning crop residue to the soil help to control erosion and minimize crusting (fig. 10). Grassed waterways also help to control erosion.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate. No-till seeding helps to control erosion.

This soil is well suited to trees. If good management is applied, seedlings grow well. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is moderately suited to building site development. The seasonal wetness and a moderate shrink-swell potential in the subsoil are limitations, especially on sites for buildings with basements. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. The highest landscape positions should be selected for building site development. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is moderately suited to septic tank absorption fields. The seasonal wetness and the moderately slow permeability are severe limitations. Perimeter drains around the absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage.

The land capability classification is IIe. The woodland ordination symbol is 5A.

CeC2—Centerburg silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained soil is on knolls, ridges, and dissected side slopes along drainageways on Wisconsinan till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 400 feet long. Most areas are irregularly shaped and are 5 to 30 acres in size. Some areas are as large as 75 acres.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown,

Figure 10.—Soybeans planted in corn stubble in an area of Centerburg silt loam, 2 to 6 percent slopes.

mottled, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous, firm loam glacial till. In places the soil is well drained. In a few areas the slope is 2 to 6 percent or 12 to 15 percent. In some areas the soil is less eroded.

Included with this soil in mapping are small areas of severely eroded soils on the upper part of the slopes, small areas of the somewhat poorly drained Bennington soils in low spots and near the base of knolls, narrow strips of the very poorly drained Pewamo soils along drainageways, and strips of the somewhat poorly drained Shoals soils on narrow flood plains. The severely eroded soils have a surface layer of gravelly clay loam in which tilth is fair. Also included are some springs and seeps. Inclusions make up about 20 percent of most areas.

Permeability is moderately slow in the Centerburg soil. Available water capacity is moderate. Runoff is rapid in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

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

This soil is moderately suited to corn, small grain, and occasionally grown soybeans. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, and contour stripcropping minimize crusting and help to control erosion. Grassed waterways also help to control erosion.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. No-till seeding helps to control erosion.

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

Because of the slope, the seasonal wetness, the moderately slow permeability, and a moderate shrink-swell potential in the subsoil, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields and interceptor drains upslope from the absorption fields help to prevent lateral seepage and lower the seasonal high water table. Installing the distribution lines on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

CfB—Centerburg-Urban land complex, 2 to 6 percent slopes. This map unit consists of a deep, gently sloping, moderately well drained Centerburg soil and areas of Urban land on low knolls and ridges on Wisconsinan till plains. Areas commonly have straight boundaries with distinct corners and are 20 to 50 acres in size. Most are about 45 percent Centerburg silt loam and 35 percent Urban land. The Centerburg soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Centerburg soil has a surface layer of brown, friable silt loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown and dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 80 inches is brown, mottled, calcareous, firm loam glacial till. In some areas the slope is 6 to 12 percent. In other areas the soil has been radically altered by cutting and filling.

The Urban land is covered by buildings and pavement. The buildings are mainly residential, but some are industrial or commercial.

Included with the Centerburg soil and Urban land in mapping are small areas of the somewhat poorly drained Bennington soils on flats and slight rises and small areas of the very poorly drained Pewamo soils in depressions. Included soils make up about 20 percent of most areas.

Most areas have been drained by sewer systems, gutters, and drains. Undrained areas of the Centerburg soil have a perched seasonal high water table at a depth of 18 to 36 inches during extended wet periods. Permeability is moderately slow in this soil. Available water capacity is moderate. Runoff is medium. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

The Centerburg soil is used for lawns, gardens, or parks. It is well suited to gardens, lawns, shrubs, and trees. The spots that have been cut and filled are not well suited to lawns and gardens. In areas where the subsoil and substratum are exposed, tilth is very poor and reaction varies. The exposed material is sticky when wet and hard when dry. Adding organic material to the soil improves tilth.

Because of the seasonal wetness, a moderate shrink-swell potential in the subsoil, and the moderately slow permeability, the Centerburg soil is only moderately suited to dwellings and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundation walls with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. In some areas sanitary facilities are connected to sewers and sewage treatment facilities. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The Centerburg soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

CfC—Centerburg-Urban land complex, 6 to 12 percent slopes. This map unit consists of a deep, sloping, moderately well drained Centerburg soil and areas of Urban land on Wisconsinan till plains. Areas are irregularly shaped but commonly have some straight boundaries. Most are 10 to 40 acres in size, but some are larger than 100 acres. Most areas are about 45 percent Centerburg silt loam and 35 percent Urban land. The Centerburg soil and Urban land occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Centerburg soil has a surface layer of brown, friable silt loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, calcareous, firm loam glacial till. In some areas the slope is 4 to 6 percent. In a few areas along drainageways, it is 12 to 18 percent. In places the soil has been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed.

The Urban land is covered by buildings and pavement. The buildings are mainly residential, but some are industrial or commercial.

Included with the Centerburg soil and Urban land in mapping are small areas of the somewhat poorly drained Bennington soils on the lower part of the slopes and on low knolls and narrow strips of the very poorly drained Pewamo soils in depressions. Included soils make up about 20 percent of most areas.

Most areas have been drained by sewer systems, gutters, and drains. Undrained areas of the Centerburg soil have a perched seasonal high water table at a depth of l8 to 36 inches during extended wet periods. Permeability is moderately slow in this soil. Available water capacity is moderate. Runoff is rapid. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact substratum.

The Centerburg soil is used for lawns, gardens, or parks. It is well suited to gardens, lawns, shrubs, and trees. The spots that have been cut and filled are not well suited to lawns and gardens. In areas where the subsoil and substratum are exposed, tilth is very poor and reaction varies. The exposed material is sticky when wet and hard when dry. Adding organic material to the soil improves tilth.

Because of the seasonal wetness, a moderate shrink-swell potential, the moderately slow permeability, and the slope, the Centerburg soil is only moderately suited to dwellings and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundation walls with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. In some areas sanitary facilities are connected to sewers and sewage treatment facilities. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

The Centerburg soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

ChA—Chili loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on flats on Wisconsinan outwash terraces. Most areas are irregularly shaped and are 10 to 100 acres in size.

Typically, the surface layer is brown, friable loam about 10 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable loam, and the lower part is brown and strong brown, friable gravelly sandy clay loam and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In some areas the slope is 2 to 4 percent. In a few areas the surface layer and the lower part of the subsoil are silt loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils in depressions. Also included, in the same landscape positions as the Chili soil, are soils in which the substratum is gravelly sandy loam. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Available water capacity is low or moderate. Runoff is slow. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used as hayland or pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. Either conventional tillage or conservation tillage can be used. Drought is a hazard during periods of low rainfall. No-till farming or another system of conservation tillage that leaves crop residue on the surface conserves moisture. The soil dries and warms early in spring and thus is well suited to tilling and planting early in spring. Frequent applications of a small amount of fertilizer minimize the loss of plant nutrients through leaching. The soil is suited to irrigation.

This soil is well suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. Deep-rooted plants, such as alfalfa, can withstand drought better than shallow-rooted plants.

Because of the suitability for cropland, only a few areas are wooded. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields. The slope, the moderately rapid permeability, and the good natural drainage favor these uses. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Sloughing is a hazard if the soil is excavated.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys. The included areas where the substratum is gravelly sandy loam are not probable sources.

The land capability classification is IIs. The woodland ordination symbol is 4A.

ChB—Chili loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on low knolls on Wisconsinan outwash terraces. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable loam about 9 inches thick. The subsoil is about 46 inches thick. The upper part is yellowish brown, friable loam, and the lower part is brown, friable gravelly sandy clay loam and gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In some areas the slope is 0 to 2 percent or 6 to 9 percent. In a few areas the surface layer and the lower part of the subsoil are silt loam.

Included with this soil in mapping are small areas of somewhat poorly drained soils in slight depressions. Also included are soils that are gravelly sandy loam in the lower part. These soils are in the same landscape positions as the Chili soil. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Available water capacity is low or moderate. Runoff is medium. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. A moderate hazard of erosion and slight droughtiness are management concerns. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including hay and cover crops in the crop rotation, and returning crop residue to the soil help to control erosion and conserve moisture. The soil dries and warms early in spring and thus is suited to tilling and planting early in spring. Frequent applications of a small amount of fertilizer minimize the loss of plant nutrients through leaching. The soil is suited to irrigation, but controlling erosion is a management concern in irrigated areas.

This soil is well suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. Deep-rooted plants, such as alfalfa, can withstand drought better than shallow-rooted plants. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a moderate hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

Because of the suitability for cropland, only a few areas are wooded. This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields. Sloughing is a hazard if the soil is excavated.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys. The included areas where the substratum is gravelly sandy loam are not probable sources.

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

ChC2—Chili loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on slope breaks on Wisconsinan outwash terraces and on knolls on kames. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 60 to 250 feet long. Those on kames commonly are 60 to 200 feet long. Most areas on outwash terraces are long, winding, and narrow and are 3 to 30 acres in size. Areas on kames commonly are oval and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil is about 44 inches thick. It is yellowish brown and friable loam. The upper part is loam and gravelly loam, and the lower part is gravelly sandy loam. The substratum to a depth of about 60 inches is strong brown, loose gravelly loamy sand. In some areas the slope is 4 to 6 percent or 12 to 15 percent.

Included with this soil in mapping are small areas of soils that are gravelly sandy loam in the lower part and small areas of soils that are droughtier than the Chili soil and contain more sand in the surface layer and subsoil. These soils are in the same landscape positions as the Chili soil. Also included are small areas of severely eroded soils that have more gravel in the surface layer than the Chili soil. In these soils, tilth is poor and the available water capacity is lower than that of the Chili soil. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Available water capacity is low or moderate. Runoff is rapid. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used as pasture, hayland, or woodland.

This soil is moderately suited to corn, soybeans, and small grain grown in rotation with meadow crops. Erosion and slight droughtiness are management concerns. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including hay and cover crops in the crop rotation, and returning crop residue to the soil help to control erosion and conserve moisture. The soil dries and warms early in spring and thus is suited to tilling and planting early in spring. Frequent applications of a small amount of fertilizer minimize the loss of plant nutrients through leaching.

This soil is well suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. Deep-rooted plants, such as alfalfa, can withstand drought better than shallow-rooted plants. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Sloughing is a hazard if the soil is excavated. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys. The depth to usable layers, the thickness of those layers, and the gradation of individual grain sizes vary, especially in areas on kames. The included areas where the substratum is gravelly sandy loam are not probable sources.

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

ChD2—Chili loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil generally is on slope breaks on Wisconsinan outwash terraces. In a few areas it is on knolls on kames. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 60 to 200 feet long. Those on kames commonly are 60 to 250 feet long. Most areas on outwash terraces are long, narrow, and winding and are 4 to 15 acres in size. Areas on kames commonly are oval and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable loam about 5 inches thick. The subsoil is about 45 inches thick. It is yellowish brown and friable. The upper part is loam and gravelly loam, and the lower part is gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, loose gravelly loamy sand. In some areas the slope is 9 to 12 percent or 18 to 25 percent.

Included with this soil in mapping are small areas of soils that are gravelly sandy loam in the lower part and small areas of soils that are droughtier than the Chili soil and contain more sand in the surface layer and subsoil. These soils are in the same landscape positions as the Chili soil. Also included, on the upper part of the slopes, are small areas of severely eroded soils that have more gravel in the surface layer than the Chili soil. In these soils, tilth is poor and the available water capacity is lower than that in the Chili soil. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Available water capacity is low or moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are used as pasture or hayland. Some areas are used for row crops or are wooded.

This soil is poorly suited to row crops. Erosion and drought are management concerns. In tilled areas the hazard of erosion is very severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include long-term hay or pasture, cover crops, and grassed waterways help to control erosion and conserve moisture. Frequent applications of a small amount of fertilizer minimize the loss of plant nutrients through leaching.

This soil is moderately suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Drought reduces yields of hay late in the growing season. Deep-rooted plants, such as alfalfa, can withstand drought better than shallow-rooted plants. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion.

Because of the slope, this soil is poorly suited to building site development and septic tank absorption fields. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting, filling, or land shaping. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Sloughing is a hazard if the soil is excavated. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys. The depth to usable layers, the thickness of those layers, and the gradation of individual grain sizes vary, especially in areas on kames. The included areas where the substratum is gravelly sandy loam are not probable sources.

The land capability classification is IVe. The woodland ordination symbol is 4R.

ChE2—Chili loam, 18 to 25 percent slopes, eroded. This deep, steep, well drained soil is on slope breaks on Wisconsinan outwash terraces. Erosion has removed part of the original surface layer. The present surface layer is a mixture of the original surface layer and some subsoil material. Slopes are smooth and commonly are 60 to 150 feet long. Most areas are long and narrow and are 4 to 15 acres in size.

Typically, the surface layer is brown, friable loam about 4 inches thick. The subsoil is about 55 inches thick. It is yellowish brown and friable. The upper part is gravelly loam, and the lower part is gravelly sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable gravelly loamy sand. In some areas the slope is 12 to 18 percent or 26 to 30 percent.

Included with this soil in mapping are small areas of severely eroded soils. In these soils tilth is poor, the available water capacity is lower than that in the Chili soil, and the surface layer contains more gravel. These soils are in the same landscape positions as the Chili soil. Also included are some seeps and springs on the lower part of the slopes. Inclusions make up about 15 percent of most areas.

Permeability is moderately rapid in the Chili soil. Available water capacity is low or moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are wooded or covered with brush. Some areas are used as pasture. A few areas in the dominantly flatter fields are used as cropland.

Because of the slope, a very severe hazard of erosion, and droughtiness, this soil is poorly suited to row crops. A permanent cover of sod or trees helps to control erosion.

Because of the slope and the very severe hazard of erosion, this soil is only moderately suited to pasture and is poorly suited to hay. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. Drought restricts plant growth during dry periods. Deep-rooted plants, such as alfalfa, grow better during dry periods than shallow-rooted plants. No-till seeding helps to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion.

Because of the slope, this soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Septic tank absorption fields should be installed on the better suited adjacent soils. Sloughing is a hazard if the soil is excavated. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys.

The land capability classification is VIe. The woodland ordination symbol is 4R.

CkB—Cincinnati silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and low knolls on loess-mantled Illinoian till plains. Most areas are irregularly shaped and are 3 to 10 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown, friable silt loam in the upper part; a fragipan of yellowish brown, very firm, brittle loam in the next part; and yellowish brown, firm clay loam in the lower part. In places the slope is 0 to 2 percent or 6 to 9 percent. In some areas the mantle of loess is less than 18 inches thick, and in other areas it is 40 to 60 inches thick.

Included with this soil in mapping are small areas of Alford soils, which do not have a fragipan, and areas of the moderately well drained Coshocton and Keene soils. The included soils are in landscape positions similar to those of the Cincinnati soil. They make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Cincinnati soil and slow or moderately slow in the fragipan. Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is perched at a depth of 30 to 48 inches during extended wet periods. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the fragipan.

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

This soil is well suited to corn, soybeans, and small grain. The hazard of erosion is moderate. A surface crust forms in tilled areas after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including hay and cover crops in the crop rotation, and returning crop residue to the soil help to control erosion and minimize crusting. Grassed waterways also help to control erosion.

This soil is well suited to hay and pasture. If properly managed, it is well suited to grazing in winter and early in spring, but compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area and installing the distribution lines above the fragipan and as close to the surface as possible improve the capacity of the fields to absorb effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

CkC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on ridgetops and side slopes on loess-mantled Illinoian till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 450 feet long. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 81 inches thick. The upper part is strong brown, friable silt loam; the next part is a fragipan of yellowish brown, mottled, very firm, brittle loam and clay loam; and the lower part is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 99 inches is dark yellowish brown, firm loam. In some areas the silty mantle is less than 18 inches thick. In other areas the slope is 12 to 18 percent.

Included with this soil in mapping are small areas of the well drained Alford soils, which do not have a fragipan, and areas of the moderately well drained Coshocton and Keene soils. The included soils are in landscape positions similar to those of the Cincinnati soil. They make up about 20 percent of most areas.

Permeability is moderate above the fragipan in the Cincinnati soil and slow or moderately slow in the fragipan. Available water capacity is moderate. Runoff is rapid in cultivated areas. The seasonal high water table is perched at a depth of 30 to 48 inches during extended wet periods. Water moves laterally along the top of the fragipan and sometimes seeps to the surface. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

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

This soil is moderately suited to corn, soybeans, and small grain grown in rotation with meadow crops. The hazard of erosion is severe in tilled areas. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface and crop rotations that include hay or cover crops help to control erosion and minimize crusting. Contour stripcropping and grassed waterways also help to control erosion. Many areas are well suited to contour stripcropping and no-till farming.

This soil is well suited to hay and pasture. If properly managed, it is well suited to grazing in winter and early in spring, but compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, the seasonal wetness, and the slow or moderately slow permeability, this soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption area and installing the distribution lines on the contour and in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent and help to prevent seepage. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

CmC2—Clarksburg silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained soil is on slightly concave foot slopes at the base of the steeper hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth or slightly concave and commonly are 150 to 300 feet long. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 49 inches thick. The upper part is yellowish brown, friable silt loam and yellowish brown, mottled, firm silty clay loam. The next part is a fragipan of dark yellowish brown, mottled, very firm, brittle silty clay loam. The lower part is dark yellowish brown, mottled, friable channery silt loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable channery silt loam. In places the fragipan is weakly developed. In a few areas the slope is 12 to 18 percent.

Included with this soil in mapping are small areas of the well drained Mentor soils on the lower part of the slopes and the well drained Brownsville soils on the upper part. Also included are some springs and seeps. Inclusions make up about 20 percent of most areas.

Permeability is moderate above the fragipan in the Clarksburg soil and slow or moderately slow in the fragipan. Available water capacity is moderate. Runoff is rapid in cultivated areas. Tilth is good. The seasonal high water table is perched at a depth of about 18 to 36 inches during extended wet periods. Water moves laterally along the top of the fragipan and sometimes surfaces as hillside seeps, especially on the lower part of the slopes. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

Most areas are used for pasture or hay. Some areas are used for row crops or small grain. A few areas are wooded.

Because of a severe hazard of erosion in tilled areas, this soil is only moderately suited to corn and small grain grown in rotation with meadow crops. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface and crop rotations that include hay or cover crops help to control erosion and minimize crusting. Contour stripcropping and grassed waterways also help to control erosion. Natural drainage is adequate for most crops, but random subsurface drains may be needed to remove excess water in areas of seeps and springs.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

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

Because of the slope, the seasonal wetness, the slow or moderately slow permeability, and a moderate shrink-swell potential, this soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption area and installing the distribution lines on the contour and in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

CmD2—Clarksburg silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, moderately well drained soil is on slightly concave foot slopes at the base of the steeper hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth or slightly concave and commonly are 150 to 300 feet long. Most areas are long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam. The next part is a fragipan of yellowish brown, very firm, brittle silty clay loam and channery silty clay loam. The lower part is yellowish brown, mottled channery silty clay loam. The substratum to a depth of about 80 inches is yellowish brown, mottled, firm channery silt loam. In a few areas the slope is 10 to 12 percent or 18 to 22 percent. In some areas the fragipan is weakly developed.

Included with this soil in mapping are small areas of the well drained Mentor and Brownsville soils. Mentor soils are on the lower part of the slopes, and Brownsville soils are on the upper part. Also included are some springs and seeps. Inclusions make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Clarksburg soil and slow or moderately slow in the fragipan. Available water capacity is moderate. Runoff is very rapid in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Water moves laterally along the top of the fragipan. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

Most areas are used for pasture or hay. Some areas are used for row crops or small grain. A few areas are wooded.

This soil is poorly suited to cultivated crops. In tilled areas the hazard of erosion is very severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface and crop rotations that include hay or cover crops help to control erosion and minimize crusting. Contour stripcropping and grassed waterways also help to control erosion. Natural drainage is adequate for most crops, but random subsurface drains may be needed to remove excess water in areas of seeps and springs.

This soil is moderately suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a very severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the slope, the seasonal wetness, the slow or moderately slow permeability, and a moderate shrink-swell potential, this soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption area and installing the distribution lines on the contour and in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 4R.

Cn—Condit silt loam. This deep, nearly level, poorly drained soil is in slight depressions and swales and on flats on Wisconsinan till plains. It receives runoff from the adjacent slopes and is subject to ponding. Most areas in swales and on flats are irregularly shaped and are 4 to 20 acres in size. Areas in closed depressions are roughly oval and are 2 to 5 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 11 inches thick. The subsoil is 27 inches of dark gray and yellowish brown, mottled, firm silty clay loam and clay loam. The substratum to a depth of about 80 inches is brown, mottled, calcareous, firm loam glacial till. In some areas the soil is somewhat poorly drained. In other areas the surface layer has alluvial sediments washed from the adjacent slopes.

Included with this soil in mapping are small areas of the very poorly drained Pewamo soils in depressions and along drainageways and small areas of the moderately well drained Centerburg soils on low knolls. Included soils make up about 10 percent of most areas.

Permeability is slow in the Condit soil. Available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is near or above the surface during extended wet periods. Tilth is good. The root zone is deep in drained areas. It is restricted by the water table in undrained areas.

Most areas are used as cropland or pasture. Some areas are wooded or covered with brush, especially if they are not drained.

If drained, this soil is moderately suited to corn, soybeans, and small grain, but the wetness delays planting and limits the choice of crops that can be grown. Undrained areas commonly do not have suitable natural outlets for subsurface drains. Open ditches and surface drains can reduce ponding and provide drainage outlets. Closely spaced subsurface drains help to lower the water table in areas where adequate outlets are available. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The species that can withstand wetness, such as alsike clover, should be selected for planting.

This soil is well suited to the species of trees that grow well on wet soils. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Frequent, light thinning or harvesting reduces the hazard of windthrow and improves the vigor of the stand. Logging when the soil is frozen or during the drier parts of the year minimizes compaction and facilitates the use of equipment. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the ponding and the slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

CoB—Coshocton silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on unglaciated ridgetops. Most areas are long and narrow and are 3 to 20 acres in size. Some areas are as large as 50 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 29 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum is brown, mottled, firm silty clay loam. Soft shale bedrock is at a depth of about 45 inches. In some places the soil is eroded and has a surface layer that is silty clay loam and that has a higher content of coarse fragments. In other places the slope is 6 to 9 percent. In some areas the upper part of the soil is glacial till. In a few areas the soil is well drained. In places the subsoil has more clay.

Included with this soil in mapping are small areas of moderately deep soils. These soils are in the same landscape positions as the Coshocton soil. They make up about 15 percent of most areas.

Permeability is slow or moderately slow in the Coshocton soil. Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Many areas are used for hay or pasture. Some areas are used for row crops, small grain, or woodland or are covered with brush.

This soil is well suited to corn and small grain. In tilled areas the hazard of erosion is moderate. A surface crust forms after hard rains. Farming on the contour, including grasses and legumes in the crop rotation, returning crop residue to the soil, and applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the seasonal wetness and a moderate shrink-swell potential, this soil is only moderately suited to building site development. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains around the absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

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

CoC2—Coshocton silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained soil is mainly on unglaciated ridgetops. In a few areas it is on hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 400 feet long. Most areas are long and narrow and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown and strong brown silt loam and silty clay loam. The next part is strong brown and light yellowish brown, mottled, firm silty clay loam. The lower part is light brownish gray and brown, mottled, firm silty clay and silty clay loam. The substratum is pale brown and grayish brown, mottled, firm silty clay loam. Soft shale bedrock is at a depth of about 67 inches. In some areas the upper part of the soil is glacial till or sandy loam colluvium. In some places the slope is 2 to 6 percent or 12 to 15 percent. In other places the surface is stony. In a few areas the subsoil is yellowish red. In places the soil is less eroded.

Included with this soil in mapping are small areas of moderately deep soils, especially on the upper part of the slopes. Also included are small areas of severely eroded soils and the well drained Rigley soils on the upper part of the slopes and small areas of the well drained Brownsville soils on the lower part of the slopes. In the severely eroded soils, the surface layer is silty clay loam and tilth is fair. Also included, especially on the lower part of some slopes, are seeps and springs. Inclusions make up about 20 percent of most areas.

Permeability is slow or moderately slow in the Coshocton soil. Available water capacity is moderate. Runoff is rapid in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used as hayland, pasture, or woodland or are covered with brush. Some areas are used for row crops or small grain.

Because of the slope and a severe hazard of erosion, this soil is only moderately suited to corn and small grain. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. Contour stripcropping, crop rotations that include hay or cover crops, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The seeps and springs on the lower part of the slopes interfere with tillage. Subsurface drains help to remove the excess water.

This soil is well suited to hay and pasture. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, the seasonal wetness, and a moderate shrink-swell potential, this soil is only moderately suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Because of the seasonal wetness and the slow permeability, this soil is poorly suited to septic tank absorption fields. Interceptor drains upslope from the absorption fields lower the seasonal high water table and intercept lateral seepage from the higher adjacent soils. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

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

CoD2—Coshocton silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, moderately well drained soil is on unglaciated hillsides and on some ridgetops. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are uniform and commonly are 200 to 600 feet long. Most areas on hillsides are long and winding and are 20 to more than 200 acres in size. Areas on ridgetops are long and narrow and commonly are 18 to 80 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum is dark grayish brown, mottled, firm silty clay loam. Soft shale bedrock is at a depth of about 55 inches. In some areas the soil is less eroded. In other areas the slope is 6 to 12 percent. In a few areas the upper part of the soil is sandy loam colluvium. In places the surface is stony.

Included with this soil in mapping are small areas of the well drained Brownsville soils on the lower part of the slopes, small areas of severely eroded soils, and small areas of moderately deep soils on the upper part of the slopes. Also included are small seeps. Inclusions make up about 20 percent of most areas.

Permeability is slow or moderately slow in the Coshocton soil. Available water capacity is moderate. Runoff is very rapid in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas were farmed in the past and are now used as hayland, pasture, or woodland or are covered with brush. Some areas are used for row crops or small grain.

Because of the slope and a very severe hazard of erosion, this soil is poorly suited to cultivated crops. Erosion has reduced natural fertility and increased the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. Contour stripcropping, crop rotations that include hay or cover crops, grassed waterways, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting. Seeps and springs interfere with tillage. Subsurface drains help to remove excess water.

This soil is moderately suited to hay and pasture. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. On south aspects, the seedling mortality rate can be reduced by planting seedlings that have been transplanted once.

Access roads to oil and gas wells are subject to severe gully erosion in areas of this soil. The hazard of erosion can be reduced by constructing the roads on the lowest possible grade and by establishing water bars.

Because of the slope, the seasonal wetness, the slow or moderately slow permeability, and a moderate shrink-swell potential, this soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. Interceptor drains upslope from septic tank absorption fields lower the seasonal high water table and intercept lateral seepage from the higher adjacent soils. Enlarging the absorption area and installing the distribution lines on the contour improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

CoE2—Coshocton silt loam, 18 to 25 percent slopes, eroded. This deep, steep, moderately well drained soil generally is on unglaciated hillsides. In a few areas it is on high knolls. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are 200 to 400 feet long. Most areas on hillsides are long and winding and are 20 to 40 acres in size, but a few areas are more than 100 acres in size. Areas on high knolls are roughly oval and are 10 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is light brownish gray and yellowish brown, mottled, firm silty clay loam. The substratum is yellowish brown, mottled, firm silty clay loam. Shale bedrock is at a depth of about 60 inches. In some areas the soil is less eroded. In other areas the slope is 15 to 18 percent or 25 to 35 percent. In a few areas the upper part of the soil is sandy loam colluvium.

Included with this soil in mapping are small areas of severely eroded soils and the well drained Brownsville soils on the lower part of the slopes and small areas of moderately deep soils on the upper part of some slopes. Also included are small seeps. Inclusions make up about 20 percent of most areas.

Permeability is slow or moderately slow in the Coshocton soil. Available water capacity is moderate. Runoff is very rapid in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas were farmed in the past but are now wooded or covered with brush. Some areas are used as pasture.

Because of the slope and a very severe hazard of erosion, this soil generally is unsuited to cultivated crops and small grain. The slope limits the use of farming equipment.

Because of the slope and the very severe hazard of erosion, this soil is only moderately suited to pasture and is poorly suited to hay. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. On south aspects, the seedling mortality rate can be reduced by planting seedlings that have been transplanted once.

Access roads to oil and gas wells are subject to severe gully erosion in areas of this soil. The hazard of erosion can be reduced by constructing the roads on the lowest possible grade and by establishing water bars.

Because of the slope, the seasonal wetness, the slow or moderately slow permeability, and a moderate shrink-swell potential, this soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

CrA—Crane silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on flats and in slight swales on Wisconsinan outwash terraces. Most areas are irregularly shaped or elongated and are 5 to 30 acres in size.

Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsurface layer also is black, friable silt loam. It is about 5 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, mottled, firm and friable silty clay loam and clay loam, and the lower part is dark grayish brown, mottled, friable gravelly sandy clay loam and gravelly sandy loam. The substratum to a depth of about 80 inches is brown very gravelly loamy sand. In some areas the soil is very poorly drained. In other areas the surface layer is very fine sandy loam or loam.

Included with this soil in mapping are small areas of moderately well drained soils on slight rises. Also included are areas of soils that have a loamy substratum. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Crane soil and very rapid in the substratum. Available water capacity is high. Runoff is very slow. Tilth is good. The seasonal high water table is at a depth of 12 to 36 inches during extended wet periods. In drained areas the root zone is deep.

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

If drained, this soil is well suited to corn, soybeans, and small grain. In undrained areas the wetness delays planting and limits the choice of crops that can be grown. Surface and subsurface drains are needed.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The species that can withstand some wetness should be selected for planting.

Because of the seasonal wetness, this soil is poorly suited to building site development and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Sloughing is a hazard if the soil is excavated. Properly landscaping building sites and absorption fields results in good surface drainage.

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

FaD—Fairpoint silty clay loam, 8 to 25 percent slopes. This deep, sloping to steep, well drained soil is on the sides of mine spoil ridges in areas that have been surface mined for coal. The substratum is a mixture of rock fragments and partly weathered fine-earth material that was in or below the profile of the original soil. The soil has been reclaimed by grading and by blanketing the surface with a layer of material from the original topsoil or with a combination of the original topsoil and subsoil stockpiled during mining. Most areas are irregularly shaped and range from 4 to 30 acres in size.

Typically, the surface layer is yellowish brown, firm silty clay loam about 6 inches thick. The substratum to a depth of about 60 inches is variegated yellowish brown, pale brown, very dark gray, and gray, very firm very shaly and very gravelly silty clay loam. In some areas the slope is less than 8 percent. In other areas the soil is strongly acid or very strongly acid near the surface.

Included with this soil in mapping are a few small areas where the slope is 25 to 30 percent. These areas are near the top of high walls. Also included are areas that have not been reclaimed and have stones on the surface and in the surface layer. Inclusions make up about 25 percent of most areas.

Permeability is moderately slow in the Fairpoint soil. Available water capacity is low. Runoff is very rapid. Tilth is poor. The depth of the root zone varies greatly within short distances because the soil material varies in density.

Most areas are covered with grasses. Because of the slope, the hazard of erosion, droughtiness, and low fertility, this soil is poorly suited to row crops and small grain. In tilled areas the hazard of erosion is very severe. This soil is well suited to no-till farming. A protective plant cover and mulch help to control runoff and erosion and increase the infiltration rate.

This soil is moderately suited to hay and pasture. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. No-till seeding helps to control erosion. Split applications of nitrogen fertilizer increase forage production. Drought reduces yields of hay late in the growing season.

This soil is best suited to trees that can withstand drought. Grasses and legumes protect the surface during periods when the trees are becoming established. Mechanical tree planters can be used on this soil.

Onsite investigation is needed to determine suitability for building site development and septic tank absorption fields. In areas where it has settled, this soil is moderately suited or poorly suited to building site development and poorly suited to septic tank absorption fields. The depth of the soil over bedrock and runoff of storm water should be considered during onsite investigation. Areas where the soil is deeper over bedrock generally require longer periods for settlement. Because of buried trees and woody debris and the hazard of subsidence, a few areas that originally were wooded should not be selected for building site development. Erosion is a hazard. It can be controlled by mulching and by establishing a temporary plant cover. Land shaping is needed in some areas.

Buildings should be designed so that they conform to the natural slope of the land. The shrink-swell potential is a limitation on sites for dwellings. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent.

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

FcA—Fitchville silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil generally is on flats and in slight depressions on Wisconsinan lake plains and slack-water terraces. In a few areas it is in draws extending into the uplands. Most areas are irregularly shaped and are 2 to 30 acres in size. Some areas are more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 52 inches of brown and yellowish brown, mottled, firm silt loam and silty clay loam. The substratum to a depth of about 70 inches is yellowish brown, mottled, firm silty clay loam. In some areas the subsoil is gravelly loam or gravelly silt loam. In areas that receive eroding sediments from the higher adjacent soils, the surface layer is thicker.

Included with this soil in mapping are small areas of the very poorly drained Luray soils. These soils are in the same landscape positions as the Fitchville soil. Also included are areas of the moderately well drained Glenford soils on slight rises and low knolls; a few small areas of soils that have a subsoil or substratum of silty clay; and, in some areas along streams, narrow strips of soils that are subject to flooding. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Fitchville soil. Available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Tilth is good. In drained areas the root zone is deep.

Most areas are used for row crops or small grain. Some areas are used as hayland or pasture. A few areas are wooded. Most of the wooded areas are undrained.

If drained, this soil is well suited to corn, soybeans, and small grain, but the seasonal wetness delays planting and limits the choice of crops that can be grown. Surface and subsurface drains commonly are used to improve drainage. In places adequately draining the soil is difficult. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing when the soil is too wet helps to keep the pasture in good condition. The species that can withstand some wetness should be selected for planting.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the seasonal wetness and the moderately slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage.

The land capability classification is IIw. The woodland ordination symbol is 5A.

FcB—Fitchville silt loam, 2 to 6 percent slopes. This deep, gently sloping, somewhat poorly drained soil is mainly on low knolls on Wisconsinan lake plains and slack-water terraces. In a few areas it is on foot slopes and in draws that extend into the uplands. Most areas are irregularly shaped and are 2 to 15 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsoil is yellowish brown, mottled, firm silty clay loam about 40 inches thick. The substratum to a depth of about 60 inches also is yellowish brown, mottled, firm silty clay loam. In some areas the subsoil is gravelly loam or gravelly silt loam.

Included with this soil in mapping are small areas of the very poorly drained Luray soils along drainageways and small areas of the moderately well drained Glenford soils on the upper part of the slopes. Also included, along streams, are narrow strips of soils that are subject to flooding. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Fitchville soil. Available water capacity is high. Runoff is medium. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. Tilth is good. In drained areas the root zone is deep.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. A few areas are wooded.

If drained, this soil is well suited to corn, soybeans, and small grain. The hazard of erosion and the seasonal wetness are management concerns. In tilled areas the hazard of erosion is moderate. A surface crust forms after hard rains. Including meadow crops in the crop rotation and returning crop residue to the soil help to control erosion and minimize crusting. Grassed waterways also help to control erosion. Adequately drained areas are suited to no-till farming or another system of conservation tillage that leaves crop residue on the surface. A drainage system can help to remove excess water in areas where suitable outlets are available.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate. No-till seeding helps to control erosion. The species that can withstand some wetness should be selected for planting.

This soil is well suited to trees that can withstand some wetness. No major hazards or limitations affect planting or harvesting.

Because of the seasonal wetness and the moderately slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIe. The woodland ordination symbol is 5A.

Figure 11.—Rill and gully erosion on Fox gravelly loam, 12 to 18 percent slopes, eroded. Conventional tillage methods were used when the corn was planted.

FoD2—Fox gravelly loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is on short, dissected side slopes on Wisconsinan outwash terraces and kames. Erosion has removed part of the original surface layer (fig. 11). Tillage has mixed subsoil material into the present surface layer. Slopes generally are 60 to 200 feet long. Most areas on terrace breaks are long, narrow, and winding and are 5 to 30 acres in size. Areas on kames are roughly circular and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is dark yellowish brown, brown, and reddish brown, firm gravelly clay loam, and the lower part is brown, friable gravelly loam and yellowish brown, very friable very gravelly sandy loam. The substratum to a depth of about 60 inches is brown, calcareous, loose very gravelly sand. In some areas the slope is 9 to 12 percent or 18 to 21 percent. In other areas depth to the calcareous substratum is less than 24 inches.

Included with this soil in mapping are small areas of severely eroded soils on the upper part of the slopes. Also included, especially on kames, are small areas of soils that have a loamy substratum. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. Available water capacity is low. Runoff is very rapid in cultivated areas. Tilth is fair. The root zone generally is moderately deep.

Most areas are used as cropland. These areas commonly are on narrow slope breaks in the dominantly flatter fields. Some areas are used as pasture or hayland. A few areas are wooded or covered with brush.

Because of the slope, a very severe hazard of erosion, and droughtiness, this soil is poorly suited to cultivated crops. Significant erosion has occurred, reducing the level of natural fertility, the depth to sand and gravel, and the available water capacity of the soil. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including long-term hay crops in the crop rotation, and returning crop residue to the soil help to control erosion and conserve moisture.

This soil is moderately suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Growing forage species helps to control erosion. If the pasture is plowed during seedbed preparation or is overgrazed, however, erosion is a very severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Drought limits yields of hay late in the growing season.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

Because of the slope and a poor filtering capacity, this soil is poorly suited to building site development and septic tank absorption fields. Designing buildings so that they conform to the natural slope of the land minimizes the need for cutting and filling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Because of the poor filtering capacity, the effluent can pollute ground water. Sloughing is a hazard if the soil is excavated. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys. The depth to usable layers, the thickness of those layers, and the gradation of individual grain sizes vary, especially in areas on kames.

The land capability classification is IVe. The woodland ordination symbol is 4R.

FoE2—Fox gravelly loam, 18 to 25 percent slopes, eroded. This deep, steep, well drained soil is on short, dissected side slopes on Wisconsinan outwash terraces and kames. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are generally smooth and are 60 to 200 feet long. Most areas on outwash terraces are long, narrow, and winding and are 5 to 20 acres in size. Areas on kames are roughly circular and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable gravelly loam about 5 inches thick. The subsoil is about 21 inches of dark yellowish brown, friable gravelly loam and gravelly clay loam. The substratum to a depth of about 60 inches is brown, calcareous, loose gravelly sand. In some areas the slope is 15 to 18 percent or 25 to 35 percent. In other areas the depth to calcareous sand and gravel is less than 24 inches.

Included with this soil in mapping are small areas of severely eroded soils on the upper part of the slopes. Also included, especially on kames, are small areas of soils that have a loamy substratum. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Fox soil and rapid or very rapid in the substratum. Available water capacity is low. Runoff is very rapid in cultivated areas. Tilth is fair. The root zone generally is moderately deep.

Most areas are used as pasture or woodland or are covered with brush. Only a few areas are used as cropland.

Because of the slope, a very severe hazard of erosion, and droughtiness, this soil is generally unsuited to cultivated crops. The slope limits the use of farming equipment.

Because of the slope and the very severe hazard of erosion, this soil is only moderately suited to pasture and is poorly suited to hay. The hazard of erosion is very severe if the pasture is reseeded by conventional tillage methods. No-till seeding helps to control erosion. Drought limits yields of hay late in the growing season.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. The seedling mortality rate can be reduced by mulching and by planting seedlings that have been transplanted once.

Because of the slope and a poor filtering capacity, this soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Sloughing is a hazard if the soil is excavated. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is a probable source of sand and gravel. The thickest deposits commonly are on terraces in the major stream valleys. The depth to usable layers, the thickness of those layers, and the gradation of individual grain sizes vary, especially in areas on kames.

The land capability classification is VIe. The woodland ordination symbol is 4R.

FrB—Frankstown Variant-Mertz complex, 2 to 6 percent slopes, very stony. These gently sloping, well drained soils are on unglaciated ridgetops. The Frankstown Variant soil is moderately deep, and the Mertz soil is deep. Stones and boulders 10 to 36 inches long cover about 0.1 to 3.0 percent of the surface. Areas generally are irregularly shaped and are 5 to 50 acres in size. They are about 45 percent Frankstown Variant silt loam and 35 percent Mertz very cherty silt loam. The two soils occur as areas so intricately mixed that separating them in mapping was not practical.

Typically, the Frankstown Variant soil has a surface layer of very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is yellowish brown, friable silt loam about 3 inches thick. The subsoil is about 19 inches of yellowish brown and strong brown, friable and firm silt loam and cherty silty clay loam. Flint bedrock is at a depth of about 25 inches. In places the soil is shallow over flint bedrock. In some areas it is not stony.

Typically, the Mertz soil has a surface layer of very dark grayish brown, friable very cherty silt loam about 3 inches thick. The subsurface layer is brown, friable very cherty silt loam about 2 inches thick. The subsoil is about 46 inches thick. The upper part is yellowish brown and strong brown, friable very cherty silt loam, and the lower part is yellowish red and strong brown, firm very cherty silty clay loam. The substratum to a depth of about 66 inches is strong brown, firm very cherty silty clay loam. In places the substratum is mottled and has fewer chert fragments.

Included with these soils in mapping are areas of the moderately well drained Guernsey soils. These included soils are in landscape positions similar to those of the Frankstown Variant and Mertz soils or are at slightly different elevations. Also included are scattered areas where numerous prehistoric pits were excavated for flint. Inclusions make up about 20 percent of most areas.

Permeability is moderate in the Frankstown Variant soil and moderately slow in the Mertz soil. Available water capacity is low in both soils. Runoff is medium. The root zone is moderately deep in the Frankstown Variant soil and deep in the Mertz soil.

Most areas are wooded. A few areas have been developed for recreational uses. Because of the stoniness and droughtiness, these soils are generally unsuitable as cropland and pasture. They are well suited to trees, but the droughtiness, the depth to bedrock in the Frankstown Variant soil, and the high content of flint fragments in the Mertz soil limit tree growth. In areas of the Mertz soil, mulching and planting seedlings that have been transplanted once reduce the seedling mortality rate. In areas of the Frankstown Variant soil, frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Plant competition can be controlled on both soils by removing vines and the less desirable trees and shrubs.

These soils are moderately suited or well suited to building site development. They are poorly suited or generally unsuited to septic tank absorption fields because of the depth to bedrock in the Frankstown Variant soil and the moderately slow permeability in the Mertz soil. The Mertz soil is better suited to these uses than the Frankstown Variant soil. The hard flint bedrock underlying the Frankstown Variant soil severely limits excavation. As a result, this soil is better suited to dwellings without basements than to dwellings with basements. Also, the sewage treatment and disposal systems in areas of this soil should not be conventional onsite systems. In areas of the Mertz soil, enlarging the absorption area improves the capacity of septic tank absorption fields to absorb effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is VIs. The woodland ordination symbol is 4D in areas of the Frankstown Variant soil and 4F in areas of the Mertz soil.

GfA—Glenford silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is mainly on flats on Wisconsinan slack-water terraces and on lake plains. In a few areas it is in upland draws. Most areas are irregularly shaped and are 10 to 30 acres in size, but a few areas are larger than 50 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, mottled, friable and firm silt loam and silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silt loam. In some areas the subsoil or substratum contains more sand or gravel.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville soils and small areas of the very poorly drained Luray soils on flats and in depressions. Also included are a few small areas of soils that have a subsoil or substratum of silty clay. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Glenford soil. Available water capacity is moderate. Runoff is slow. The seasonal high water table is at a depth of about 24 to 42 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used for row crops, small grain, hay, or pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. Natural drainage generally is adequate for most crops, but random subsurface drains may be needed to remove excess water in the wetter included areas. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil and applying a system of conservation tillage that leaves crop residue on the surface minimize crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

Because of the suitability for cropland, only a few areas are wooded. This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the seasonal wetness, the shrink-swell potential, and the moderately slow permeability, this soil is only moderately suited to building site development and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage.

The land capability classification is I. The woodland ordination symbol is 5A.

GfB—Glenford silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is mainly on low knolls and slight rises on Wisconsinan lake plains and slack-water terraces. In a few areas it is on foot slopes. Most areas are irregularly shaped and are 10 to 30 acres in size. A few areas are larger than 50 acres.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown and dark yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm silty clay loam. In some areas the slope is 6 to 12 percent. In places the subsoil and substratum are loam.

Included with this soil in mapping are small areas of the very poorly drained Luray and poorly drained Sebring soils in depressions and along drainageways and a few small areas of soils that have a clayey subsoil and substratum. Also included are some seeps on the lower part of the slopes. Inclusions make up about 10 percent of most areas.

Permeability is moderately slow in the Glenford soil. Available water capacity is moderate. Runoff is medium. The seasonal high water table is at a depth of 24 to 42 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used as cropland or pasture (fig. 12). A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. In tilled areas erosion is a moderate hazard. A surface crust forms after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including meadow crops in the crop rotation, returning crop residue to the soil, and establishing grassed waterways help to control erosion and minimize crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and increased runoff result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

Because of the suitability for cropland, only a few areas are wooded. This soil is well suited to trees. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

Because of the seasonal wetness, a moderate shrink-swell potential, and the moderately slow permeability, this soil is only moderately suited to building site development and septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with a material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Properly landscaping building sites and absorption fields results in good surface drainage.

The land capability classification is IIe. The woodland ordination symbol is 5A.

GnB—Guernsey silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on unglaciated ridgetops. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 44 inches thick. The upper part is yellowish brown, friable silt loam. The next part is yellowish brown, brownish yellow, and light brownish gray, mottled, firm and very firm silty clay loam and silty clay. The lower part is yellowish brown, mottled, very firm silty clay loam. The substratum is gray, very firm silty clay. Soft siltstone bedrock is at a depth of about 71 inches. In some areas the slope is 0 to 2 percent or 6 to 9 percent.

Included with this soil in mapping are small areas of Alford and Keene soils. These soils are in landscape positions similar to those of the Guernsey soil. Alford soils are well drained. Keene soils contain less clay in the upper part than the Guernsey soil. Also included are

Figure 12.—Bales of wheat straw on Glenford silt loam, 2 to 6 percent slopes. This soil is well suited to crops and pasture.

small areas of somewhat poorly drained soils on the lower part of the slopes. Included soils make up about 10 percent of most areas.

Permeability is slow or moderately slow in the Guernsey soil. Available water capacity is moderate. Runoff is medium in cultivated areas. The shrink-swell potential is high. The seasonal high water table is perched at a depth of 24 to 42 inches during extended wet periods. Tilth is good. The root zone is deep.

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

This soil is well suited to a cropping system of corn, small grain, and hay. Erosion is the main hazard. A surface crust forms in tilled areas after hard rains. Applying a system of conservation tillage that leaves crop residue on the surface, including meadow crops in the crop rotation, and returning crop residue to the soil help to maintain tilth, minimize crusting, and control erosion. Grassed waterways also help to control erosion.

This soil is well suited to hay and pasture. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate. No-till seeding helps to control erosion.

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

This soil is moderately suited to building site development, but the seasonal wetness and the high shrink-swell potential are limitations, especially on sites for buildings with basements. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Because of the seasonal wetness and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains around the absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

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

GnC2—Guernsey silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained soil generally is on unglaciated ridgetops. In a few areas it is on unglaciated hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are smooth and are 100 to 300 feet long. Most areas on ridgetops are roughly oval and are 5 to 15 acres in size. Most areas on hillsides are long and narrow and are 10 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 42 inches of yellowish brown, firm silty clay loam and silty clay. It is mottled below a depth of about 12 inches. The substratum is yellowish brown, mottled, very firm silty clay. Soft shale bedrock is at a depth of about 60 inches. In some areas the slope is 2 to 6 percent or 12 to 15 percent. In other areas the soil is less eroded.

Included with this soil in mapping are small areas of the well drained Rigley soils on the lower part of the slopes and areas of severely eroded soils on the upper part of the slopes. The severely eroded soils have a surface layer of silty clay loam. Also included are some seeps on hillsides. Inclusions make up about 10 percent of most areas.

Permeability is slow or moderately slow in the Guernsey soil. Available water capacity is moderate. Runoff is rapid in cultivated areas. The shrink-swell potential is high. The seasonal high water table is perched at a depth of 24 to 42 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used for hay or pasture. Some areas are used for row crops or small grain or are wooded.

This soil is moderately suited to corn and small grain. In tilled areas erosion is a severe hazard. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface and crop rotations that include hay or cover crops help to maintain tilth, control erosion, and minimize crusting. Grassed waterways also help to control erosion.

This soil is well suited to hay and pasture. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. No-till seeding helps to control erosion.

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

Because of the slope, the seasonal wetness, and the high shrink-swell potential, this soil is only moderately suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Because of the slope, the seasonal wetness, and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains around the absorption fields and interceptor drains upslope from the fields lower the seasonal high water table and intercept lateral seepage. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

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

GnD—Guernsey silt loam, 12 to 18 percent slopes. This deep, moderately steep, moderately well drained soil is dominantly on unglaciated hillsides. In a few areas it is on ridgetops. Slopes commonly are smooth and are 100 to 300 feet long. Most areas on hillsides are narrow and winding and are 20 to 60 acres in size. Most areas on ridgetops are roughly oval or circular.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is about 44 inches of yellowish brown, firm silty clay loam and silty clay. It is mottled below a depth of about 18 inches. The substratum is yellowish brown, mottled, firm silty clay loam. Soft shale bedrock is at a depth of about 60 inches. In some areas the slope is 10 to 12 percent. In other areas the soil is eroded. In places, the surface layer has chert fragments or stones are on the surface.

Included with this soil in mapping are small areas of the well drained Rigley soils and Berks soils. Rigley soils are on the lower part of some slopes. Berks soils are in landscape positions similar to those of the Guernsey soil. Also included are seeps on the lower part of some slopes. Inclusions make up about 25 percent of most areas.

Permeability is slow or moderately slow in the

Guernsey soil. Available water capacity is moderate. Runoff is very rapid in cultivated areas. The shrink-swell potential is high. The seasonal high water table is perched at a depth of 24 to 42 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are wooded or are covered with brush. Some areas are used as hayland or pasture. A few areas are used for row crops or small grain.

This soil is poorly suited to cultivated crops. In tilled areas the hazard of erosion is very severe. A surface crust forms after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay or cover crops, and contour stripcropping help to control erosion and minimize surface crusting. Grassed waterways also help to control erosion.

This soil is moderately suited to hay and pasture. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. On south aspects, the seedling mortality rate can be reduced by planting seedlings that have been transplanted once.

Because of the slope, the seasonal wetness, the hazard of slippage, and the high shrink-swell potential, this soil is poorly suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Minimizing cutting and filling helps to prevent slippage. Random subsurface drains that intercept lateral seepage from the higher adjacent soils and divert runoff from foundations help to prevent slippage, lower the seasonal high water table, and help to keep basements dry. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling along foundations with a material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling.

Because of the slope, the seasonal wetness, and the slow or moderately slow permeability, this soil is poorly suited to septic tank absorption fields. Perimeter drains around the absorption fields lower the seasonal high water table and intercept lateral seepage from the higher adjacent soils. Enlarging the absorption area and installing the distribution lines on the contour improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 4R.

HeF—Hazleton-Rock outcrop complex, 25 to 70 percent slopes. This map unit occurs as areas of a deep, very steep, well drained Hazleton soil intermingled with areas where sandstone crops out. The unit is on hillsides. The Hazleton soil is on the lower part of side slopes and on foot slopes. The Rock outcrop is on vertical cliffs and ledges on the upper part of side slopes and on shoulder slopes (fig. 13). Slopes are irregular and generally are 50 to 75 feet long. Areas commonly are long, narrow, and winding and range from 5 to 80 acres in size. Most are about 55 percent Hazleton soil and 25 percent Rock outcrop. The Hazleton soil and the Rock outcrop occur as areas so intricately mixed that separating them in mapping was not practical.

Typically, the Hazleton soil has a surface layer of black, very friable channery sandy loam about 2 inches thick. The subsurface layer is brown, very friable channery sandy loam about 3 inches thick. The subsoil is yellowish brown, very friable very channery sandy loam about 22 inches thick. The substratum is yellowish brown, very friable very channery sandy loam. Sandstone bedrock is at a depth of about 54 inches. In some areas the surface layer is stony. In other areas the soil is moderately deep over bedrock.

Included with the Hazleton soil and Rock outcrop in mapping are small areas of shallow soils. These soils are around the Rock outcrop on the upper part of the slopes. They make up about 20 percent of most areas.

Permeability is moderately rapid or rapid in the Hazleton soil. Runoff is very rapid. Available water capacity is low. The root zone is deep.

Most areas are wooded. Because of the slope, the Rock outcrop, droughtiness, and the hazard of erosion, this map unit is generally unsuited to cultivated crops and pasture. It is only moderately suited to trees because the low available water capacity slows tree growth and the slope and Rock outcrop severely restrict the use of equipment. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. The trees can be logged in areas above or below the Rock outcrop. In areas of the Hazleton soil on south aspects, the seedling mortality rate can be reduced by mulching or by planting seedlings that have been transplanted once.

Figure 13.—Rock outcrop in an area of Hazleton-Rock outcrop complex, 25 to 70 percent slopes.

Because of the slope, the Rock outcrop, and a poor filtering capacity, this map unit generally is unsuited to building site development and septic tank absorption fields. Some areas are scenic and can be used for hiking trails and lookout points. The hazard of erosion is severe if the plant cover is removed.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Hazleton soil is 4R on north aspects and 3R on south aspects. The Rock outcrop is not assigned a woodland ordination symbol.

HkC2—Hickory silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on knolls, ridgetops, and dissected side slopes on Illinoian till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are smooth and are 150 to 500 feet long. Most areas are irregularly shaped and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 33 inches of yellowish brown, firm and very firm silty clay loam and clay loam. The substratum to a depth of about 80 inches is yellowish brown, very firm, calcareous clay loam glacial till. In some areas the slope is 2 to 6 percent or 12 to 15 percent. In places the substratum is silty clay loam. In a few areas the soil is moderately well drained.

Included with this soil in mapping are narrow bands of somewhat poorly drained soils along drainageways and areas of severely eroded soils on the upper part of the slopes. The severely eroded soils have a lower available water capacity than the Hickory soil and have a thinner subsoil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Hickory soil. Available water capacity is high. Runoff is rapid in cultivated areas. Tilth is good. The root zone is deep.

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

This soil is moderately suited to corn, soybeans, and small grain grown in rotation with meadow crops. Erosion is the main hazard. A surface crust forms in tilled areas after hard rains. Erosion has reduced the level of natural fertility and increased the need for lime and fertilizer. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, contour stripcropping, and grassed waterways help to control erosion. The soil is well suited to conservation tillage systems, including no-till farming.

This soil is well suited to hay and pasture. If well managed, it is suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, the moderate permeability, and a moderate shrink-swell potential, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

HkD2—Hickory silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil commonly is on dissected side slopes on Illinoian till plains. In some areas it is on knolls. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are smooth and are 100 to 400 feet long. Most areas are irregularly shaped and range from 4 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is dark yellowish brown and yellowish brown, firm clay loam about 35 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown, calcareous, firm clay loam glacial till. In some areas the slope is 9 to 12 percent or 18 to 25 percent. In other areas the substratum is silty clay loam. In a few places the soil is moderately well drained.

Included with this soil in mapping are narrow bands of the somewhat poorly drained Orrville soils on flood plains and some areas of severely eroded soils on the upper part of the slopes. The surface layer and subsoil of the severely eroded soils are thinner than those of the Hickory soil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Hickory soil. Available water capacity is high. Runoff is very rapid in cultivated areas. Tilth is good. The root zone is deep.

Most areas are used for hay or pasture. Some areas are wooded. A few areas are used for row crops or small grain.

This soil is poorly suited to cultivated crops. In tilled areas the hazard of erosion is very severe. Erosion has reduced the level of natural fertility and increased the need for lime and fertilizer. Crop rotations that include hay and cover crops, contour stripcropping, grassed waterways, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion. The good drainage favors no-till farming.

This soil is moderately suited to hay and pasture. If well managed, it is suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. No-till seeding helps to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment.

Because of the slope, the moderate permeability, and a moderate shrink-swell potential, this soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Enlarging the absorption area improves the capacity of the fields to absorb the effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 5R.

HoB—Homewood silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained and well drained soil is on ridgetops, low knolls, and rises on Illinoian till plains. Most areas are irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is clay loam about 56 inches thick. The upper part is yellowish brown and is friable and firm; the next part is a yellowish brown, very firm, brittle fragipan; and the lower part is strong brown and firm. The substratum to a depth of about 80 inches is yellowish brown, mottled, firm loam. In some areas the slope is 0 to 2 percent or 6 to 9 percent. In other areas the soil is eroded.

Included with this soil in mapping are small areas of well drained soils that do not have a fragipan. These soils are in the same landscape positions as the Homewood soil. Also included are small areas of somewhat poorly drained soils on concave slopes. Included soils make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is at a depth of 30 to 48 inches during extended wet periods. Water moves laterally along the top of the fragipan and occasionally surfaces as seeps. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

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

This soil is well suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is moderate. A surface crust forms after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including hay and cover crops in the crop rotation, returning crop residue to the soil, and establishing grassed waterways help to control erosion and minimize crusting. Natural drainage generally is adequate for most crops, but random subsurface drains may be needed to remove excess water in some of the wetter included areas.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow permeability. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields intercept lateral seepage and lower the seasonal high water table. Enlarging the absorption area and installing the distribution lines in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIe. The woodland ordination symbol is 5A.

HoC2—Homewood silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained and well drained soil is on ridgetops, knolls, dissected side slopes, and foot slopes on Illinoian till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 500 feet long. Most areas are irregularly shaped and are 5 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 46 inches thick. The upper part is yellowish brown, firm silty clay loam and clay loam, and the lower part is a fragipan of yellowish brown, mottled, very firm, brittle clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam. In some areas the soil is only slightly eroded. In other areas the substratum is stratified sandy loam and silt loam.

Included with this soil in mapping are small areas of Hickory soils. These soils do not have a fragipan. They are in the same landscape positions as the Homewood soil. Also included are small areas of the somewhat poorly drained Orrville soils on narrow flood plains and a few seeps and springs. Inclusions make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Available water capacity is moderate. Runoff is rapid in cultivated areas. The seasonal high water table is at a depth of 30 to 48 inches during extended wet periods. Water moves laterally along the top of the fragipan and occasionally surfaces as seeps. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

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

This soil is moderately suited to corn, soybeans, and small grain grown in rotation with meadow crops. Erosion is a severe hazard in tilled areas. It has reduced the level of natural fertility and increased the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, and contour stripcropping help to control erosion and minimize crusting. Grassed waterways also help to control erosion. In many areas slopes are long and uniform and therefore are well suited to contour stripcropping. Natural drainage is adequate for most crops, but random subsurface drains are needed in the included areas of seeps and springs.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, the seasonal wetness, and the slow permeability, this soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption area and installing the distribution lines on the contour and in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

HoD2—Homewood silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, moderately well drained and well drained soil is on dissected side slopes and foot slopes on Illinoian till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 100 to 400 feet long. Most areas are long and narrow and are 4 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is yellowish brown clay loam about 49 inches thick. The upper part is firm; the next part is a mottled, very firm, brittle fragipan; and the lower part is firm. The substratum to a depth of about 60 inches is yellowish brown, firm loam. In a few places the soil is less eroded.

Included with this soil in mapping are small areas of Hickory soils. These soils do not have a fragipan. They are in the same landscape positions as the Homewood soil. Also included are narrow strips of the somewhat poorly drained Orrville soils on narrow flood plains; some springs and seeps; and, on the upper part of the slopes, areas of severely eroded soils that have a surface layer of clay loam. Tilth is fair in the severely eroded soils. Inclusions make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Available water capacity is moderate. Runoff is very rapid in cultivated areas. The seasonal high water table is at a depth of 30 to 48 inches during extended wet periods. Water moves laterally along the top of the fragipan and occasionally surfaces as seeps. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

Most areas are used as pasture, woodland, or hayland. Some areas are used for row crops or small grain.

Because of a very severe hazard of erosion in tilled areas, this soil is poorly suited to cultivated crops. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, and contour stripcropping help to control erosion and minimize crusting. Natural drainage is adequate for most crops, but random subsurface drains may be needed to remove excess water in the included areas of seeps and springs.

This soil is moderately suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion. On south aspects, the seedling mortality rate can be reduced by planting seedlings that have been transplanted once.

This soil is poorly suited to building site development and septic tank absorption fields because of the slope, the seasonal wetness, and the slow permeability. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. Enlarging the absorption area and installing the distribution lines on the contour and in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 5R.

HoE2—Homewood silt loam, 18 to 25 percent slopes, eroded. This deep, steep, moderately well drained and well drained soil is on dissected side slopes along drainageways on Illinoian till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 75 to 250 feet long. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is clay loam about 50 inches thick. The upper part is yellowish brown and firm; the next part is a yellowish brown, mottled, very firm, brittle fragipan; and the lower part is dark yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, firm clay loam. In some areas the slope is more than 25 percent.

Included with this soil in mapping are small areas of soils that do not have a fragipan. These soils are in the same landscape positions as the Homewood soil. Also included are strips of the somewhat poorly drained Orrville soils on narrow flood plains; some springs and seeps; and, on the upper part of the slopes, areas of severely eroded soils that have a surface layer of clay loam. Tilth is fair in the severely eroded soils. Inclusions make up about 15 percent of most areas.

Permeability is moderate above the fragipan in the Homewood soil and slow in and below the fragipan. Available water capacity is moderate. Runoff is very rapid. The seasonal high water table is at a depth of 30 to 48 inches during extended wet periods. Water moves laterally along the top of the fragipan and occasionally surfaces as seeps. Tilth is good. The root zone generally is moderately deep. It commonly is restricted to the part of the profile above the compact fragipan.

Most areas are wooded. Some areas are used as pasture. A few areas are used for row crops, small grain, or hay.

Because of the slope and a very severe hazard of erosion, this soil generally is unsuited to cultivated crops, is only moderately suited to pasture, and is poorly suited to hay. If properly managed, however, it is well suited to grazing in winter and early in spring. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. On south aspects, the seedling mortality rate can be reduced by planting seedlings that have been transplanted once.

This soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields because of the slope, the seasonal wetness, and the slow permeability. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Septic tank absorption fields should be installed on the better suited adjacent soils. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is VIe. The woodland ordination symbol is 5R.

KeB—Keene silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on unglaciated ridgetops. Most areas are long and narrow and are 3 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam and silty clay. The substratum is yellowish brown, mottled, firm silty clay. Soft shale bedrock is at a depth of about 55 inches. In some areas the upper part of the soil has a higher content of sand and coarse fragments. In a few places the slope is 6 to 9 percent.

Included with this soil in mapping are small areas of the well drained Alford soils. These soils are in landscape positions similar to those of the Keene soil. They make up about 15 percent of most areas.

Permeability is moderate or moderately slow in the upper part of the subsoil in the Keene soil and slow or moderately slow in the lower part and in the substratum.

Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used as cropland. Some areas are used for hay, pasture, or woodland or are covered with brush.

This soil is well suited to corn and small grain. In tilled areas erosion is a moderate hazard. A surface crust forms after hard rains. Including grasses and legumes in the crop rotation, returning crop residue to the soil, and applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting. Contour farming also helps to control erosion.

This soil is well suited to hay and pasture. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is moderate. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the seasonal wetness and a moderate shrink-swell potential, this soil is only moderately suited to building site development. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is poorly suited to septic tank absorption fields because of the seasonal wetness and the slow or moderately slow permeability. Perimeter drains around the absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

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

KeC2—Keene silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained soil is on unglaciated ridgetops. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 200 to 400 feet long. Most areas are long and narrow and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum is grayish brown, mottled, firm silty clay loam. Soft siltstone bedrock is at a depth of about 60 inches. In some areas the slope is 4 to 6 percent or 12 to 15 percent.

Included with this soil in mapping are small areas of the well drained Alford soils. These soils are in landscape positions similar to those of the Keene soil or are in the less sloping areas. Also included are small areas of the well drained Rigley soils on the higher parts of ridgetops, small areas of moderately deep soils and severely eroded soils on the upper part of the slopes, and some springs and seeps on the lower part of the slopes. Inclusions make up about 20 percent of most areas.

Permeability is moderate or moderately slow in the upper part of the subsoil in the Keene soil and slow or moderately slow in the lower part and in the substratum. Available water capacity is moderate. Runoff is rapid in tilled areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used for pasture or hay. Some areas are used for row crops, small grain, or woodland or are covered with brush.

This soil is only moderately suited to corn and small grain because of the slope and a severe hazard of erosion. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. Contour stripcropping, crop rotations that include hay or cover crops, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting. The soil is only moderately suited to no-till farming because of the seasonal wetness. Seeps and springs interfere with tillage. Random subsurface drains are needed to remove excess water in areas around the seeps and springs.

This soil is well suited to hay and pasture. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, the seasonal wetness, and a moderate shrink-swell potential, this soil is only moderately suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is poorly suited to septic tank absorption fields because of the slope, the seasonal wetness, and the slow or moderately slow permeability. Perimeter drains around the absorption fields lower the seasonal high water table and intercept lateral seepage from the higher adjacent areas. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

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

KeD2—Keene silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, moderately well drained soil is on unglaciated hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and commonly are 300 to 600 feet long. Most areas are irregularly shaped and are 20 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 53 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The substratum is grayish brown and yellowish brown, mottled, firm silty clay loam. Soft siltstone bedrock is at a depth of about 76 inches. In some areas the slope is 9 to 12 percent.

Included with this soil in mapping are areas of well drained soils that have a subsoil and substratum of silt loam. These soils are in the same landscape position as the Keene soil. Also included are small areas of moderately deep soils and severely eroded soils on the upper part of the slopes and some seeps and springs on the lower part. Inclusions make up about 20 percent of most areas.

Permeability is moderate or moderately slow in the upper part of the subsoil in the Keene soil and slow or moderately slow in the lower part and in the substratum. Available water capacity is moderate. Runoff is very rapid in tilled areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas formerly were used as cropland but now are used as woodland or are covered with brush. Some areas are used for pasture or hay. A few areas are used for row crops or small grain.

This soil is poorly suited to cultivated crops because of the slope and a very severe hazard of erosion. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. Crop rotations that include hay and cover crops and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting. Contour stripcropping and grassed waterways also help to control erosion. Seeps and springs interfere with tillage. Subsurface drains are needed to remove excess water in areas around the seeps and springs.

This soil is moderately suited to hay and pasture. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion.

Access roads to oil and gas wells are subject to severe gully erosion in areas of this soil. The hazard of erosion can be reduced by constructing the roads on the lowest possible grade and by establishing water bars.

This soil is poorly suited to building site development and septic tank absorption fields because of the slope, the seasonal wetness, the moderately slow or slow permeability, and a moderate shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields lower the seasonal high water table and intercept lateral seepage from the higher adjacent soils. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 4R.

Kk—Killbuck silt loam, frequently flooded. This deep, nearly level, poorly drained soil is on flood plains. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 10 to 40 acres in size.

Typically, the surface layer is grayish brown, mottled, friable silt loam about 6 inches thick. The next 14 inches also is grayish brown, mottled, friable silt loam. Below this is a buried surface layer of black, firm silty clay loam about 8 inches thick. The buried subsoil is gray, mottled, firm silty clay loam about 24 inches thick. The substratum to a depth of about 60 inches is dark gray, mottled, firm silty clay loam. In some areas less than 15 inches or more than 36 inches of alluvium overlies the buried soil. In a few areas the soil does not have a buried surface layer. In places it is somewhat poorly drained.

Included with this soil in mapping are small areas of the very poorly drained Sloan and Wallkill soils. These soils are in the same landscape position as the Killbuck soil. Also included are the very poorly drained Luray soils along the edges of some mapped areas. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Killbuck soil. Available water capacity is high. Runoff is very slow. The seasonal high water table is near the surface during extended wet periods. Tilth is good. The root zone commonly is restricted by the water table, but it is deep in drained areas.

Many areas, especially those that are undrained, are used for hay, pasture, or woodland. Some areas are used as cropland.

If drained, this soil is moderately suited to corn and soybeans. It generally is unsuited to small grain because of the flooding. The seasonal wetness and the flooding are the main management concerns. Establishing drainage outlets is difficult in some areas. In areas where suitable outlets are available, surface and subsurface drains can lower the seasonal high water table. Dikes protect a few areas from flooding. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage.

This soil is well suited to trees that can withstand wetness. Selecting species that can withstand wetness and flooding and planting seedlings that have been transplanted once reduce the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Logging when the soil is frozen or during the drier parts of the year facilitates the use of equipment and minimizes compaction and the formation of ruts. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding, the wetness, and the moderately slow permeability.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Lu—Luray silty clay loam. This deep, nearly level, very poorly drained soil is on flats and in depressions on Wisconsinan lake plains and on terraces along streams. It receives runoff from the higher adjacent soils and is subject to ponding. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 20 to 60 acres in size. A few areas are larger than 100 acres.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is black, friable silty clay loam about 4 inches thick. The subsoil is about 28 inches of dark gray and dark grayish brown, mottled, firm silty clay loam and friable silt loam. The substratum to a depth of about 60 inches is dark grayish brown, mottled, friable silt loam. In some areas the substratum has strata of gravelly sandy loam or gravelly loamy sand. In other areas a thin layer of lighter colored recent alluvium is on the surface. In places the surface soil is 18 to 20 inches thick. In a few areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville and moderately well drained Glenford soils. These soils are slightly higher on the landscape than the Luray soil. Also included, in some small depressions, are small areas of Carlisle soils, which formed in organic deposits. Included soils make up about 10 percent of most areas.

Permeability is moderately slow in the Luray soil. Available water capacity is high. Runoff is very slow or ponded. In undrained areas the seasonal high water table is near or above the surface during extended wet periods. Tilth is fair. Unless the soil is drained, the root zone is restricted by the water table.

Most areas are used for row crops or small grain. Some areas are used as pasture, woodland, or hayland. Most of the wooded areas are undrained.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. It delays planting and limits the choice of crops that can be grown. During a wet spring, the seasonal high water table restricts the root development of most crops in undrained areas. Moisture stress is a problem during a hot, dry summer. Harvesting activities can result in compaction and the formation of ruts in areas that are not adequately drained. The soil responds well to measures that improve drainage and prevent compaction. A surface and subsurface drainage system can be used to remove excess water. Fall tillage is less likely to cause compaction than spring tillage because the soil generally is drier in the fall. A tillage system that leaves the surface rough hastens drying.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The forage species that can withstand wetness should be selected for planting.

This soil is well suited to trees that can withstand wetness. Selecting species that can withstand wetness and planting seedlings that have been transplanted once reduce the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Logging when the soil is frozen or during the drier parts of the year facilitates the use of equipment and minimizes compaction and the formation of ruts. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and septic tank absorption fields because of the ponding and the moderately slow permeability. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

The land capability classification is IIw. The woodland ordination symbol is 5W.

McB—Mechanicsburg silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is in areas on glaciated ridgetops where a mantle of glacial till overlies fine grained sandstone or siltstone bedrock. Most areas are irregularly shaped and are 10 to 25 acres in size. Some areas are as large as 60 acres.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper part is brown, friable silt loam and yellowish brown, friable silty clay loam; the next part is yellowish brown, firm clay loam; and the lower part is yellowish brown, firm channery loam. The substratum is yellowish brown, friable extremely channery loam. Thinly bedded, fractured siltstone or fine grained sandstone bedrock is at a depth of about 54 inches. In some areas the lower part of the subsoil is yellowish red. In other areas the slope is 6 to 9 percent. In places the soil is moderately well drained.

Included with this soil in mapping are areas of the well drained Amanda soils. These soils formed in 60 or more inches of glacial till. Also included are areas of the moderately deep, well drained Berks soils, which formed in material weathered from shale, siltstone, and sandstone. The included soils are in the same landscape positions as the Mechanicsburg soil. They make up about 20 percent of most areas.

Permeability and available water capacity are moderate in the Mechanicsburg soil. Runoff is medium in tilled areas. Tilth is good. The root zone is deep.

Many areas are used as cropland, hayland, or pasture. Some areas are wooded or covered with brush.

This soil is well suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is moderate. The soil is somewhat droughty in the areas where it is shallowest over bedrock. It dries and warms early in the spring and thus is suited to tilling and planting early in spring. A surface crust forms in tilled areas after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including meadow crops in the crop rotation, and returning crop residue to the soil conserve moisture, help to control erosion, and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. If properly managed, it is well suited to grazing in winter and early in spring because of the good drainage. Alfalfa can be grown if lime is applied. No-till seeding helps to control erosion and conserves moisture.

This soil is well suited to trees. Seedlings grow well if good management is applied. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Depending on the depth to bedrock, this soil is either poorly suited or moderately suited to septic tank absorption fields. Where the bedrock is near a depth of 40 inches, the filtration of effluent in the absorption fields is inadequate. Effluent that enters cracks in the underlying bedrock can move considerable distances and pollute ground water. Installing the absorption field in suitable fill material can improve filtration. In areas where it is deep enough to provide adequate filtration, the soil is moderately suited to septic tank absorption fields. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Onsite investigation can determine the depth to bedrock.

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

McC2—Mechanicsburg silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on glaciated ridgetops and dissected side slopes. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are smooth and are 100 to 300 feet long. Most areas are irregularly shaped and are 5 to 20 acres in size. Some areas are as large as 70 acres.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 36 inches of yellowish brown, friable silty clay loam, clay loam, and channery loam. The substratum is yellowish brown, friable extremely channery silt loam. Thinly bedded, fractured siltstone and fine grained sandstone bedrock is at a depth of about 60 inches. In some areas the slope is 4 to 6 percent or 12 to 15 percent. In other areas the soil is moderately well drained. In places the lower part of the subsoil is yellowish red.

Included with this soil in mapping are small areas of Amanda and Brownsville soils. Brownsville soils are in the same landscape positions as the Mechanicsburg soil, and Amanda soils are in the same positions or in the lower positions. Amanda soils have fewer coarse fragments in the lower part than the Mechanicsburg soil, and Brownsville soils have a higher content of coarse fragments in the upper part. Also included are small areas of moderately deep soils and severely eroded soils on the upper part of the slopes. Included soils make up about 20 percent of most areas.

Permeability and available water capacity are moderate in the Mechanicsburg soil. Runoff is rapid in tilled areas. Tilth is good. The root zone is deep.

Many areas are used as cropland or pasture. Some areas are wooded or are covered with brush.

This soil is moderately suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is severe. The soil is somewhat droughty in the areas where it is shallowest over bedrock. It dries and warms early in spring and thus is suited to tilling and planting early in spring. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations, and contour stripcropping conserve moisture, help to control erosion, and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is only moderately suited to building site development because of the slope and a moderate shrink-swell potential. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

Depending on the depth to bedrock, this soil is either poorly suited or moderately suited to septic tank absorption fields. Where the bedrock is near a depth of 40 inches, the filtration of effluent in the absorption fields is inadequate. Effluent that enters cracks in the underlying bedrock can move considerable distances and pollute ground water. Installing the absorption field in suitable fill material can improve filtration. In areas where it is sufficiently deep for adequate filtration, the soil is moderately suited to septic tank absorption fields. Enlarging the absorption area improves the capacity of the fields to absorb effluent. Installing the distribution lines on the contour helps to prevent seepage of the effluent to the surface.

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

McD2—Mechanicsburg silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is on glaciated hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are smooth and are 150 to 300 feet long. Most areas are winding and narrow and are 10 to 60 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 44 inches thick. It is yellowish brown. The upper part is friable silt loam and loam, and the lower part is friable channery loam and very channery silt loam. The substratum is brown, friable extremely channery silt loam. Fractured siltstone bedrock is at a depth of about 60 inches. In some areas the slope is more than 18 percent. In places the soil is moderately well drained.

Included with this soil in mapping are small areas of Amanda and Brownsville soils. Brownsville soils are in the same landscape positions as the Mechanicsburg soil, and Amanda soils are in the same positions or in the lower positions. Amanda soils have fewer coarse fragments in the lower part than the Mechanicsburg soil, and Brownsville soils have a higher content of coarse fragments in the upper part. Also included are small areas of moderately deep soils and severely eroded soils on the upper part of the slopes. Included soils make up about 20 percent of most areas.

Permeability and available water capacity are moderate in the Mechanicsburg soil. Runoff is very rapid in tilled areas. Tilth is good. The root zone is deep.

Most areas formerly were farmed, but many are reverting to woodland. Many areas are used as pasture. Some are used as cropland.

This soil is poorly suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is very severe. The soil is somewhat droughty in the areas where it is shallowest over bedrock. It dries and warms early in spring and thus is suited to tilling and planting early in spring. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include hay and cover crops, and contour stripcropping conserve moisture and help to control erosion. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is moderately suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a very severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion.

Because of the slope and a moderate shrink-swell potential, this soil is poorly suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is poorly suited to septic tank absorption fields because of the slope and the depth to bedrock. Onsite investigation is needed to determine the depth to bedrock. Where the soil is shallowest over bedrock, the filtration of effluent typically is inadequate. Effluent that enters cracks in the underlying bedrock can move considerable distances and pollute ground water. Installing the absorption field in suitable fill material can improve filtration. In areas where the soil is deep enough to provide adequate filtration, enlarging the absorption area and installing the distribution lines on the contour improve the capacity of the fields to absorb effluent and help to prevent seepage of the effluent to the surface.

The land capability classification is IVe. The woodland ordination symbol is 4R.

McE—Mechanicsburg silt loam, 18 to 25 percent slopes. This deep, steep, well drained soil is on glaciated hillsides. Slopes commonly are smooth and are 150 to 400 feet long. Areas generally range from 10 to 60 acres in size. Most are long and winding or are dendritic. A few are oval.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 26 inches thick. It is brown, strong brown, and yellowish brown, friable silt loam, loam, and channery loam. The substratum is yellowish brown, friable very channery silt loam. Thinly bedded, fractured siltstone and fine grained sandstone bedrock is at a depth of about 60 inches.

Included with this soil in mapping are small areas of Amanda and Brownsville soils. Brownsville soils are in the same landscape positions as the Mechanicsburg soil, and Amanda soils are in the same positions or in the lower positions. Amanda soils have fewer coarse fragments in the lower part than the Mechanicsburg soil, and Brownsville soils have a higher content of coarse fragments in the upper part. Also included are areas of moderately deep soils on the upper part of the slopes. Included soils make up about 20 percent of most areas.

Permeability and available water capacity are moderate in the Mechanicsburg soil. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas formerly were farmed, but many are reverting to woodland. Many areas are used as pasture. Only a few are used as cropland.

This soil is generally unsuited to cultivated crops because of the slope and a very severe hazard of erosion. The slope limits the use of farming equipment.

Because of the slope and the hazard of erosion, this soil is only moderately suited to pasture and is poorly suited to hay. It is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. No-till seeding helps to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion.

This soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields because of the slope, the depth to bedrock, and a moderate shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is VIe. The woodland ordination symbol is 4R.

Md—Medway silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil is on narrow or broad flood plains. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 20 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer also is very dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 31 inches of yellowish brown, mottled, friable silt loam, silty clay loam, and loam. The substratum to a depth of about 60 inches is dark yellowish brown, mottled, friable gravelly sandy loam. In places the substratum is very gravelly sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Shoals and very poorly drained Sloan soils. These soils are slightly lower on the landscape than the Medway soil and in high water channels. Also included, especially near the major drainageways, are small areas of well drained soils that have a sandy subsoil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Medway soil. Available water capacity is high. Runoff is slow. The seasonal high water table is at a depth of 18 to 36 inches during extended wet periods. Tilth is good, and the soil can be worked throughout a wide range of moisture content. The root zone is deep.

Most areas are used for row crops, small grain, hay, or pasture. Some areas are wooded.

This soil is well suited to corn, soybeans, and small grain. Flooding is the main hazard, especially in areas used for winter grain crops. Floodwater can wash out or bury seedlings with sediment, cut gullies, and carry away recently applied plant nutrients. Natural drainage is generally adequate for crops, but random subsurface drains are needed in the wetter included areas.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the flooding and the seasonal wetness, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is IIw. The woodland ordination symbol is 5A.

Me—Melvin silt loam, frequently flooded. This deep, nearly level, poorly drained soil is on flats and in depressions on flood plains. Slopes are 0 to 2 percent. Most areas are long and relatively narrow and are 10 to 30 acres in size. A few areas are more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is gray, mottled, friable silt loam about 15 inches thick. The substratum to a depth of about 60 inches is gray, mottled, friable silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Algiers and Orrville soils. These soils are in the same landscape positions as the Melvin soil. Also included are areas of the somewhat poorly drained Fitchville soils in the slightly higher positions on slack-water terraces and lake plains. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Melvin soil. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near the surface during extended wet periods. Tilth is good. Unless the soil is drained, the root zone is restricted by the water table.

Many areas, especially those that are undrained, are used as hayland, pasture, or woodland or are covered with brush. Some areas are used for row crops.

If drained, this soil is moderately suited to corn and soybeans. It is generally unsuited to small grain because of the flooding. The seasonal wetness and the hazard of flooding are the main management concerns. Draining the soil is difficult in some areas. In areas where suitable outlets are available, surface and subsurface drains commonly are used to lower the seasonal high water table. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting. Tilling and harvesting at the optimum moisture content help to prevent excessive compaction.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet.

Deferment of grazing during wet periods helps to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage. The species that can withstand wetness should be selected for planting.

This soil is well suited to trees that can withstand wetness. The species that can withstand wetness and flooding should be selected for planting. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Logging when the soil is frozen or during the drier parts of the year facilitates the use of equipment and minimizes compaction and the formation of ruts. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Harvesting procedures that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

This soil is generally unsuited to building site development and septic tank absorption fields because of the flooding and the wetness.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

MnA—Mentor silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on flats on Wisconsinan terraces and lake plains. Most areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 40 inches of yellowish brown, friable silt loam and silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In places the soil is moderately well drained. In some areas the lower part of the subsoil or the substratum is sandy loam or gravelly sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville soils in swales and slight depressions. These soils make up about 10 percent of most areas.

Permeability is moderate in the Mentor soil. Available water capacity is high. Runoff is slow. The seasonal high water table is at a depth of 48 to 72 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used as hayland or pasture. Only a few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil, including meadow crops in the crop rotation, and applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface help to maintain tilth and minimize crusting.

This soil is well suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields, but the slight seasonal wetness is a limitation. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains reduce the seasonal wetness in septic tank absorption fields. Properly landscaping building sites and absorption fields results in good surface drainage.

The land capability classification is I. The woodland ordination symbol is 5A.

MnB—Mentor silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil generally is on low knolls and rises on Wisconsinan terraces along streams and on lake plains. In some areas it is on foot slopes. Most areas are 5 to 50 acres in size and are irregularly shaped.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 39 inches of yellowish brown, friable and firm silt loam. It is mottled below a depth of about 28 inches. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable silt loam. In some areas the slope is 6 to 9 percent. In some places the soil is moderately well drained. In other places it has mixed siltstone and sandstone fragments throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Fitchville and very poorly drained Luray soils in shallow depressions and drainageways. Also included are small areas of Ockley and Chili soils, which contain more gravel in the lower part than the Mentor soil. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Mentor soil. Available water capacity is high. Runoff is medium. The seasonal high water table is at a depth of 48 to 72 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. A few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. The hazard of erosion is moderate. A surface crust forms in tilled areas after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including meadow crops in the crop rotation, and returning crop residue to the soil help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to pasture and hay. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields, but the slight seasonal wetness is a limitation. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains reduce the seasonal wetness in septic tank absorption fields. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIe. The woodland ordination symbol is 5A.

MnC2—Mentor silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on dissected side slopes on Wisconsinan terraces along streams and on foot slopes at the base of the steeper hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are smooth and are 100 to 300 feet long. Most areas are long and narrow and are 5 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 39 inches thick. The upper part is brown, friable silt loam, and the lower part is yellowish brown, friable silt loam and firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, friable, stratified silt loam and fine sandy loam. In some areas the slope is 4 to 6 percent or 12 to 16 percent. In other areas the soil is moderately well drained. In some places the subsoil or substratum is loam or clay loam. In other places the soil has mixed sandstone or siltstone fragments throughout.

Included with this soil in mapping are small areas of Chili soils. These soils are in landscape positions similar to those of the Mentor soil. They contain more gravel in the lower part than the Mentor soil. They make up about 15 percent of most areas.

Permeability is moderate in the Mentor soil. Available water capacity is high. Runoff is rapid. The seasonal high water table is at a depth of 48 to 72 inches during extended wet periods. Tilth is good. The root zone is deep.

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

This soil is moderately suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, and contour stripcropping help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Alfalfa can be grown if lime is applied. No-till seeding helps to control erosion and conserves moisture.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope and some seasonal wetness, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Installing interceptor drains upslope from the absorption fields reduces the seasonal wetness. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

MnD2—Mentor silt loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is mainly on dissected side slopes on terraces along streams. In some areas it is on foot slopes at the base of the steeper hillsides, and in a few areas it is on dissected high terraces. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and are 100 to 300 feet long. Most areas are long and narrow and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The subsoil is about 35 inches of yellowish brown, friable silt loam and firm silty clay loam. The substratum to a depth of about 60 inches is brown, friable silt loam and silty clay loam. In some areas the slope is 18 to 25 percent. In some places the soil is moderately well drained. In other places it has mixed sandstone and siltstone fragments throughout.

Included with this soil in mapping are small areas of Chili soils. These soils are in the same landscape positions as the Mentor soil. They contain more gravel in the lower part than the Mentor soil. They make up about 15 percent of most areas.

Permeability is moderate in the Mentor soil. Available water capacity is high. Runoff is very rapid. The seasonal high water table is at a depth of 48 to 72 inches during extended wet periods. Tilth is good. The root zone is deep.

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

This soil is poorly suited to cultivated crops because of the slope and the hazard of erosion. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. In tilled areas the hazard of erosion is very severe. A surface crust forms after hard rains. Crop rotations that include grasses and legumes, cover crops, and no-till farming or another system of conservation tillage that leaves crop residue on the surface help to control erosion and minimize crusting.

This soil is moderately suited to hay and pasture. It is suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. Growing forage species helps to control erosion. If the pasture is plowed during seedbed preparation or is overgrazed, however, erosion is a very severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion.

Because of the slope and some seasonal wetness, this soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Installing interceptor drains upslope from the absorption fields reduces the seasonal wetness. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 5R.

MrE—Mertz very cherty silt loam, 18 to 35 percent slopes, very stony. This deep, steep and very steep, well drained soil is on unglaciated hillsides. Surface stones 10 to 24 inches long cover 0.1 to 3.0 percent of the surface. Slopes are generally short and uniform and are 70 to 200 feet long. Most areas are long, narrow, and winding and are 10 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is dark yellowish brown, friable very cherty silt loam about 3 inches thick. The subsoil is about 47 inches of strong brown and yellowish brown, friable very cherty, extremely cherty, and very channery silt loam. The substratum to a depth of about 60 inches is brown, friable extremely channery silty clay loam. In some areas the upper part of the subsoil has fewer coarse fragments.

Included with this soil in mapping are small areas of moderately deep soils on the upper part of the slopes. These soils make up about 20 percent of most areas.

Permeability is moderately slow in the Mertz soil. Available water capacity is low. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are wooded. Because of the slope, a very severe hazard of erosion, the stoniness, and droughtiness, this soil is generally unsuited to cultivated crops and pasture. It is well suited to woodland. The slope, the surface stoniness, and the high content of chert fragments throughout the soil are the main limitations in the wooded areas. Building logging roads and skid trails on the contour facilitates the use of equipment. The seedling mortality rate can be reduced by mulching or by planting seedlings that have been transplanted once. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields because of the slope and the moderately slow permeability. Buildings should be designed so that they conform to the natural slope of the land. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is VIIe. The woodland ordination symbol is 4F.

NeC2—Negley loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is mainly on dissected side slopes on Illinoian outwash terraces and kames. In a few areas it is on knolls on Illinoian till plains. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are 100 to 300 feet long. Most areas are 5 to 25 acres in size.

Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil to a depth of about 60 inches is strong brown and yellowish red, friable clay loam, loam, and gravelly clay loam. In some areas the slope is 12 to 15 percent. In a few areas it is 2 to 6 percent.

Included with this soil in mapping are small areas of Homewood and Parke soils. These soils are in landscape positions similar to those of the Negley soil.

Homewood soils have a fragipan. Parke soils have a lower content of sand and coarse fragments in the upper part than the Negley soil. Also included are narrow strips of severely eroded soils on the upper part of the slopes. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Negley soil. Available water capacity is moderate. Runoff is rapid. Tilth is good.

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

This soil is moderately suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, and contour stripcropping help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Because of the good drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

This soil is a probable source of sand and gravel.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

NeD2—Negley loam, 12 to 18 percent slopes, eroded. This deep, moderately steep, well drained soil is on dissected side slopes on Illinoian outwash terraces and on kames. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are 100 to 300 feet long. Most areas are irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil to a depth of about 80 inches is yellowish brown, strong brown, and yellowish red, friable loam, clay loam, and gravelly clay loam. It is mottled below a depth of about 75 inches. In some areas the slope is 9 to 12 percent or 18 to 21 percent.

Included with this soil in mapping are small areas of Homewood and Parke soils. These soils are in landscape positions similar to those of the Negley soil. Homewood soils have a fragipan. Parke soils have a lower content of sand and coarse fragments in the upper part than the Negley soil. Also included are narrow strips of severely eroded soils on the upper part of the slopes. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Negley soil. Available water capacity is moderate. Runoff is very rapid in tilled areas. Tilth is good. The root zone is deep.

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

This soil is poorly suited to corn, soybeans, and small grain because of the slope and a very severe hazard of erosion. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. In tilled areas the hazard of erosion is very severe. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, contour stripcropping, and grassed waterways help to control erosion.

This soil is moderately suited to pasture and hay. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied. If the pasture is plowed during seedbed preparation or is overgrazed, erosion is a very severe hazard. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion.

Because of the slope, this soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IVe. The woodland ordination symbol is 5R.

NeE—Negley loam, 18 to 25 percent slopes. This deep, steep, well drained soil is on dissected side slopes on Illinoian outwash terraces. Slopes are uniform and commonly are 200 to 350 feet long. Most areas are long and winding and are 5 to 25 acres in size.

Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil to a depth of about 60 inches is dark brown and strong brown, friable loam and gravelly clay loam. In some areas the slope is 15 to 18 percent or 26 to 30 percent. In other areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Homewood soils. These soils are in landscape positions similar to those of the Negley soil. They have a fragipan. Also included are narrow strips of severely eroded soils on the upper part of the slopes. Included soils make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the Negley soil. Available water capacity is moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are wooded. Some areas are used as permanent pasture. Only a few areas are used as cropland.

This soil is generally unsuited to row crops because of the slope and a very severe hazard of erosion. The slope limits the use of farming equipment.

Because of the slope, this soil is only moderately suited to pasture and is poorly suited to hay. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. No-till seeding helps to control erosion.

This soil is well suited to trees. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion.

Because of the slope, this soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is VIe. The woodland ordination symbol is 5R.

NeF—Negley loam, 25 to 70 percent slopes. This deep, very steep, well drained soil is on dissected side slopes on Illinoian outwash terraces. Slopes commonly are 150 to 300 feet long. Most areas are long and winding and are 5 to 40 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is brown, friable loam in the upper part and strong brown, friable gravelly sandy clay loam, gravelly loam, and gravelly sandy loam in the lower part. In some areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Homewood soils. These soils are in landscape positions similar to those of the Negley soil. They have a fragipan. Also included are severely eroded soils on the upper part of the slopes. Included soils make up about 15 percent of most areas.

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

Permeability is moderate or moderately rapid in the Negley soil. Available water capacity is moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Because of the slope and a very severe hazard of erosion, this soil is generally unsuited to row crops, small grain, and hay and is poorly suited to pasture. The slope limits the use of most farm machinery. Unless an adequate plant cover is maintained, the hazard of erosion is very severe. No-till seeding helps to control erosion in pastured areas.

This soil is well suited to trees, but the hazard of erosion is very severe unless an adequate ground cover is maintained. Building logging roads and skid trails on the contour facilitates the use of equipment and helps to control erosion. Water bars and a good plant cover also help to control erosion.

This soil is generally unsuited to building site development and septic tank absorption fields because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 5R.

OcA—Ockley silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on flats on Wisconsinan outwash terraces. Areas commonly are irregularly shaped and are 20 to 60 acres in size. A few areas are more than 200 acres in size.

Typically, the surface layer is brown, very friable silt loam about 10 inches thick. The subsoil is about 46 inches thick. The upper part is yellowish brown and brown, friable silt loam and firm silty clay loam and clay loam, and the lower part is brown and dark yellowish brown, friable sandy clay loam and gravelly clay loam. The substratum to a depth of about 80 inches is brown, calcareous, loose very gravelly sand. In some areas the slope is 2 to 4 percent. In places the surface layer is gravelly silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils and small areas of Fox soils. Sleeth and Westland soils are in depressions and along small drainageways. Fox soils are intermingled with

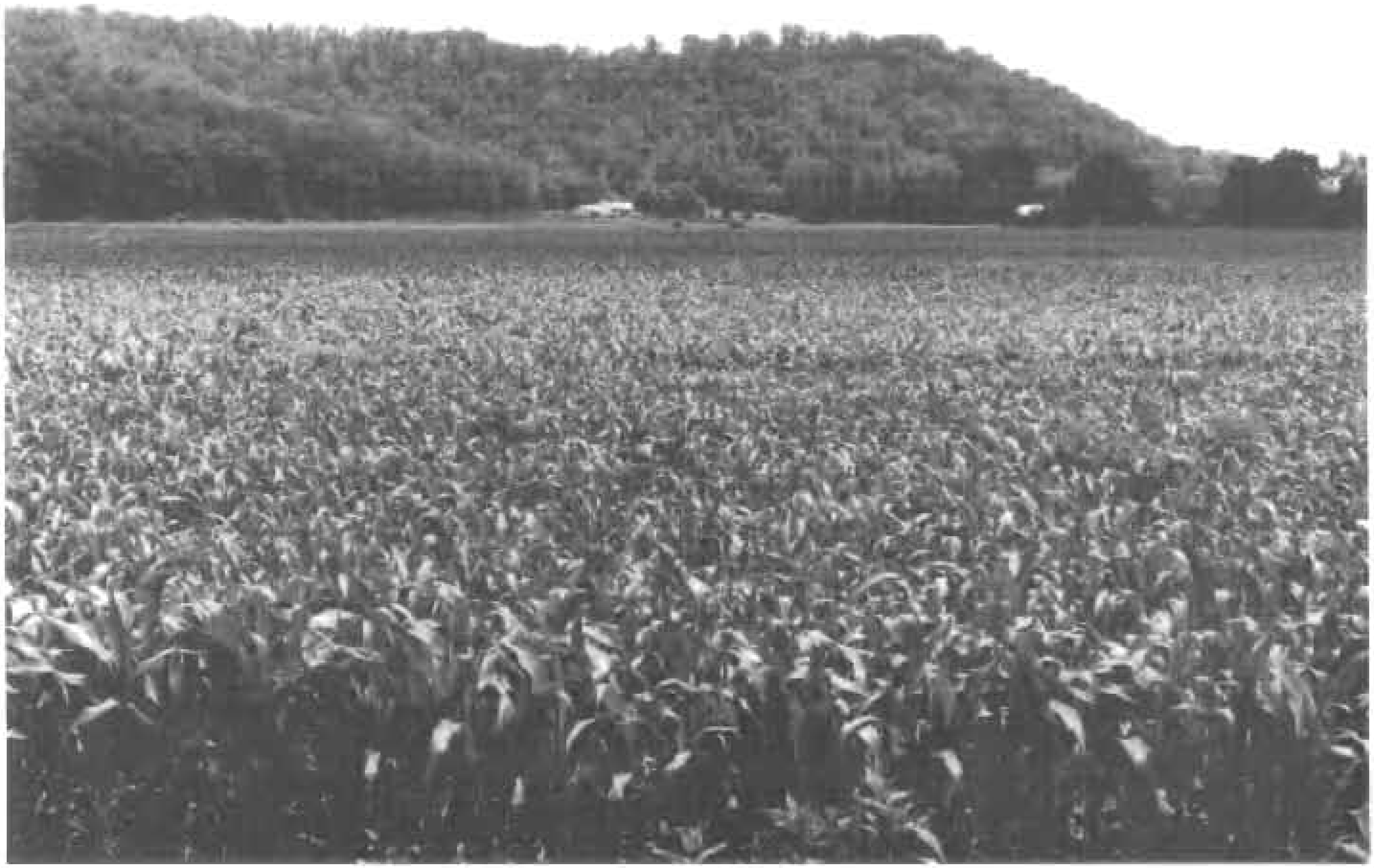


Figure 14.—An area of Ockley silt loam, 0 to 2 percent slopes, used for corn. Brownsville soils are on the wooded hillside in the background.

areas of the Ockley soil. Their subsoil is thinner than that of the Ockley soil. Also included are small areas of soils in which the substratum is silty clay, gravelly loam, gravelly sandy loam, or loam. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is slow. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used as hayland or pasture. Because of the suitability of this soil for cropland, only a few areas are wooded.

This soil is well suited to corn, soybeans, and small grain (fig. 14). Either conventional tillage methods or a system of conservation tillage that leaves crop residue on the surface can be used. The soil warms and dries early in spring and thus is well suited to tilling and planting early in spring. A surface crust forms in tilled areas after heavy rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface or returning crop residue to the soil minimizes crusting and helps to maintain tilth.

This soil is well suited to pasture and hay. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Sloughing is a hazard in shallow excavations.

This soil is a probable source of sand and gravel.

The land capability classification is I. The woodland ordination symbol is 5A.

OcB—Ockley silt loam, 2 to 6 percent slopes. This deep, gently sloping, well drained soil is on rises and low knolls on Wisconsinan outwash terraces. Most areas are irregularly shaped and are 15 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 42 inches thick. The upper part is dark yellowish brown and strong brown, friable clay loam, and the lower part is brown and dark yellowish brown, friable gravelly sandy clay loam. The substratum to a depth of about 80 inches is yellowish brown, calcareous, loose very gravelly loamy sand. In some areas the slope is 0 to 2 percent or 6 to 9 percent. In places the surface layer is gravelly silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth and very poorly drained Westland soils in depressions and along small drainageways and small areas of Fox soils, which are moderately deep to sand and gravel. Fox soils are intermingled with areas of the Ockley soil. Also included are areas of soils in which the substratum is gravelly loam, gravelly sandy loam, or loam. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is medium. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. Because of the suitability of this soil for cropland, only a few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. The soil warms and dries early in spring and thus is well suited to tilling and planting early in spring. A surface crust forms after heavy rains. The hazard of erosion is moderate in tilled areas. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including grasses and legumes in the crop rotation, and returning crop residue to the soil help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime is applied.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site. Sloughing is a hazard in shallow excavations.

This soil is a probable source of sand and gravel.

The land capability classification is IIe. The woodland ordination symbol is 5A.

OcC2—Ockley silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is mainly on dissected side slopes on Wisconsinan outwash terraces. In some areas it is on kames. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes commonly are 50 to 250 feet long. Most areas are long and narrow and are 3 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil is about 44 inches thick. The upper part is brown, firm clay loam, and the lower part is brown, friable gravelly clay loam. The substratum to a depth of about 60 inches is brown, loose gravelly sand. In places the slope is 12 to 14 percent. In some areas the surface layer is gravelly silt loam.

Included with this soil in mapping are small areas of Fox soils, especially on the steeper part of the slopes, and areas of soils in which the substratum is loam or gravelly sandy loam. Fox soils have a subsoil that is thinner than that of the Ockley soil. Also included, on the upper part of the slopes, are small areas of severely eroded soils that have a surface layer of gravelly clay loam. Tilth is poor in the severely eroded soils. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is rapid. Tilth is good. The root zone is deep.

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

This soil is moderately suited to corn, soybeans, and small grain. A surface crust forms after hard rains. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, increasing the need for lime and fertilizer. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations, and cover crops help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to conservation tillage, including no-till farming.

This soil is well suited to hay and pasture. It is well suited to alfalfa. If properly managed, it is well suited to grazing in winter and early in spring because of the good natural drainage. No-till seeding helps to control erosion and conserves moisture.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope and a moderate shrink-swell potential, this soil is moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site. Sloughing is a hazard in shallow excavations.

This soil is a probable source of sand and gravel.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

OeA—Ockley-Urban land complex, 0 to 3 percent slopes. This map unit consists of a deep, nearly level, well drained Ockley soil and areas of Urban land on flats on Wisconsinan outwash terraces. Slopes are dominantly less than 2 percent. Areas are narrow or broad and are 10 to more than 1,000 acres in size. Most are about 45 percent Ockley silt loam and 35 percent Urban land. The Ockley soil and Urban land occur as areas so intricately mixed that separating them in mapping was not practical.

Typically, the Ockley soil has a surface layer of brown, very friable silt loam about 10 inches thick. The subsoil is about 46 inches thick. The upper part is yellowish brown and brown, friable silt loam and firm silty clay loam and clay loam, and the lower part is brown and dark yellowish brown, friable sandy clay loam and gravelly clay loam. The substratum to a depth of about 80 inches is brown, calcareous, loose very gravelly sand. Some low areas have been filled or leveled during construction, and other small areas have been built up or smoothed. In places the subsoil is silt loam.

The Urban land is covered by buildings and pavement. The buildings are mainly residential or commercial, but some are industrial.

Included with the Ockley soil and Urban land in mapping are small areas that have been radically altered by deep cutting and filling, narrow strips of the very poorly drained Westland and somewhat poorly drained Sleeth soils along drainageways and in depressions, and some small dumps. The excavated areas commonly have sand and gravel near the surface, but in filled areas the soil is considerably deeper to sand and gravel. Inclusions make up about 20 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is slow. Tilth is good. The root zone is deep.

The Ockley soil is used for lawns, gardens, or parks. It is well suited to lawns, vegetable and flower gardens, trees, and shrubs. It generally is unsuited to water impoundments because of the very rapidly permeable substratum. Erosion generally is a concern only in disturbed areas where the surface is not protected. The included areas that have been cut and filled are not well suited to lawns and gardens. Tilth is poor where the subsoil is exposed. The exposed material is sticky when wet and hard when dry. Adding organic material to the soil improves tilth.

The Ockley soil is well suited to building site development and septic tank absorption fields. Backfilling along foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Sloughing is a hazard in shallow excavations.

The Ockley soil and Urban land are not assigned a land capability classification or a woodland ordination symbol.

OeC—Ockley-Urban land complex, 6 to 12 percent slopes. This map unit consists of a deep, sloping, well drained Ockley soil and areas of Urban land. The unit generally is on dissected side slopes on Wisconsinan outwash terraces. In a few areas it is on knolls. Areas commonly occur as long, narrow bands that are 10 to 30 acres in size. Most are about 45 percent Ockley silt loam and 35 percent Urban land. The Ockley soil and Urban land occur as areas so intricately mixed that separating them in mapping was not practical.

Typically, the Ockley soil has a surface layer of brown, friable silt loam about 6 inches thick. The subsoil is about 44 inches thick. The upper part is brown, firm clay loam, and the lower part is brown, friable gravelly clay loam. The substratum to a depth of about 60 inches is brown, calcareous, loose gravelly sand. In some areas the slope is 12 to 18 percent. Some low areas have been filled or leveled during construction, and other areas have been built up or smoothed.

The Urban land is covered by buildings and pavement. The buildings are mainly residential or commercial, but some are industrial.

Included with the Ockley soil and Urban land in mapping are small areas of Fox soils. These soils are in the steeper areas. Their subsoil is thinner than that of the Ockley soil. Also included are areas that have been radically altered by deep cutting and filling. The excavated areas commonly have sand and gravel near the surface, but in the filled areas the soil commonly is deeper to sand and gravel. Inclusions make up about 20 percent of most areas.

Permeability is moderate in the subsoil of the Ockley soil and very rapid in the substratum. Available water capacity is moderate. Runoff is rapid. Tilth is good. The root zone is deep.

The Ockley soil is used for lawns or gardens. It is well suited to trees and shrubs. It is only moderately suited to lawns and to vegetable and flower gardens because of the slope. It is poorly suited to water impoundments because of the very rapidly permeable substratum and the hazard of seepage. The included areas that have been cut and filled are not well suited to lawns and gardens. Tilth is poor where the subsoil is exposed. The exposed material is sticky when wet and hard when dry. Adding organic material to the soil improves tilth.

The Ockley soil is only moderately suited to building site development and septic tank absorption fields because of the slope and a moderate shrink-swell potential. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site. Sloughing is a hazard in shallow excavations.

The Ockley soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

Or—Orrville silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. Slopes are 0 to 2 percent. Most areas are long and narrow and are 4 to 50 acres in size. Some areas are about 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is dark gray and brown, mottled, friable silt loam, and the lower part is yellowish brown and brown, mottled, friable loam. The substratum to a depth of about 60 inches is brown, mottled, very friable sandy loam and dark yellowish brown, very friable loamy sand. In places the surface layer is loam or fine sandy loam.

Included with this soil in mapping are small areas of the well drained Tioga soils. These soils are slightly higher on the landscape than the Orrville soil. Also included are areas of poorly drained soils in high water channels and depressions. Included soils make up about 20 percent of most areas.

Permeability is moderate in the Orrville soil. Available water capacity is moderate or high. Runoff is very slow. Tilth is good. The seasonal high water table is at a depth of 12 to 30 inches during extended wet periods. In drained areas the root zone is deep.

The use of this soil is determined to a large extent by the size and accessibility of individual areas. Many of the wider areas are used for row crops or hay. The narrow, inaccessible, or dissected areas are used mainly as pasture or woodland or are covered with brush.

If drained, this soil is well suited to corn and soybeans. Because of the flooding, it is not so well suited to winter wheat and oats. The flooding and the seasonal wetness are the major management concerns. Subsurface drains can be used to lower the seasonal high water table in areas where suitable outlets are available. Open ditches are needed to provide outlets in some areas. Water is likely to back up into subsurface drains when water levels are high in the stream channels. Floodwater causes gullying, washes out subsurface drains, buries seedlings, and carries away recently applied plant nutrients.

This soil is well suited to hay and pasture. Because of the seasonal wetness, it is better suited to grasses than to legumes. Most undrained areas are too wet for deep-rooted legumes. The plants grow well through the dry part of the summer. Grazing when the soil is too wet causes compaction and poor tilth. Deferment of grazing during wet periods helps to keep the pasture in good condition. The deposition of sediments caused by floodwater reduces the quality of the forage.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is generally unsuited to building site development and septic tank absorption fields because of the seasonal wetness and the hazard of flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A.

PaC2—Parke silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on dissected side slopes on Illinoian outwash terraces. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth and typically are 100 to 300 feet long. Most areas are long and narrow and are 10 to 50 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown, friable silty clay loam and silt loam in the upper part and strong brown and reddish brown, friable loam and very gravelly sandy loam in the lower part. In some areas the layers of silt loam and silty clay loam are thicker. In places the slope is 4 to 6 percent or 12 to 15 percent.

Included with this soil in mapping are areas of Negley soils. These soils are in the same landscape positions as the Parke soil or are in the steeper areas. They have a higher content of sand and coarse fragments in the upper part than the Parke soil. They make up about 15 percent of most areas.

Permeability is moderate in the Parke soil. Available water capacity is high. Runoff is rapid. Tilth is good.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. A few areas are wooded or are used for the production of nursery stock.

This soil is moderately suited to corn, soybeans, and small grain. It warms early in the spring and thus is well suited to tilling and planting early in spring. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations, and contour stripcropping help to control erosion and minimize crusting. Grassed waterways also help to control erosion. The soil is well suited to no-till farming.

This soil is well suited to hay and pasture. Because of the good natural drainage, it is well suited to grazing in winter and early in spring. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. Seeding a cover or companion crop, mulching, and no-till seeding help to control erosion.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope and a moderate shrink-swell potential, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

Pe—Pewamo silty clay loam. This deep, nearly level, very poorly drained soil is on broad flats, in depressions, and in small upland drainageways on Wisconsinan till plains. It receives runoff from the higher adjacent soils and is subject to ponding. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 4 to 40 acres in size. Some areas are more than 100 acres in size.

Typically, the surface soil is very dark grayish brown, firm silty clay loam about 12 inches thick. It is mottled below a depth of about 8 inches. The subsoil to a depth of about 60 inches is multicolored, firm silty clay loam. In some areas the surface layer is silt loam. In other areas the dark surface soil is thicker. In some places light colored sediments from the adjacent slopes overlie the dark surface soil. In other places the subsoil or substratum is loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Bennington and moderately well drained Centerburg soils on slight rises and low knolls. Also included are small areas of the poorly drained Condit soils in landscape positions similar to those of the Pewamo soil. Included soils make up about 15 percent of most areas.

Permeability is moderately slow in the Pewamo soil. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface during extended wet periods. Tilth is fair. The root zone is deep in drained areas.

Most areas are used as cropland. Some areas are used as pasture or woodland. Most of the wooded areas are not drained.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. It delays planting and restricts the choice of crops that can be grown. In undrained areas the wetness limits the root development of most crops. The soil responds well to measures that improve drainage and minimize compaction. A surface and subsurface drainage system can help to remove excess water in areas where suitable outlets are available. Many areas do not have natural outlets. Draining closed depressions commonly is difficult. Fall tillage is less likely to cause compaction than spring tillage because the soil is generally drier in the fall. A tillage system that leaves the surface rough hastens drying. Tilling or harvesting when the soil is wet causes compaction and the formation of ruts.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The species that can withstand wetness, such as alsike clover, should be selected for planting.

This soil is well suited to trees that can withstand wetness. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Logging during the drier parts of the year or when the soil is frozen minimizes compaction and the formation of ruts and facilitates the use of equipment. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow.

This soil is poorly suited to building site development and septic tank absorption fields because of the ponding and the moderately slow permeability. Properly landscaping building sites and absorption fields results in good surface drainage. Natural drainage outlets are not available in many areas. Open ditches and surface drains commonly are used as outlets. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential and reinforcing walls and foundations help to prevent the structural damage caused by shrinking and swelling. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Pf—Pewamo-Urban land complex. This map unit consists of a deep, nearly level, very poorly drained Pewamo soil and Urban land on broad flats, in depressions, and along drainageways. The Pewamo soil receives runoff from the higher adjacent areas and is subject to ponding. Slopes are 0 to 2 percent. Most areas are long and narrow or irregularly shaped and are 5 to 30 acres in size. They are about 50 percent Pewamo silty clay loam and 30 percent Urban land. The Pewamo soil and Urban land occur in areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Pewamo soil has a surface layer of very dark grayish brown, firm silty clay loam about 12 inches thick. The subsoil to a depth of about 60 inches is multicolored, firm silty clay loam. In places the soil has been covered with fill material.

The Urban land is covered by buildings and pavement. The buildings are mainly single-family houses or apartment buildings, but some are industrial or commercial.

Included with the Pewamo soil and Urban land in mapping are small areas of the somewhat poorly drained Bennington soils on flats and small areas of the moderately well drained Centerburg soils on low knolls and ridges. Included soils make up about 20 percent of most areas.

Most areas have been drained by sewer systems, gutters, and storm drains. In undrained areas the Pewamo soil has a seasonal high water table near or above the surface during extended wet periods. Runoff is very slow or ponded on this soil. Permeability is moderately slow. Available water capacity is high. Tilth is fair.

The Pewamo soil is used for lawns or gardens. If drained, it is well suited to vegetables, flowers, trees, and shrubs. Water-tolerant plants grow in undrained areas. Filled areas are not well suited to lawns and gardens. Tilth is very poor in areas where the subsoil is exposed.

The Pewamo soil is poorly suited to building site development and septic tank absorption fields because of the moderately slow permeability and the ponding. Drainage is required in areas used for these purposes. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. In some areas sanitary facilities are connected to sewers and sewage treatment facilities. Perimeter drains around the absorption fields can lower the seasonal high water table in areas where suitable outlets are available. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

The Pewamo soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

Pg—Pits, gravel. This map unit consists of open excavations in areas where sand and gravel have been surface mined. Most of the pits are on Illinoian and Wisconsinan outwash terraces in areas associated with Chili, Fox, Negley, Ockley, and Rush soils. Some are on kames or moraines in areas associated with Amanda, Chili, Fox, Negley, and Ockley soils, and some are along stream channels or on flood plains. Typically, slopes are very irregular because of spoil piles, overburden, and unmined banks. Water fills some of the excavations, creating ponds that vary in size and depth. The pits generally are 10 to 60 acres in size, but they range from 2 to more than 100 acres.

Most of the larger pits are being mined. Many of the smaller ones have been abandoned. Once surface mining stops, the pits revert to weeds, grasses, and shrubs and drought-tolerant tree species eventually grow on the steep gravel banks, spoil piles, and droughty pit bottoms. Plants that can withstand wetness commonly grow in areas of ponds.

The soil material in the gravel pits occurs as layers of sand and gravel that vary in thickness and composition within short distances. The physical properties of this material are poor. Available water capacity is very low. The suitability for plants is poor.

Because of the instability and loose consistency of the poorly graded sand and gravel, most areas are subject to erosion and are a potential source of sedimentation. Accelerated streambank erosion is a hazard along stream channels and on flood plains. Establishing a plant cover in abandoned areas helps to control erosion and minimizes sedimentation. The grasses and trees that can withstand drought and the other somewhat unfavorable soil properties should be selected for planting.

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

RgC—Rigley fine sandy loam, 6 to 12 percent slopes. This deep, sloping, well drained soil is on unglaciated ridgetops and knolls. Slopes are smooth and commonly are 100 to 300 feet long. Areas generally are 2 to 15 acres in size. Most of those on ridgetops are long and narrow. Those on knolls generally are oval.

Typically, the surface layer is brown, very friable fine sandy loam about 8 inches thick. The subsoil is yellowish brown, very friable sandy loam about 35 inches thick. The substratum to a depth of about 60 inches is brownish yellow, very friable channery sandy loam. In some areas the slope is 12 to 15 percent. In other areas the surface layer is stony. In places bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the lower part of the slopes and areas of soils that have a substratum of grayish brown, mottled, firm silty clay loam. Included soils make up about 15 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Available water capacity is low or moderate. Runoff is rapid. Tilth is good. The root zone is deep.

Most areas are used as hayland or pasture. Some areas are used for woodland, row crops, or small grain or are covered with brush.

This soil is moderately suited to corn, soybeans, and small grain. A severe hazard of erosion, the slope, and droughtiness are the main management concerns. The soil dries and warms early in spring and thus is well suited to tilling and planting early in spring and to no-till farming. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, and contour stripcropping help to control erosion and conserve moisture. Grassed waterways also help to control erosion. Because of the moderately rapid permeability, frequent applications of a small amount of fertilizer and lime are more effective than one application of a large amount.

This soil is well suited to pasture and hay. If properly managed, it is well suited to grazing in winter and early in spring because of the good natural drainage. Alfalfa can be grown if lime and fertilizer are applied. Drought reduces yields of hay late in the growing season. Grasses grow poorly on unimproved pastures during dry periods. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. No-till seeding helps to control erosion and conserves moisture.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the slope, this soil is only moderately suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

RgD—Rigley fine sandy loam, 12 to 18 percent slopes. This deep, moderately steep, well drained soil is on unglaciated hillsides, narrow ridgetops, and high knolls. Slopes commonly are 100 to 250 feet long. Most areas on hillsides and ridgetops are long and narrow and are 10 to 40 acres in size. Areas on knolls generally are oval and are 5 to 10 acres in size.

Typically, the surface layer is brown, very friable fine sandy loam about 8 inches thick. The subsoil is yellowish brown, very friable sandy loam about 32 inches thick. The substratum to a depth of about 60 inches is yellowish brown, very friable channery sandy loam. In some areas the slope is 9 to 12 percent or 18 to 21 percent. In other areas the surface layer is stony. In places bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils, especially on the lower or upper part of the slopes, and some small areas of rock outcrop on shoulder slopes. Inclusions make up about 20 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Available water capacity is low or moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are used as hayland, pasture, or woodland or are covered with brush. Only a few areas are used for row crops or small grain.

Because of the slope, a very severe hazard of erosion, and droughtiness, this soil is poorly suited to cultivated crops. It dries and warms early in spring and thus is well suited to tilling and planting early in spring. No-till farming or another system of conservation tillage that leaves crop residue on the surface, cover crops, and contour stripcropping help to control erosion and conserve moisture. Grassed waterways also help to control erosion. The soil is well suited to conservation tillage systems, including no-till farming. Because of the moderately rapid permeability, frequent applications of a small amount of fertilizer are more effective than one application of a large amount.

This soil is moderately suited to pasture and hay. If properly managed, it is well suited to grazing in winter and early in spring. Alfalfa can be grown if lime and fertilizer are applied. Drought reduces yields of hay late in the growing season. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is very severe. No-till seeding helps to control erosion and conserves moisture.

This soil is well suited or moderately suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. The seedling mortality rate on south aspects can be reduced by planting seedlings that have been transplanted once or by mulching.

This soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface.

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

RgE—Rigley fine sandy loam, 18 to 25 percent slopes. This deep, steep, well drained soil is on unglaciated hillsides. Slopes commonly are 150 to 350 feet long. Most areas are long and narrow and are 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, very friable fine sandy loam about 3 inches thick. The subsurface layer is brown, very friable fine sandy loam about 5 inches thick. The subsoil is yellowish brown and brownish yellow, very friable sandy loam about 42 inches thick. The substratum to a depth of about 70 inches is brownish yellow, very friable channery sandy loam. In some areas the slope is 15 to 18 percent or 25 to 30 percent. In other areas the surface layer is stony. In places bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils, especially on the lower or upper part of the slopes, seeps on the lower part of some slopes, and small areas of rock outcrop on shoulder slopes. Inclusions make up about 20 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Available water capacity is low or moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are used as pasture or woodland or are covered with brush. Because of the slope, a very severe hazard of erosion, and droughtiness, this soil generally is unsuited to row crops and small grain, is only moderately suited to pasture, and is poorly suited to hay. It is well suited to grazing in winter and early in spring. The slope limits the use of farming equipment. In most years drought reduces forage production late in summer. The hazard of erosion is very severe if the pasture is plowed during seedbed preparation or is overgrazed. No-till seeding helps to control erosion and conserves moisture.

This soil is well suited or moderately suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. The seedling mortality rate on south aspects can be reduced by planting seedlings that have been transplanted once or by mulching.

Because of the slope, this soil is poorly suited to building site development and generally is unsuited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

RgF—Rigley fine sandy loam, 25 to 35 percent slopes. This deep, very steep, well drained soil is on unglaciated hillsides. Slopes commonly are 150 to 300 feet long. Most areas are long and narrow and are 10 to 100 acres in size.

Typically, the surface layer is black, very friable fine sandy loam about 2 inches thick. The subsurface layer is brown, very friable fine sandy loam about 4 inches thick. The subsoil is about 37 inches thick. The upper part is brown and yellowish brown, very friable sandy loam, and the lower part is yellowish brown, very friable very channery sandy loam. The substratum to a depth of about 60 inches is yellowish brown, very friable channery sandy loam. In some areas the slope is more than 35 percent. In other areas the surface layer is stony. In places bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of the moderately well drained Coshocton soils on the upper or lower part of the slopes, some seeps on the lower part of some slopes, and small areas of rock outcrop on shoulder slopes. Inclusions make up about 10 to 15 percent of most areas.

Permeability is moderately rapid in the Rigley soil. Available water capacity is low or moderate. Runoff is very rapid. Tilth is good. The root zone is deep.

Most areas are wooded or covered with brush. A few areas are used as permanent pasture.

Because of the slope, a very severe hazard of erosion, and droughtiness, this soil generally is unsuited to cultivated crops and is poorly suited to pasture. It is too steep for intensive pasture management. In most years drought reduces forage yields late in summer. No-till seeding helps to control erosion.

This soil is well suited or moderately suited to trees. Building logging roads and skid trails on the contour helps to control erosion and facilitates the use of equipment. Water bars and a good plant cover also help to control erosion. The seedling mortality rate on south aspects can be reduced by planting seedlings that have been transplanted once or by mulching.

This soil generally is unsuited to building site development and septic tank absorption fields because of the slope.

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

RhE—Rigley-Coshocton complex, 18 to 25 percent slopes. These steep soils are on unglaciated hillsides. The well drained Rigley soil commonly is on the upper part of the slopes, and the moderately well drained Coshocton soil is on the lower part. Slopes are generally uniform and are about 200 to 300 feet long. Areas generally are long and narrow and are 10 to 50 acres in size. They are about 45 percent Rigley fine sandy loam and 40 percent Coshocton silt loam. Either soil can dominate on any given slope. The two soils occur as areas so intricately mixed that separating them in mapping was not practical.

Typically, the Rigley soil has a surface layer of very dark grayish brown, very friable fine sandy loam about 3 inches thick. The subsurface layer is brown, very friable fine sandy loam about 5 inches thick. The subsoil is yellowish brown and brownish yellow, very friable sandy loam about 42 inches thick. The substratum to a depth of about 70 inches is brownish yellow, very friable channery sandy loam. In some areas the surface layer is sandy loam or stony fine sandy loam.

Typically, the Coshocton soil has a surface layer of brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam and firm silty clay loam, and the lower part is yellowish brown and light brownish gray, mottled, firm silty clay loam. The substratum is yellowish brown, mottled, firm silty clay loam. Soft shale bedrock is at a depth of about 67 inches. In places the surface layer and the upper part of the subsoil are loam or stony silt loam.

Included with these soils in mapping are soils that are very channery in the surface layer and in the upper part of the subsoil. Also included are seeps in areas where the Coshocton soil is downslope from the Rigley soil. Inclusions make up about 15 percent of most areas.

Permeability is moderately rapid in the Rigley soil and moderately slow or slow in the Coshocton soil. Available water capacity is low or moderate in the Rigley soil and moderate in the Coshocton soil. Runoff is very rapid on both soils. The Coshocton soil has a perched seasonal high water table at a depth of 18 to 36 inches during extended wet periods. Tilth is good in both soils. The root zone is deep.

Most areas are used as woodland. Some areas are used for hay or permanent pasture.

These soils are generally unsuited to row crops because of the slope and the hazard of erosion. They are poorly suited to hay but are moderately suited to permanent pasture. Unless an adequate plant cover is maintained, especially in conventionally tilled areas, erosion is a very severe hazard. No-till seeding helps to control erosion and conserves moisture. The Rigley soil is better suited to grazing in winter and early in spring than to grazing during other parts of the year because the low or moderate available water capacity retards plant growth during dry periods. Grazing when the Coshocton soil is too wet causes compaction, poor tilth, and an increased runoff rate. Deferment of grazing during wet periods helps to keep the pasture in good condition.

These soils are well suited or moderately suited to trees. If too much of the ground cover is removed when the trees are harvested, erosion is a hazard. Building logging roads or skid trails on the contour and establishing water bars and a good plant cover help to control erosion and facilitate the use of equipment. The seedling mortality rate on south aspects can be reduced by planting seedlings that have been transplanted once or by mulching.

These soils are poorly suited to building site development and are generally unsuited to septic tank absorption fields because of the slope of both soils and the wetness and slow permeability in the Coshocton soil. Buildings should be designed so that they conform to the natural slope of the land. In areas of the Coshocton soil, installing drains at the base of footings helps to keep basements dry. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

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

RsA—Rush silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on flats on Wisconsinan outwash terraces. Areas are irregularly shaped and are 50 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 10 inches thick. The subsoil is about 58 inches thick. The upper part is yellowish brown and strong brown, friable silt loam and silty clay loam, and the lower part is brown, firm gravelly clay loam and very gravelly sandy clay loam. The substratum to a depth of about 80 inches is brown, calcareous, loose very gravelly loamy sand. In a few places the surface layer is darker colored. In some areas sand and gravel are below a depth of 80 inches. In other areas the upper part of the subsoil is thicker.

Included with this soil in mapping are small areas where the substratum is gravelly loam or gravelly sandy loam. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Rush soil and very rapid in the substratum. Available water capacity is high. Runoff is slow. Tilth is good. The root zone is deep.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. Because of the suitability of this soil for cropland, only a few areas are wooded.

This soil is well suited to corn, soybeans, and small grain. It is well suited to row cropping year after year and to specialty crops because of the nearly level slopes, the high available water capacity, and the good natural drainage. Either conventional tillage methods or a system of conservation tillage that leaves crop residue on the surface can be used. The soil dries and warms early in spring and thus is well suited to tilling and planting early in spring. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil helps to maintain tilth and minimizes crusting.

This soil is well suited to pasture and hay. Because of the good drainage, it is well suited to grazing in winter and early in spring. If lime is applied, it is well suited to deep-rooted legumes, such as alfalfa.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields, but a moderate shrink-swell potential is a limitation. Backfilling around foundations with material that has a low shrink-swell potential helps to prevent the structural damage caused by shrinking and swelling. Sloughing is a hazard in shallow excavations.

This soil is a probable source of sand and gravel.

The land capability classification is I. The woodland ordination symbol is 5A.

Se—Sebring silt loam. This deep, nearly level, poorly drained soil is on flats and in depressions on Wisconsinan lake plains and terraces along streams. It receives runoff from the higher adjacent soils and is subject to ponding. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 4 to 20 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 8 inches thick. The subsoil is about 42 inches of light brownish gray and gray, mottled, friable silt loam and firm silty clay loam. The substratum to a depth of about 80 inches is gray, mottled, firm silt loam. In places the subsoil or substratum is loam.

Included with this soil in mapping are small areas of the very poorly drained Luray soils in depressions and small areas of the moderately well drained Glenford soils on slight rises. Also included are some areas where the subsoil or substratum has layers of gravelly loam or sandy loam. Included soils make up about 20 percent of most areas.

Permeability is moderately slow in the Sebring soil. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface during extended wet periods. Tilth is good. Unless the soil is drained, the water table restricts the root zone.

Most areas are used as hayland, pasture, or woodland. Some areas are used for row crops or small grain.

If drained, this soil is moderately suited to corn, soybeans, and small grain. Surface and subsurface drains commonly are used to remove excess surface water and lower the seasonal high water table in areas where adequate outlets are available. In areas where natural drainage outlets are not available, the ponding can destroy small grain crops. A surface crust forms in tilled areas after hard rains.

This soil is well suited to forage species that can withstand wetness. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. Forage production is relatively good during dry periods.

This soil is well suited to trees that can withstand wetness. Planting seedlings that can withstand wetness and that have been transplanted once reduces the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Logging when the soil is frozen or during the drier parts of the year minimizes compaction and the formation of ruts and facilitates the use of equipment.

Because of the ponding and the moderately slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. It is better suited to dwellings without basements than to dwellings with basements. A drainage system is needed, but drainage outlets are not available in some areas. Properly landscaping building sites results in good surface drainage. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Enlarging the absorption area improves the capacity of the fields to absorb effluent.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Sh—Shoals silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains. It occupies the entire width of narrow flood plains and commonly is in low areas on wide flood plains. Slopes are 0 to 2 percent. Most areas are long and narrow and are 4 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 13 inches thick. The upper part of the substratum is grayish brown and yellowish brown, mottled, firm silt loam and silty clay loam and friable loam. The lower part to a depth of about 60 inches is gray, mottled, friable loam and gravelly loam. In some places the lower part of the substratum is loam glacial till. In other places the soil is moderately well drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Algiers soils. These soils are in the same landscape positions as the Shoals soil. Also included are the very poorly drained Sloan soils in some high water channels. Included soils make up about 15 percent of most areas.

Permeability is moderate in the Shoals soil. Available water capacity is high. Runoff is very slow. The seasonal high water table is at a depth of 6 to 18 inches during extended wet periods. Tilth is good. Unless the soil is drained, the water table restricts the root zone.

The use of this soil is determined to a large extent by the size, shape, and accessibility of individual areas. Most of the larger, more accessible areas are used for row crops or hay. Many of the narrow, inaccessible areas and the areas dissected by old stream channels are used as pasture or woodland.

If drained, this soil is well suited to corn and soybeans. Because of the flooding, it is not so well suited to winter wheat and oats. The flooding and the seasonal wetness are the major management concerns, especially in areas used for small grain. Subsurface drains are used to lower the seasonal high water table in areas where good outlets are available. Some areas do not have suitable natural outlets. Water is likely to back up into subsurface drains when water levels are high in the stream channels. Floodwater results in gullying, washes out subsurface drains, buries seedlings, and carries away recently applied plant nutrients. A surface crust forms in tilled areas after heavy rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage.

This soil is well suited to trees that can withstand some wetness. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Logging when the soil is frozen or during the drier parts of the year minimizes compaction and the formation of ruts and facilitates the use of equipment. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil generally is unsuited to building site development and septic tank absorption fields because of the flooding and the seasonal wetness.

The land capability classification is IIw. The woodland ordination symbol is 5W.

SkA—Sleeth silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on flats and slight rises on Wisconsinan outwash terraces. Most areas are irregularly shaped and are 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The subsoil is about 46 inches thick. The upper part is brown and yellowish brown, mottled, friable silt loam, loam, and clay loam, and the lower part is dark grayish brown and grayish brown, mottled, firm gravelly clay loam and gravelly sandy clay loam. The substratum to a depth of about 60 inches is grayish brown, loose gravelly sand.

Included with this soil in mapping are small areas of the very poorly drained Westland soils in depressions, small areas of the well drained Ockley soils on slight rises, and areas of soils in which the substratum is loam or gravelly sandy loam. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Sleeth soil and very rapid in the substratum. Available water capacity is moderate or high. Runoff is slow. The seasonal high water table is at a depth of 12 to 36 inches during extended wet periods. Tilth is good. Unless the soil is drained, the water table restricts the root zone.

Most areas are used for row crops or small grain. Some areas are used for hay or pasture. A few areas are wooded.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. It delays planting and limits the choice of crops that can be grown. Surface drains commonly are used to remove excess surface water and provide outlets for subsurface drains. Subsurface drains commonly are used to lower the seasonal high water table. A surface crust forms in tilled areas after hard rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. Deep-rooted legumes can be grown in areas that are adequately drained.

This soil is well suited to trees that can withstand some seasonal wetness. No major hazards or limitations affect planting or harvesting.

This soil is poorly suited to building site development and septic tank absorption fields because of the seasonal wetness. Subsurface drains reduce the wetness. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Sloughing is a hazard in shallow excavations.

This soil is a probable source of sand and gravel. The included areas where the substratum is loam or gravelly sandy loam are not probable sources.

The land capability classification is IIw. The woodland ordination symbol is 5A.

So—Sloan silt loam, frequently flooded. This deep, nearly level, very poorly drained soil is on flood plains. It commonly is in high water channels and on other low parts of the flood plains. Slopes are 0 to 2 percent. Most areas are long and narrow and are 10 to 35 acres in size.

Typically, the surface layer is black, friable silt loam about 9 inches thick. The subsurface layer is about 10 inches of black and very dark gray, friable silt loam and clay loam. It is mottled below a depth of about 14 inches. The subsoil is dark gray and dark grayish brown, mottled, friable loam about 17 inches thick. The substratum to a depth of about 60 inches is dark grayish brown and gray, mottled, friable gravelly loam and silt loam. In some areas the surface layer and subsurface layer are thicker. In a few places the upper part of the soil is muck.

Included with this soil in mapping are small areas of the moderately well drained Medway and somewhat poorly drained Shoals soils. These soils are slightly higher on the landscape than the Sloan soil. They make up about 15 percent of most areas.

Permeability is moderate or moderately slow in the Sloan soil. Available water capacity is high. Runoff is very slow. The seasonal high water table is at or near the surface during extended wet periods. Tilth is good. Unless the soil is drained, the water table restricts the root zone.

The use of this soil is determined to a large extent by the size, shape, and accessibility of individual areas. Most of the larger, more accessible areas that are drained are used for row crops or hay. Many of the narrow, inaccessible areas and the areas dissected by high water channels are used as pasture or woodland.

If drained, this soil is moderately suited to corn and soybeans. Flooding severely damages winter grain. Surface drains commonly are used to remove excess surface water. Subsurface drains are used to remove excess water from the subsoil in areas where suitable drainage outlets are available. Water backs up in subsurface drains when water levels are high in stream channels. Establishing adequate outlets is difficult in some areas. Tilling and harvesting at optimum moisture levels help to maintain tilth and minimize compaction.

This soil is well suited to hay and pasture. Grazing when the soil is too wet causes compaction and poor tilth. Pasture rotation and deferment of grazing during wet periods help to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage.

This soil is well suited to trees that can withstand wetness. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Plant competition can be controlled by removing vines and the less desirable trees and shrubs. Frequent, light thinning or harvesting improves the vigor of the stand

and reduces the hazard of windthrow. Logging when the soil is frozen or during the drier parts of the year minimizes compaction and the formation of ruts and facilitates the use of equipment.

This soil is generally unsuited to building site development and septic tank absorption fields because of the flooding, the seasonal wetness, and the moderate or moderately slow permeability.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

St—Stonelick loam, occasionally flooded. This deep, nearly level, well drained soil is on narrow or wide flood plains that originate mainly in areas of Wisconsinan glacial drift. Slopes are 0 to 2 percent. Most areas are 10 to 70 acres in size. Some areas are larger than 100 acres.

Typically, the surface layer is brown, calcareous, friable loam about 9 inches thick. The subsurface layer also is brown, calcareous, friable loam. It is about 5 inches thick. The upper part of the substratum is dark yellowish brown and yellowish brown, calcareous, friable and very friable fine sandy loam. The lower part to a depth of about 60 inches is dark yellowish brown, calcareous, very friable and loose, stratified silt loam, fine sandy loam, and loamy sand. In some areas the substratum contains more silt and less sand. In a few areas the soil is subject to rare flooding. In places it is not calcareous throughout.

Included with this soil in mapping are narrow areas of the somewhat poorly drained Shoals soils in slight depressions and high water channels. Some of these areas are in the flood pool of the Dillon Reservoir and are subject to controlled flooding. Also included are areas where unstabilized, gravelly, sandy, and silty riverwash of recent origin is in or along perennial or intermittent stream channels. These areas are flooded and washed or reworked by streams so frequently that they commonly are devoid of vegetation. Inclusions make up about 20 percent of most areas.

Permeability is moderately rapid in the Stonelick soil. Available water capacity is low or moderate. Runoff is slow. Tilth is good. The root zone is deep.

Most areas are used for row crops, small grain, hay, or pasture. Some areas are wooded, especially along the stream channels.

This soil is well suited to corn and soybeans, but droughtiness and the hazard of flooding are management concerns. The flooding can damage small grain in some areas. Irrigation can minimize droughtiness. The surface layer can be worked throughout a wide range of moisture content. If good management, including adequate weed control, is applied, the soil is well suited to no-till farming or another system of conservation tillage that leaves crop residue on the surface and thus conserves moisture. Unlike most of the soils in the county, this soil typically has a mildly alkaline surface layer that is high in content of lime. As a result, applications of lime are not needed. Applying acid-based fertilizer reduces the alkalinity. The reaction to applications of nitrogen, phosphorus, and herbicide can differ from the reaction on more acid soils. The soil can be deficient in trace elements. The included areas of riverwash generally are unsuited to cultivated crops. Some areas along the stream channels are subject to streambank erosion.

This soil is well suited to hay and pasture. The sedimentation caused by floodwater reduces the quality of the forage. Drought retards the growth of forage plants.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

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

This soil is a probable source of sand.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Su—Stonelick-Urban land complex, occasionally flooded. This map unit consists of a deep, nearly level, well drained Stonelick soil and areas of Urban land on flood plains. Flooding can occur at any time of the year but is most likely in winter and spring. Some areas are protected to varying degrees by levees. Slopes are 0 to 2 percent. Areas commonly have straight boundaries with distinct corners and are 50 to 200 acres in size. Most are about 40 percent Stonelick loam and 35 percent Urban land. The Stonelick soil and Urban land occur as areas so intricately mixed or small that separating them in mapping was not practical.

Typically, the Stonelick soil has a surface layer of brown, calcareous, friable loam about 9 inches thick. The subsurface layer also is brown, calcareous, friable loam. It is about 5 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown and yellowish brown, calcareous, friable fine sandy loam and silt loam and loose loamy sand. Some areas have been filled and thus are elevated above the normal level of flooding.

The Urban land is covered by streets, highways, parking lots, buildings, and other structures.

Included with the Stonelick soil and Urban land in mapping are small areas of the well drained Ockley soils on outwash terraces above the flood plains. These soils make up about 25 percent of most areas.

Permeability is moderately rapid in the Stonelick soil. Available water capacity is low or moderate. Runoff is slow. Tilth is good. The root zone is deep.

The Stonelick soil is used for lawns, gardens, or parks. It is droughty during extended dry periods. The grasses, legumes, and shrubs selected for planting, especially in some of the droughtier areas, should be those that can withstand the low or moderate available water capacity.

Because of the flooding, the Stonelick soil is generally unsuited to building site development and septic tank absorption fields, but it is well suited in the areas that are protected by levees.

The Stonelick soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

Tg—Tioga fine sandy loam, occasionally flooded. This deep, nearly level, well drained soil is on narrow or wide flood plains that originate mainly in areas of sandstone, siltstone, and shale bedrock. Slopes are 0 to 2 percent. Most areas are long and narrow and are 10 to 70 acres in size. Some areas are larger than 100 acres.

Typically, the surface layer is brown, very friable fine sandy loam about 8 inches thick. The subsoil is yellowish brown and dark yellowish brown, very friable fine sandy loam about 15 inches thick. The substratum to a depth of about 60 inches is yellowish brown, loose very gravelly loamy sand. In some places the soil is moderately well drained. In other places the subsoil contains more silt and less sand.

Included with this soil in mapping are narrow areas of the somewhat poorly drained Orrville soils in slight depressions and high water channels. Also included are small areas where unstabilized, gravelly, sandy, and silty riverwash is in or along the stream channels. Inclusions make up about 15 percent of most areas.

Permeability is moderate or moderately rapid in the subsoil of the Tioga soil and rapid in the substratum. Available water capacity is low or moderate. Runoff is slow. The seasonal high water table is at a depth of 36 to 72 inches during extended wet periods. Tilth is good. The root zone is deep.

Most areas are used for row crops, small grain, hay, or pasture. Some areas are wooded.

This soil is well suited to corn, soybeans, and small grain. The hazard of flooding and droughtiness during extended dry periods are the main management concerns. Irrigation can reduce the droughtiness. The surface layer can be worked throughout a wide range of moisture content. Small, frequent applications of plant nutrients minimize the losses caused by leaching. If good management, including adequate weed control, is applied, the soil is well suited to no-till farming or another system of conservation tillage that leaves crop residue on the surface and thus conserves moisture. Some areas along the stream channels are subject to streambank erosion.

This soil is well suited to pasture and hay. Alfalfa can be grown if lime is applied. Drought retards plant growth during dry periods. The sedimentation caused by floodwater reduces the quality of the forage.

This soil is well suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the flooding, the seasonal wetness, and a poor filtering capacity, this soil is generally unsuited to building site development and septic tank absorption fields.

This soil is a probable source of sand and gravel.

The land capability classification is IIw. The woodland ordination symbol is 4A.

TsB—Titusville silt loam, 2 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on low knolls and ridges on Illinoian till plains. Most areas are irregularly shaped and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 9 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable and firm silt loam and silty clay loam. The next part is a fragipan of yellowish brown, very firm, brittle gravelly loam and clay loam. The lower part is yellowish brown, firm loam. The subsoil is mottled below a depth of about 18 inches. The substratum to a depth of about 80 inches is yellowish brown, mottled, firm loam glacial till. In some areas the slope is 0 to 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained soils along drainageways and small areas of Coshocton soils on the higher parts of ridges and knolls. Coshocton soils do not have a fragipan. Included soils make up about 10 percent of most areas.

Permeability is slow in the Titusville soil. Available water capacity is moderate. Runoff is medium in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone commonly is restricted to the part of the profile above the compact, dense fragipan at a depth of 18 to 28 inches.

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

This soil is well suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is moderate. A surface crust forms after hard rains. Applying a system of no-till farming or another type of conservation tillage that leaves crop residue on the surface, including grasses and legumes in the crop rotation, and returning crop residue to the soil help to control erosion and minimize crusting. Grassed waterways also help to control erosion. Subsurface drains are used to remove excess water.

This soil is well suited to hay and pasture. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. If lime is applied, deep-rooted legumes can be grown in adequately drained areas.

This soil is well suited to trees. The seedling mortality rate can be reduced by planting seedlings that have been transplanted once. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow.

Because of the seasonal wetness and the slow permeability, this soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Surface and subsurface drains remove excess water and lower the seasonal high water table. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Enlarging septic tank absorption fields and installing the distribution lines in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent. Perimeter drains around the absorption fields lower the seasonal high water table and intercept lateral seepage along the top of the fragipan. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIe. The woodland ordination symbol is 5D.

TsC2—Titusville silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, moderately well drained soil is mainly on ridges and knolls on Illinoian till plains. In some areas it is on foot slopes at the base of the steeper hillsides. Erosion has removed part of the original surface layer. Tillage has mixed subsoil material into the present surface layer. Slopes are smooth or concave and commonly are 100 to 300 feet long. Most areas are irregularly shaped and are 5 to 15 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. It has yellowish brown specks. The subsoil extends to a depth of about 60 inches. The upper part is yellowish brown, firm silty clay loam and clay loam. The next part is a fragipan of yellowish brown, very firm, brittle clay loam. The lower part is brown, firm loam. The subsoil is mottled below a depth of about 17 inches. In some areas the fragipan contains more silt.

Included with this soil in mapping are small areas of Coshocton soils on the upper part of some slopes, a few seeps on the lower part of some slopes, and some areas of severely eroded soils on the upper part of the slopes. Coshocton soils do not have a fragipan. In the severely eroded soils, the surface layer is clay loam and tilth is fair. Inclusions make up about 15 percent of most areas.

Permeability is slow in the Titusville soil. Available water capacity is moderate. Runoff is rapid in cultivated areas. The seasonal high water table is perched at a depth of 18 to 36 inches during extended wet periods. Tilth is good. The root zone commonly is restricted to the part of the profile above the compact, dense fragipan at a depth of 18 to 28 inches.

Most areas are used for hay or pasture. Some areas are used for row crops or small grain or are wooded.

This soil is moderately suited to corn, soybeans, and small grain. In tilled areas the hazard of erosion is severe. Significant erosion has occurred, reducing the level of natural fertility and increasing the need for lime and fertilizer. A surface crust forms in tilled areas after hard rains. No-till farming or another system of conservation tillage that leaves crop residue on the surface, crop rotations that include meadow crops, and contour stripcropping help to control erosion and minimize crusting. Grassed waterways also help to control erosion. Random subsurface drains are used to remove excess water in areas of seeps.

This soil is well suited to hay and pasture. Compaction, poor tilth, and an increased runoff rate result from grazing when the soil is too wet. Timely deferment of grazing helps to keep the pasture in good condition. If the pasture is plowed during seedbed preparation or is overgrazed, the hazard of erosion is severe. No-till seeding helps to control erosion.

This soil is well suited to trees. The seedling mortality rate can be reduced by planting seedlings that have been transplanted once. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow.

Because of the slope, the seasonal wetness, and the slow permeability, this soil is only moderately suited to building site development and is poorly suited to septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Water moves laterally on top of the fragipan and into excavations, particularly in concave areas and on the lower part of the slopes. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Installing the distribution lines in septic tank absorption fields on the contour helps to prevent seepage of effluent to the surface. Perimeter drains upslope from the absorption fields intercept lateral seepage and lower the seasonal high water table. Enlarging septic tank absorption fields and installing the distribution lines in the part of the profile above the fragipan improve the capacity of the fields to absorb effluent. The hazards of runoff and erosion can be reduced by maintaining a plant cover where possible on the construction site.

The land capability classification is IIIe. The woodland ordination symbol is 5D.

Uf—Udorthents, loamy. These soils are in areas that have been used for the disposal of trash, concrete, wood, bricks, and other waste products. A few areas were filled mainly with fiberglass waste material. One area was used as a borrow pit for road subgrade and does not have waste material. In the areas that have waste material, slopes are smooth, are convex, or are irregularly contoured because of settling. They are dominantly 6 to 12 percent. Most areas are 5 to 25 acres in size, but a few are larger.

Typically, the surface layer is firm, calcareous loam about 18 inches thick. It is underlain by the discarded material.

Included with these soils in mapping are small areas of soils that are similar to the adjacent soils. These included soils are around the edges of the mapped areas. Also included are a few areas where the slope is 2 to 6 percent or 12 to 25 percent, some areas that have mostly solid mineral waste and are relatively stable, areas that have a very high content of organic material that is very unstable and will gradually decompose and cause settling, and areas where the upper part of the original soil has been removed and the subsoil or substratum is exposed. Inclusions make up about 20 percent of most areas.

The Udorthents have poor physical properties. Runoff varies greatly but is dominantly medium or rapid.

A plant cover is needed on these soils to control erosion. Adding topsoil can increase the depth of the root zone and the available water capacity of the soils. Onsite investigation is needed to determine the suitability for specific uses.

These soils are not assigned a land capability classification or a woodland ordination symbol.

Wa—Wallkill silt loam, clayey substratum, frequently flooded. This deep, nearly level, very poorly drained soil is in depressions on flood plains. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 10 to 60 acres in size.

Typically, the upper 24 inches is recent alluvium, which is dark grayish brown, friable silt loam. The alluvium is mottled in the lower part. It is underlain by black, friable and slightly sticky muck about 18 inches thick. The substratum to a depth of about 80 inches is black, slightly sticky, organic-rich clay and gray, very sticky clay. In some areas the alluvium is less than 16 inches deep over the buried muck. In a few areas the soil has no underlying layers of clay.

Included with this soil in mapping are small areas of the poorly drained Kilbuck and somewhat poorly drained Algiers soils. These soils are in the same landscape positions as the Wallkill soil. They make up about 15 percent of most areas.

Permeability is moderate in the recent alluvium in the Wallkill soil and slow in the underlying clay. Available water capacity is very high. Runoff is very slow. The seasonal high water table is at or near the surface during extended wet periods. Tilth is good. Unless the soil is drained, the water table restricts the root zone.

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

If drained, this soil is moderately suited to corn, soybeans, and some specialty crops. It is generally unsuited to small grain because of the frequent flooding. Surface and subsurface drains can remove excess surface water and lower the water table in areas where suitable outlets are available. Establishing adequate outlets is difficult in some areas. A surface crust forms in tilled areas after heavy rains. Returning crop residue to the soil minimizes crusting.

This soil is well suited to hay and pasture. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The sedimentation caused by floodwater reduces the quality of the forage. The species that can withstand wetness should be selected for planting.

This soil is moderately suited to trees. Planting seedlings that have been transplanted once and can withstand wetness reduces the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Logging when the soil is frozen or during the drier parts of the year minimizes compaction and the formation of ruts and facilitates the use of equipment. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is generally unsuited to building site development and septic tank absorption fields because of the frequent flooding, the wetness, low strength in the buried organic layer, and the slow permeability.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

Ws—Westland silty clay loam. This deep, nearly level, very poorly drained soil is on flats and in depressions on Wisconsinan outwash terraces. It receives runoff from the higher adjacent areas and is subject to ponding. Slopes are 0 to 2 percent. Most areas are irregularly shaped and are 10 to 40 acres in size. Some areas are larger than 150 acres.

Typically, the surface layer is black, firm silty clay loam about 8 inches thick. The subsurface layer also is black, firm silty clay loam. It is about 7 inches thick. The subsoil is about 40 inches thick. The upper part is dark gray and gray, mottled, firm clay loam, and the lower part is gray, mottled, firm loam and dark gray, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark gray, loose very gravelly loamy coarse sand. In places the soil is somewhat poorly drained. In some areas it receives light colored overwash from the adjacent eroding slopes.

Included with this soil in mapping are small areas of the somewhat poorly drained Sleeth soils on slight rises and small areas of the very poorly drained Luray soils in depressions. Also included are areas of soils in which the substratum is gravelly loam glacial outwash or loam glacial till. Included soils make up about 15 percent of most areas.

Permeability is moderate in the subsoil of the Westland soil and very rapid in the substratum. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface during extended wet periods. Tilth is fair. Unless the soil is drained, the water table restricts the root zone.

Most areas are used for row crops or small grain. Some areas are used as pasture or hayland. Undrained areas commonly are wooded.

If drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the main limitation. It delays planting and limits the number of crops that can be grown. The soil responds well to measures that improve drainage and minimize compaction. Surface and subsurface drains commonly are used to remove excess water. Fall tillage is less likely to cause compaction than spring tillage because the soil is generally drier in the fall. Puddles and clods form if the soil is worked when it is too wet. A tillage system that leaves the surface rough hastens drying.

This soil is well suited to pasture and hay. Compaction, poor tilth, and a decreased rate of water infiltration result from grazing when the soil is too wet. Deferment of grazing during wet periods helps to keep the pasture in good condition. The species that can withstand wetness, such as alsike clover, should be selected for planting.

This soil is well suited to trees that can withstand wetness. Logging when the soil is frozen or during the drier parts of the year helps to prevent the formation of ruts, minimizes compaction, and facilitates the use of equipment. Planting seedlings that have been transplanted once reduces the seedling mortality rate. Frequent, light thinning or harvesting improves the vigor of the stand and reduces the hazard of windthrow. Plant competition can be controlled by removing vines and the less desirable trees and shrubs.

This soil is poorly suited to building site development and septic tank absorption fields because of the ponding. It is better suited to dwellings without basements than to dwellings with basements. In areas where adequate outlets are available, drains at the base of footings can remove excess water. Applying an exterior coating to basement walls helps to keep basements dry. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Perimeter drains around the absorption fields can lower the seasonal high water table in areas where adequate outlets are available.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Wt—Westland-Urban land complex. This map unit consists of a deep, nearly level, very poorly drained Westland soil and Urban land on flats and in depressions on Wisconsinan outwash terraces. The Westland soil receives runoff from the higher adjacent areas and is subject to ponding. Slopes are 0 to 2 percent. Areas generally are long and narrow and are 10 to 100 acres in size. They are about 50 percent Westland silty clay loam and 30 percent Urban land. The Westland soil and Urban land occur in areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Westland soil has a surface layer of black, firm silty clay loam about 8 inches thick. The subsurface layer also is black, firm silty clay loam. It is about 7 inches thick. The subsoil is about 40 inches thick. The upper part is dark gray and gray, mottled, firm clay loam, and the lower part is gray, mottled, firm loam and dark gray, very friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark gray, loose very gravelly loamy coarse sand. In some places the soil is somewhat poorly drained. In a few areas the surface has been covered with fill material.

The Urban land is covered by buildings and pavement. The buildings are mainly single-family houses or apartment buildings, but some are industrial or commercial.

Included with the Westland soil and Urban land in mapping are small areas of the somewhat poorly drained Sleeth soils on slight rises, small areas of the well drained Ockley soils on low knolls and ridges, a few small areas of Carlisle soils in depressions, and areas of Luray soils. Carlisle soils are organic throughout. Luray soils contain more silt and clay in the substratum than the Westland soil. They are in the same landscape positions as the Westland soil. Included soils make up about 20 percent of most areas.

Most areas have been drained by sewer systems, gutters, and storm drains. In undrained areas the Westland soil has a seasonal high water table near or above the surface during extended wet periods. Permeability is moderate in the subsoil of this soil and very rapid in the substratum. Available water capacity is high. Runoff is very slow or ponded. Tilth is fair.

The Westland soil is used for lawns or gardens. If drained, it is well suited to most vegetables, flowers, trees, and shrubs. Water-tolerant plants grow in undrained areas. The included filled areas are not well suited to lawns and gardens. In areas where the subsoil and substratum are exposed, tilth is very poor.

The Westland soil is poorly suited to building site development and septic tank absorption fields because of the ponding. A drainage system is needed. Properly landscaping building sites and septic tank absorption fields results in good surface drainage. Installing drains at the base of footings and applying an exterior coating to basement walls help to keep basements dry. Perimeter drains around septic tank absorption fields lower the seasonal high water table.

The Westland soil and the Urban land are not assigned a land capability classification or a woodland ordination symbol.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture.

Figure 15.—An area of Ockley soils where prime farmland is being converted to urban uses.

It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 241,000 acres in Licking County, or nearly 55 percent of the total acreage, potentially is prime farmland. Some of this acreage requires a drainage system or protection from flooding. The western part of the county is dominantly prime farmland. In the central and eastern parts, prime farmland generally is confined to areas on terraces, to some areas on flood plains in the major valleys, and to a small acreage on relatively narrow ridgetops.

A recent trend in land use in some parts of the county has resulted in the loss of some prime farmland to urban and industrial uses (fig. 15). The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, less easily cultivated, and less productive than prime farmland.

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

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

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 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 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 drainage projects, construction projects, and safe waste disposal sites.

The soils in the county are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

James A. McCluskey, 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 1982, more than 205,000 acres in Licking County was used for crops and about 54,000 acres was used as pasture *(24)*. Of this total, about 112,600 acres was used for row crops, mainly corn and soybeans, 15,900 acres for close-growing crops, mainly wheat and oats, and 27,000 acres for rotation hay and pasture *(5)*.

The potential of the soils in the county for increased production of food or forage is good. About 71,100 acres of potential cropland is used as woodland, and about 45,400 acres is used as pasture. About 69,200 acres of this potential cropland, however, is in land capability class III or IV and would require good management to control water erosion if it were used as cropland. The conversion of pasture and woodland to cropland would depend on economic considerations. Crop production could also be increased considerably by applying the latest cropping techniques and by using the information in this survey.

Corn and soybeans are the main grain crops grown in Licking County, but the soils and climate also are suited to grain sorghum, sunflowers, and similar crops. Wheat and oats are the most common close-growing crops. Other crops, such as barley, rye, and buckwheat, could be grown, and grass seed could be produced from bromegrass, timothy, fescue, redtop, and bluegrass.

The different kinds of soil in Licking County are affected by different management concerns. The main management needs are measures that control water erosion and soil blowing, minimize surface compaction, reduce seasonal wetness, maintain fertility and tilth, and reduce droughtiness.

Water erosion is a major concern on about half of the cropland and pasture in the county. It generally is a hazard where the slope is more than 2 percent. The hazard increases as the slope increases. In cultivated or overgrazed areas, it generally is moderate if the slope is 2 to 6 percent, severe if the slope is 6 to 18 percent, and very severe if the slope is more than 18 percent.

Erosion reduces natural soil fertility and productivity as the original topsoil is removed and the more acid subsoil is incorporated into the surface layer through subsequent tillage. The need for lime and fertilizer to replace lost plant nutrients and maintain productivity is thus increased. If the amount of annual soil loss exceeds the rate at which the soil rebuilds itself, long-term productivity and natural fertility will be reduced. Loss of the original topsoil is especially damaging on soils that have a high content of clay in the subsoil, such as Bennington and Guernsey soils, and on soils that have a fragipan in the subsoil that limits the depth of the root zone, such as Cincinnati and Homewood soils.

Erosion increases the cost of crop production, results in poor tilth, increases the need for tillage, and reduces the available water capacity of the soil. Tilling and preparing a good seedbed are difficult in the more eroded spots in many sloping fields where most of the original surface layer has been lost. In these spots reduced seed-soil contact and reduced available water capacity commonly result in poorer stands. These spots are common in areas of the eroded Amanda, Centerburg, Coshocton, and Homewood soils.

Eroding sediments, which include chemical fertilizer, herbicides, and pesticides, enter into waterways, streams, ponds, and lakes. The sediments can fill drainage ditches and block drainage outlets, often requiring more costly ditch maintenance for proper operation. Control of erosion protects the soil resource base, maintains productivity, minimizes the pollution of streams, and improves the quality of water for municipal and recreational uses and for fish and wildlife.

Soil management measures that control erosion include proper crop rotations, contour farming, contour stripcropping, cover crops, crop residue management, grassed waterways, terraces and diversions, conservation tillage, and spring plowing rather than fall plowing. The measures that conform to a particular cropping system can be selected to reduce soil loss to an amount that will not reduce long-term productivity.

Crop rotations that include cover crops and grasses and legumes reduce the hazard of erosion by providing a plant cover for extended periods and improve soil tilth for the following crop. They are effective on gently sloping soils and on steeper soils. The proportion of hay or pasture in the rotation should increase as slope increases.

In areas where slopes are relatively long and uniform, farming gently sloping soils on the contour and contour stripcropping the steeper soils are effective in controlling erosion. Contour stripcropping is effective in areas of the sloping Amanda, Alford, Centerburg, Cincinnati, Clarksburg, Coshocton, Hickory, Homewood, and Keene soils that have relatively long, uniform slopes (fig. 16). Many areas of sloping soils have slopes that are so short and irregular that contour stripcropping is not practical. On these soils, a cropping system that provides a substantial plant cover or a system of conservation tillage that leaves crop residue on the surface is needed to control erosion.

Terraces and diversions help to control erosion by intercepting runoff and safely diverting it across the slope. They are most effective on deep, well drained, gently sloping and sloping soils that have relatively long and uniform slopes. Other soils are less well suited to terracing because of irregular slopes, excessive wetness in the terrace channels, a clayey subsoil or fragipan that would be exposed in the terrace channels, or bedrock within a depth of 40 inches.

A system of conservation tillage, including no-till planting, that leaves crop residue on the surface can help to control erosion on most of the soils in the county (fig. 17). It is best suited to well drained and moderately well drained soils that dry and warm up early in the spring. Adequate drainage is important when conservation tillage systems are used on very poorly drained to somewhat poorly drained soils. A high level of management, including weed and insect control, is needed in areas where a system of conservation is applied. Contour farming, contour stripcropping, and grassed waterways can be used along with conservation tillage to further reduce the hazard of erosion.

Soil blowing is a hazard on Carlisle soils. It can damage these mucky soils if winds are strong and if the soils are dry and have no vegetation or surface mulch. Maintaining a plant cover, surface mulching, and roughening the surface by proper tillage methods minimize soil blowing on these soils. Windbreaks of suitable shrubs also can be effective in controlling soil blowing.

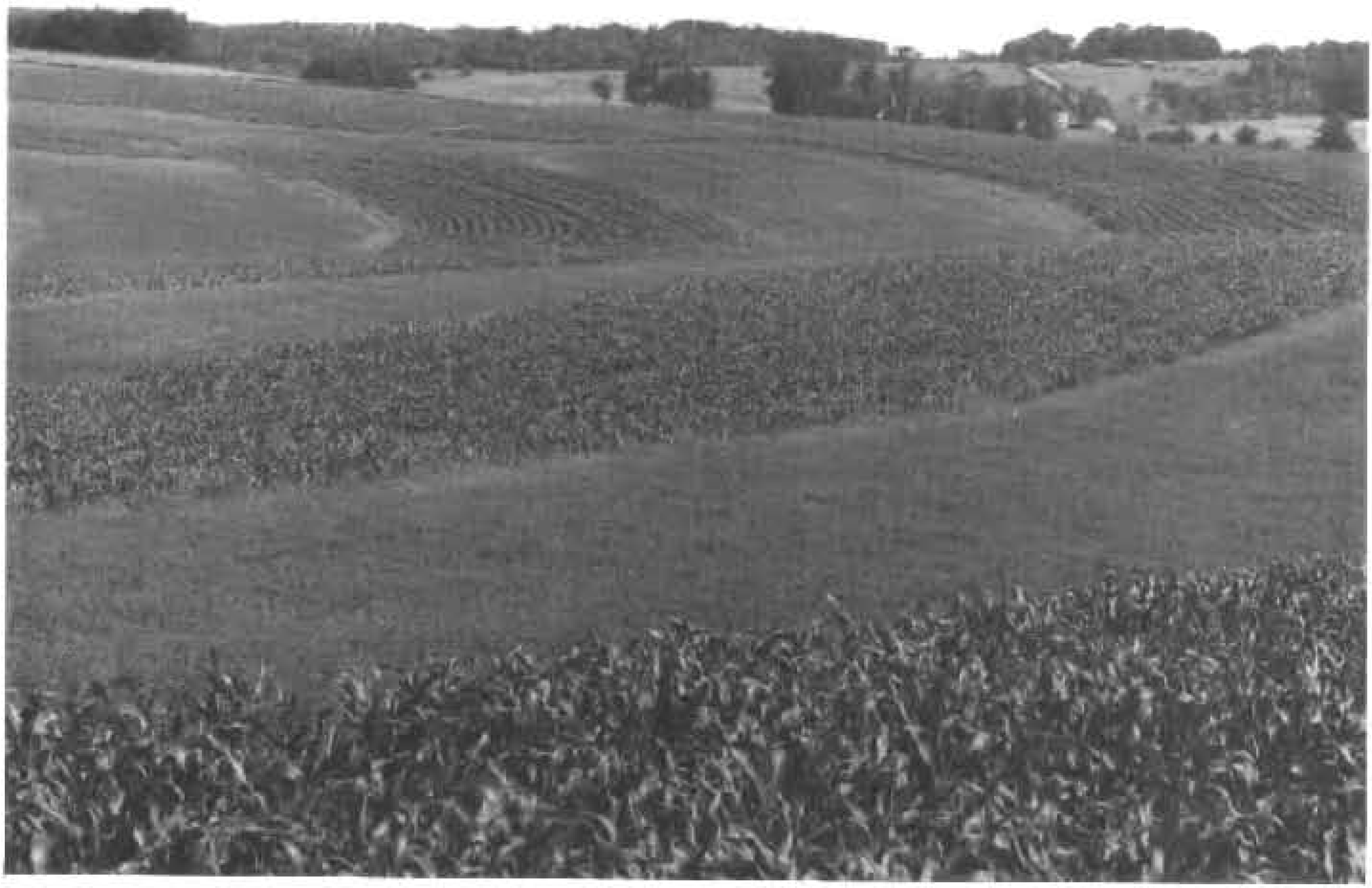


Figure 16.—Contour stripcropping in an area of Hickory silt loam, 6 to 12 percent slopes, eroded.

Information about the measures that control erosion and soil blowing on each kind of soil is available at the local office of the Soil Conservation Service.

Soil compaction is a general management concern on all of the cropland in the county. Pressure applied to the surface by farm machinery can cause compaction, especially if the soil is soft and compressible because of wetness. When the soil becomes compacted, the total porosity of the affected soil is reduced and soil structure is damaged. Compaction caused by traffic during seedbed preparation and harvesting can extend well into the subsoil, restricting air and water movement and root penetration. The factors affecting compaction on cropland include machinery size, weight, and design; the type of farm implements; the timeliness of fieldwork; soil texture; and soil moisture content. Compaction can be minimized by tilling the soil at the proper soil moisture content, by using machinery with lower axle weights, by using the most efficient implements, and by minimizing tillage.

Soil drainage is the major management concern on about half of the acreage used for crops and pasture in the county. The poorly drained and very poorly drained Carlisle, Condit, Killbuck, Luray, Melvin, Pewamo, Sebring, Sloan, Wallkill, and Westland soils are naturally so wet that crop production is generally not possible unless a drainage system is installed. These soils make up about 51,000 acres in the county.

Figure 17.—No-till corn planted in rye in an area of Centerburg silt loam, 2 to 6 percent slopes.

excluding the acreage used for urban development. Unless drained, the somewhat poorly drained Algiers, Bennington, Fitchville, Orrville, Shoals, and Sleeth soils are so wet that the crops are damaged during most years and planting or harvesting is delayed. These soils make up about 86,000 acres in the county, excluding the acreage used for urban development.

Small areas of wet soils in seepy spots, along drainageways, and in swales are commonly included with the moderately well drained soils, such as Centerburg and Titusville soils, in mapping. A drainage system is needed in these areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drainage is needed in most areas of the poorly drained and very poorly drained soils that are used for intensive row cropping. Drains should be more closely spaced in slowly permeable soils than in the more permeable soils. Subsurface drainage is slow in Condit and Bennington soils. Establishing adequate outlets for subsurface drainage systems can be difficult in many areas of Algiers, Carlisle, Condit, Killbuck, Luray, Melvin, Pewamo, Sebring, Sloan, Wallkill, and Westland soils.

Organic soils oxidize and subside when their pore space is filled with air; therefore, special drainage systems are needed to control the water table and the period of drainage. Keeping the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of organic soils.

Periodic inspection and maintenance are needed to keep a drainage system working properly. Regularly cleaning outlet ditches helps to prevent blockage by sediments and keeps brush from restricting the flow of water. Controlling weeds and brush and maintaining a cover of grasses along the ditchbanks keep ditchbanks stable and reduce the risk of streambank erosion. Subsurface drainage outlets should be protected against erosion. Animal guards keep rodents from entering the outlets and blocking the drains. Replacing broken drains helps to prevent the accumulation of sediments, which can restrict the flow of water.

Information about the design of drainage systems for each kind of soil is given in the Technical Guide, which is available in the local office of the Soil Conservation Service.

The *fertility* of a soil depends on the natural fertility level and on past use and management, including previous applications of lime and fertilizer. As a result, fertility can vary widely from field to field, even on the same kind of soil.

About 16 chemical elements are essential to the growth of plants *(17)*. High crop yields and productive pastures require adequate levels of plant nutrients, lime, and organic matter. Maintaining these levels results in sustained high yields on all of the soils in the county.

Many nutrients are most readily available to plants where the soil is nearly neutral in reaction. They are less readily available where the soil is more acid or more alkaline. Most of the soils in Licking County, such as Amanda, Bennington, Centerburg, Coshocton, and Homewood soils, are acid in the upper part of the root zone and require periodic additions of lime to increase the availability of plant nutrients.

Soil texture, organic matter content, and the type of clay minerals influence the cation-exchange capacity of the soil, which affects the storage and availability of nutrients. The ability to store and release plant nutrients increases as the content of clay and organic matter increases. Pewamo soils have a high content of clay and organic matter and a high capacity to store and release plant nutrients. Soils that have a lower content of clay or organic matter, such as Chili and Rigley soils, have a reduced capacity to store and release nutrients and lose more nutrients through leaching. On these soils frequent applications of a small amount of fertilizer reduce the amount of nutrients lost through leaching.

On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Organic matter influences many soil properties, including color, structure, tilth, water infiltration, available water capacity, and cation-exchange capacity. In the light colored mineral soils in Licking County, the organic matter content in the surface layer generally is moderate in uneroded areas and low in eroded areas. It generally is high in the dark mineral soils in the county. Cultivation tends to lower the organic matter content by increasing the rates of oxidation and erosion on sloping soils. Returning all crop residue to the soil helps to maintain the organic matter content. Cover crops, sod crops, green manure crops, and additions of barnyard manure increase the organic matter content.

Sewage sludge can have economic value as a source of organic matter and some plant nutrients. If the sludge is applied to land, management concerns include the application rate, the hazards associated with heavy metals, and possible odor problems and health hazards. The chemical composition of the sludge should be determined before its application on land. Additions of sludge to cropland should be based on analysis of the sludge, the results of soil tests, and the expected level of yields. The Cooperative Extension Service can provide information about the application of sewage sludge.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. Maintaining tilth is a management concern on many of the soils in Licking County.

Most of the soils used for crops in the county have a surface layer of silt loam that is light in color and moderate or low in content of organic matter. Generally, the structure of these soils is relatively weak. During periods of heavy rainfall, a crust forms on the bare surface. The crust is hard when dry. It reduces the rate of water infiltration and impedes the movement of air. It retards seedling emergence and increases the runoff rate. Regular applications of crop residue, manure, and other organic material can improve soil structure and minimize crusting. A system of conservation tillage, including no-till planting, that leaves crop residue on the surface improves tilth by minimizing crusting and improving soil structure. If a conventional tillage system is used, shallow cultivation breaks up the crust.

Fall plowing is generally not a good practice on light colored soils that have a surface layer of silt loam because of the formation of a crust during winter and spring. If plowed in the fall, many soils are nearly as dense and hard at planting time as they were before they were plowed. Also, about half of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall.

In many sloping areas, tilling and preparing a good seedbed are difficult because erosion has removed part of the original surface layer and tillage has mixed subsoil material that has a higher content of clay into the present surface layer.

The dark Luray, Pewamo, and Westland soils have a high content of clay. Poor tilth is a problem because these soils often stay wet until late in spring. If plowed when wet, the soils tend to be very compacted and cloddy when dry. Thus, preparing a good seedbed is difficult. Fall plowing generally results in good tilth in spring.

Droughtiness is a major management concern on some soils in Licking County. The more droughty soils, such as Hazleton and Rigley soils, are used mainly as woodland. Occasional shortages of available moisture occur on many of the soils used for crops, hay, or pasture. These shortages are most common on Chili, Fox, Stonelick, and Tioga soils and on soils that have a restricted root zone, such as Homewood and Cincinnati soils.

Many of the soils in which moisture shortages occur are well suited to a system of conservation tillage, such as no-till planting, that leaves crop residue on the surface. The crop residue increases the moisture supply by increasing the rate of water infiltration and by reducing runoff and evaporation rates.

Nearly one-fourth of the acreage in the county is used as pasture. The more common pasture and hay plants are alfalfa, red clover, alsike clover, bluegrass, orchardgrass, tall fescue, timothy, and bromegrass.

The ability of a pasture to produce forage and to provide enough cover to control erosion is influenced by the number of livestock, the length of the period of grazing, the timeliness of grazing, the forage being grazed, and the availability of water. Good management measures, such as proper stocking rates, pasture rotation, timely deferment of grazing, applications of lime and fertilizer, and control of weeds and insects, help to maintain the key forage plants. Applying herbicides and mowing help to control weeds. The need for lime and fertilizer should be determined by the results of soil tests. The amount to be applied should be based on the requirements of the grasses or legumes to be grown.

Erosion control is a major management need on gently sloping to very steep soils because the hazard of erosion increases as the slope increases. Many of these soils are already eroded. Control of erosion is particularly important when the pasture is seeded. Using a no-till seeding method or growing small grain as a companion crop can help to control further erosion.

Soil compaction is caused by overgrazing or grazing when the soils are wet. It can greatly reduce the vigor of pasture plants. Also, it can increase the runoff rate and the hazard of erosion on sloping soils. Deferment of grazing during wet periods minimizes compaction. Subsurface drains can be effective in removing excess water from pastured areas.

Seeding mixtures should be selected on the basis of soil type and the desired management system. Legumes increase the nutrient value of the forage and provide nitrogen for the growth of grasses. Alfalfa should be seeded on well drained soils that have adequate levels of plant nutrients and lime. The wetter soils are better suited to alsike clover than to red clover. Information about seeding mixtures, herbicide treatment, and other management measures for specific soils can be obtained from local offices of the Soil Conservation Service and the Cooperative Extension Service.

The specialty crops grown commercially in Licking County include vegetables, nursery stock, Christmas trees, and fruits. A small acreage throughout the county is used for melons, strawberries, raspberries, popcorn, sweet corn, tomatoes, other vegetables, and small fruits. Potatoes are grown commercially on a small acreage in the central part of the county. Apples and peaches are the most important tree fruits grown in the county.

Large areas in the county are suited to specialty crops, such as tomatoes and other vegetables. Celery, onions, lettuce, and other truck crops could be grown on organic soils that are adequately drained. Most of the well drained soils are suitable for orchards and nursery plants. In the higher areas on the landscape where cold air drainage is good, frost is less likely to damage orchards. Soils in low positions where frost is frequent generally are less well suited to early vegetables, small fruits, and orchards.

The latest information about growing specialty crops can be obtained from local offices of the Soil Conservation Service and the Cooperative Extension Service.

Yields Per Acre

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

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the 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 *(21)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry. In class I there are no subclasses because the soils of this class have few limitations.

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

Woodland Management and Productivity

R.A. Cappell, service forester, Ohio Department of Natural Resources, Division of Forestry, helped prepare this section.

Woodland is an important land use in Licking County. About 97,000 acres in the county, or 22 percent of the total acreage, is woodland *(24)*. About 73,400 acres, or about 75 percent of the woodland, is in land capability class III, IV, VI, or VII. The most extensive areas of woodland are in the eastern part of the county. The wooded acreage consists mainly of privately owned stands of timber and farm woodlots. The State of Ohio owns several wooded tracts, including Black Hand Gorge State Preserve and Flint Ridge State Memorial. In many areas farmland that has been poorly managed is idle and is reverting to woodland.

The woodland occurs mainly as areas of mixed hardwoods. The major forest types are beech-maple in the western half of the county; mixed mesophytic in the northeast corner; and oak-hickory in the southeast corner. The elm-ash forest type is in scattered areas throughout the western part of the county. Of the total acreage of woodland, about 7,000 acres is pine, 56,000 acres is oaks, 7,000 acres is elm and ash, and 27,000 acres is northern hardwoods *(6)*.

The scattered woodlots in the western half of the county are typically small and are on short slopes along narrow stream valleys, on narrow flood plains, and in undrained areas on uplands. Most of the woodland in the eastern half of the county occurs as areas of moderately steep to very steep soils on hillsides and sloping soils on some ridgetops. Christmas trees are grown on farms throughout the county.

Many woodlots in the county have been poorly managed. Heavy selective cutting without planning for future timber crops has resulted in stands of overly mature and cull trees. High grading has continually removed the best trees and left cull trees and trees of low value to occupy valuable growing space. In many areas grazing livestock have destroyed the leaf litter and desirable young trees, damaged roots, and compacted the soil. In some areas forest fires have damaged large trees, interfered with natural seeding, and destroyed the leaf litter, which increases the supply of moisture and protects the soil against erosion.

If properly managed, the woodland can be restored to a high level of production. Good management includes measures that protect the woodland from fire and from grazing by livestock, timber stand improvement, prescribed marking, and appropriate harvesting techniques. Measures that improve the timber stands, including culling diseased and less desirable trees and cutting or spraying grapevines, increase the growth rate of valuable trees and shorten the rotation time considerably. On soils that have a high water table, the trees should be harvested during the drier periods or when the ground is frozen.

Seedling survival in newly planted areas is affected by the vigor of the planting stock, the adequacy of site preparation, applications of fertilizer, and control of competing weeds. The trees selected for planting should be those that are vigorous and are suited to the soil. Applying the necessary cultural measures after planting increases the growth rate. Competing vegetation can be controlled by disking, mowing, spraying, mulching, girdling, and cutting. The most valuable trees can be reestablished in intensively managed areas where the soils are well suited to hardwoods. Pine can be grown on soils that are poorly suited to hardwoods or in areas that are not constantly managed.

Productivity of woodland varies widely from soil to soil. The factors influencing tree growth include internal drainage, soil reaction, texture, depth, natural fertility, available water capacity, slope, aspect, and position on the landscape. Other factors include radiation, precipitation, and the movement of air *(22)*.

Aspect is the direction a slope faces. Trees grow best on north and east aspects because of less exposure to the prevailing wind and the sun and because of more abundant soil moisture. South and west aspects are less well suited to woodland because of a higher soil temperature and evaporation rate and earlier snowmelt. North aspects have an azimuth of 355 to 95 degrees, and south aspects have an azimuth of 96 to 354 degrees *(4)*.

The position of soils on long side slopes influences the amount of moisture available for tree growth. The soils in the lower positions generally receive more moisture than those in the higher positions because of downslope runoff and seepage.

The hazard of erosion and the use of equipment are influenced by the slope. As the percentage of slope increases, the runoff rate and the hazard of erosion also increase. Erosion reduces the depth of the soil and thus the amount of available water. Severe erosion commonly exposes the less porous subsoil, thus increasing the runoff rate and lowering the rate of water infiltration. The increased runoff rate and lower infiltration rate hinder tree growth and natural reseeding. Erosion can be controlled by building logging roads and skid trails on the contour and by establishing water bars where needed.

Additional information about woodland management can be obtained from the local offices of the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Forestry.

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

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 30, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for 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 ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from a commercial nursery or from local offices of the Soil Conservation Service; the Ohio Department of Natural Resources, Division of Forestry; and the Cooperative Extension Service.

Recreation

Licking County has many recreational areas, including Black Hand Gorge State Preserve, Dawes Arboretum, Flint Ridge State Memorial, Moundbuilders and Octagon Earthworks State Memorials, Buckeye Lake, and Camp Ohio, a 4-H camp, in the northeastern part of the county. These areas provide opportunities for fishing, swimming, boating, picnicking, camping, and hiking.

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 sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for 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

In Licking County a wide variety of wildlife is supported by diverse habitats, including cropland, openland, woodland, swamps, and ponds. Some of the birds that inhabit the county are mourning dove, ruffed grouse, red-tailed hawk, crow, owl, pileated woodpecker, pheasant, and songbirds. Some wild turkeys have been released in the eastern part of the county. Ducks, geese, and blue herons inhabit scattered wetlands and ponds. Some of the mammals inhabiting the county are rabbit, squirrel, woodchuck, deer, raccoon, and fox.

In the western part of the county, cottontail rabbit, bobwhite quail, and ring-necked pheasant were once the most abundant openland game species. The populations of these species have decreased greatly because the removal of fencerows and fall plowing have reduced the extent of their habitat and the supply of winter food. Many areas in the eastern part of the county provide habitat for woodland wildlife. Squirrel, ruffed grouse, and deer are plentiful in these areas.

If properly managed, the soils in the county can provide food and shelter for wildlife. Incorporating openland, wetland, and woodland wildlife habitat into a single area attracts the greatest variety of wildlife species to the area.

Habitat for wetland wildlife can be developed in undrained depressions on uplands and in old stream meanders on flood plains. Ponds also can be used as habitat for wetland wildlife. Special plantings help to attract waterfowl.

Habitat for openland wildlife can be developed in eroded areas by planting mixtures of meadow plants and shrubs that provide food, shelter, and nesting areas. Mowing meadows after the nesting season ensures higher survival rates. A good plant cover helps to control erosion.

Woodlots can be improved as habitat for woodland wildlife by maintaining den trees and trees that produce nuts or berries. If managed properly, cropland can be a major source of food for wildlife.

Additional information about improving wildlife habitat can be obtained from the local offices of the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Wildlife.

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, soybeans, 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 fall panicum.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, beech, maple, hawthorn, dogwood, hickory, blackberry, and spicebush.

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, hemlock, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are duckweed, wild millet, cattail, willow, 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. 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 white-tailed 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, muskrat, mink, and beaver.

Engineering

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

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

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

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

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

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Gordon C. Postle, district program administrator, Licking County Soil and Water Conservation District, helped prepare this section.

More than 33,000 acres in Licking County was used for urban development in 1982 *(24)*. Since then, an additional acreage of farmland has been converted to urban uses, especially in the western and central parts of the county. Many soil properties, such as depth to the seasonal high water table, slope, permeability, and depth to bedrock, can limit urban development. Wet basements, improper functioning of onsite sewage disposal systems, erosion on construction sites, and flooding are problems if soil features are ignored.

Erosion is a hazard on sloping soils during construction. This hazard increases as slope increases and the plant cover is removed. The hazards of runoff and erosion can be reduced by maintaining a plant cover wherever possible during construction.

Properly landscaping building sites and septic tank absorption fields helps to keep surface water away from foundations and absorption fields. An evaluation of the water supply on rural building sites and of the adequacy of outlets for foundation and basement drains and for perimeter drains around septic tank absorption fields is needed before construction.

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, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

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

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

Sanitary Facilities

Table 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 resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation 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 to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils 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 high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; 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. Availability of drainage outlets is not considered in the ratings.

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

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

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

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

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

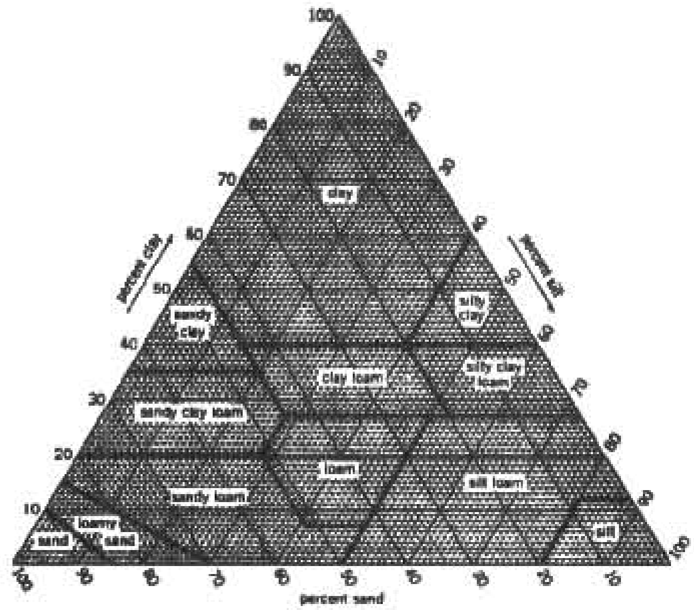


Figure 18.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 18). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

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

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested is given in table 19.

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

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

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

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to 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 ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

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

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather 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.

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.

One area that is subject to controlled inundation is upstream from the Dillon Lake flood-control structure in the valley of the Licking River in the eastern part of the county. The area of the flood pool is shown on the soil map. During periods of high rainfall and runoff, water is impounded behind the structure, resulting in the possibility of local flooding.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

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

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

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Many of the soils in Licking County were sampled and analyzed by the Soil Characterization Laboratory, Department of Agronomy, Ohio State University, Columbus, Ohio. The physical and chemical data obtained from most of the samples include particle-size distribution, reaction, organic matter content, calcium carbonate equivalent, and extractable cations. These data were used in classifying the soils and evaluating their behavior under various land uses.

Nine pedons selected as representative of their respective series were sampled for analysis. They are described in the section "Soil Series and Their Morphology." These series and their laboratory identification numbers are Amanda series (LC-32), Bennington series (LC-23), Brownsville series (LC-27), Centerburg series (LC-22), Clarksburg series (LC-31), Coshocton series (LC-26), Medway series (LC-29), Mertz series (LC-28), and Pewamo series (LC-30).

In addition to the data from Licking County, laboratory data also are available from nearby counties that have many of the same soils. These data and the data from Licking County are on file at the Soil Characterization Laboratory, Department of Agronomy, Ohio State University; the Ohio Department of Natural Resources, Division of Soil and Water Conservation; and the State Office of the Soil Conservation Service, Columbus, Ohio.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Ohio Department of Transportation, Division of Highways, Bureau of Testing, Soils and Foundation Section.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(23)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aqualf (*Aqu*, meaning water, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraqualfs (*Ochr*, meaning light colored surface layer, plus *aqualf*, the suborder of the Alfisols that has an aquic 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 Ochraqualfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, illitic, mesic Typic Ochraqualfs.

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" *(20)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(23)*. 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."

Alford Series

The Alford series consists of deep, well drained, moderately permeable soils on high Illinoian outwash terraces and on uplands. These soils formed in 5 to 12 feet of Wisconsinan loess. The loess overlies outwash on terraces and till or residuum on uplands. Slopes range from 0 to 12 percent.

Alford soils are similar to Mentor and Parke soils and are commonly adjacent to Brownsville, Cincinnati, and Parke soils. Brownsville soils have a higher content of coarse fragments throughout than the Alford soils. They are on hillsides and ridgetops, commonly at the higher elevations. Cincinnati soils have a fragipan. They are on side slopes and ridgetops. Mentor soils have bedding planes in the lower part. Parke soils have more sand in the lower part than the Alford soils. They are on terrace breaks.

Typical pedon of Alford silt loam, 2 to 6 percent slopes, about 3 miles northeast of Newark; in Madison Township; about 1,440 yards north and 1,610 yards west of the southeast corner of quarter township 2, T. 2 N., R. 11 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common medium and many fine roots; strongly acid; abrupt smooth boundary.

BE—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure parting to weak fine granular; friable; few medium and common fine roots; common faint yellowish brown (10YR 5/4) silt coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—13 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few medium and fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; few distinct black (10YR 2/1) stains (iron and manganese oxide) on faces of peds; strongly acid; clear wavy boundary.

Bt2—20 to 30 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few medium and fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct black (10YR 2/1) stains (iron and manganese oxide) on faces of peds; strongly acid; gradual wavy boundary.

BC—30 to 48 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate thick platy structure parting to weak fine subangular blocky; friable; few fine roots; very few faint dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; few distinct black (10YR 2/1) stains (iron and manganese oxide) on vertical faces of peds; strongly acid; gradual wavy boundary.

C—48 to 60 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light yellowish brown (10YR 6/4) mottles; weak thick platy structure; friable; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The Ap horizon has 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. It is silt loam or silty clay loam. The C horizon has hue of 7.5YR or 10YR and chroma of 4 to 6.

Algiers Series

The Algiers series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in recent alluvium 20 to 36 inches deep over a very poorly drained buried mineral soil. Slopes are 0 to 2 percent.

Algiers soils are similar to Killbuck soils and are commonly adjacent to Luray, Shoals, Sloan, and Wallkill soils. Killbuck soils are poorly drained. Luray and Sloan soils have a mollic epipedon. Luray soils are on broad flats on lake plains. Shoals and Sloan soils formed entirely in alluvium on flood plains. Wallkill soils formed in recent alluvium over a buried organic soil. They are in depressions.

Typical pedon of Algiers silt loam, frequently flooded, about 1 mile southwest of Luray; in Union Township; about 815 yards south and 610 yards west of the northeast corner of sec. 8, T. 17 N., R. 18 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate fine granular structure; friable; common fine roots; about 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

C—10 to 28 inches; brown (10YR 4/3) silt loam; common medium faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; few fine roots; about 1 percent coarse fragments; slightly acid; clear wavy boundary.

2Ab—28 to 44 inches; very dark gray (10YR 3/1) silty clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; about 2 percent coarse fragments; slightly acid; clear wavy boundary.

2Btgb1—44 to 51 inches; dark gray (10YR 4/1) silty clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint very dark gray (10YR 3/1) clay films on faces of peds; about 2 percent coarse fragments; slightly acid; clear wavy boundary.

2Btgb2—51 to 60 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; few faint very dark gray (10YR 3/1) clay films on faces of peds; about 2 percent coarse fragments; slightly acid.

The thickness of the recent alluvium ranges from 20 to 36 inches. The content of coarse fragments is 0 to 5 percent in the Ap and C horizons and 0 to 15 percent in the 2Ab and 2Btgb horizons.

The Ap and C horizons have chroma of 2 or 3. In some pedons the C horizon is mottled below a depth of 20 inches. It is typically silt loam but is loam in some pedons. The 2Ab horizon has value of 2 or 3. It is silt loam or silty clay loam. The 2Btgb horizon has value of 4 or 5 and chroma of 1 or 2. It is commonly silty clay loam but is loam, clay loam, or silty clay in some pedons. Some pedons have a 2C horizon. This horizon is typically silty clay loam but in some pedons is clay loam, loam, or the gravelly analogs of those textures.

Amanda Series

The Amanda series consists of deep, well drained, moderately slowly permeable soils formed in calcareous Wisconsinan glacial till. These soils are mainly on end moraines and the dissected parts of ground moraines. In a few areas, however, they are on kames. Slopes range from 2 to 40 percent.

Amanda soils are similar to Centerburg and Hickory soils and are commonly adjacent to Bennington and Centerburg soils. Bennington soils are somewhat poorly drained, and Centerburg soils are moderately well drained. Bennington soils are on flats, slight rises, and low knolls. Centerburg soils are on knolls, on ridges, and on side slopes in dissected areas. Hickory soils have a higher content of igneous fragments and fewer sandstone fragments throughout the solum than the Amanda soils.

Typical pedon of Amanda silt loam, 6 to 12 percent slopes, eroded, about 1.3 miles southwest of Utica; in Washington Township; about 650 yards north and 270 yards east of the southwest corner of quarter township 2, T. 4 N., R. 12 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; common fine roots; about 10 percent yellowish brown (10YR 5/6) subsoil material; about 5 percent coarse fragments; medium acid; abrupt smooth boundary.

Bt1—6 to 14 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct brown (10YR 4/3) organic coatings in old root channels; about 5 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—14 to 21 inches; yellowish brown (10YR 5/6) clay loam; moderate fine subangular blocky structure; firm; few fine roots; many distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt3—21 to 28 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; many distinct yellowish brown (10YR 5/6) clay films on faces of peds; few fine yellowish red (5YR 5/8) stains (iron and manganese oxide); about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt4—28 to 35 inches; yellowish brown (10YR 5/4) clay loam; common medium faint pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; firm; few fine roots; many distinct pale brown (10YR 6/3) clay films on faces of peds; few fine yellowish red (5YR 5/8) stains (iron and manganese oxide); about 10 percent coarse fragments; medium acid; clear smooth boundary.

BC—35 to 45 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; firm; about 10 percent coarse fragments; few fine yellowish red (5YR 5/8) stains (iron and manganese oxide); slightly acid; clear wavy boundary.

C—45 to 60 inches; dark yellowish brown (10YR 4/4) loam; massive; firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. The content of coarse fragments ranges from 0 to 10 percent in the upper part of the solum, from 2 to 15 percent in the lower part, and from 5 to 15 percent in the C horizon. These are dominantly sandstone fragments, but some are crystalline rock fragments and some limestone and shale fragments are in the C horizon.

The Ap horizon has chroma of 2 to 4. Some pedons have an A horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam or loam, but many pedons have subhorizons of silty clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is dominantly loam but is silt loam in some pedons.

Amanda Variant

The Amanda Variant consists of deep, well drained, moderately permeable soils on foot slopes. These soils formed in silty colluvium and the underlying glacial drift. Slopes range from 6 to 18 percent.

Amanda Variant soils are commonly adjacent to Brownsville, Fitchville, and Glenford soils. Brownsville soils have a higher content of coarse fragments throughout than the Amanda Variant soils. They are on hillsides and ridgetops. The somewhat poorly drained Fitchville and moderately well drained Glenford soils are on flats and low knolls on terraces and lake plains.

Typical pedon of Amanda Variant silt loam, 12 to 18 percent slopes, eroded, about 3.5 miles northwest of Newark; in Newark Township; 980 yards north and 1,980 yards east of the southwest corner of quarter township 2, T. 2 N., R. 12 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and few medium roots; specks of Bt1 material; medium acid; abrupt smooth boundary.

Bt1—7 to 15 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct strong brown (7.5YR 5/6) clay films on horizontal and vertical faces of peds; brown (10YR 4/3) coatings along old root channels; medium acid; clear smooth boundary.

Bt2—15 to 24 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct strong brown (7.5YR 5/6) clay films on horizontal and vertical faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

Bt3—24 to 34 inches; brown (7.5YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films on horizontal and vertical faces of peds; strongly acid; clear smooth boundary.

Bt4—34 to 42 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films on horizontal and vertical faces of peds; strongly acid; clear smooth boundary.

Bt5—42 to 53 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films on horizontal and vertical faces of peds; medium acid; clear wavy boundary.

2Bt6—53 to 60 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few faint strong brown (7.5YR 5/6) clay films on vertical faces of peds; about 12 percent coarse fragments; medium acid; clear wavy boundary.

2C—60 to 80 inches; yellowish brown (10YR 5/4) loam; massive; firm; about 10 percent coarse fragments; slightly acid.

The thickness of the solum ranges from 45 to 70 inches. The thickness of the silty mantle ranges from 20 to 60 inches. The content of coarse fragments ranges from 0 to 5 percent in the A horizon, from 0 to 10 percent in the Bt horizon, from 5 to 20 percent in the 2Bt horizon, and from 5 to 15 percent in the 2C horizon. These are dominantly fine grained sandstone and siltstone fragments, but the 2C horizon also has crystalline pebbles and shale and limestone fragments.

The Ap horizon has chroma of 2 or 3. The Bt horizon is dominantly silt loam but is silty clay loam in some pedons. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, silt loam, clay loam, or the gravelly analogs of those textures. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is dominantly loam but is silt loam in some pedons.

Bennington Series

The Bennington series consists of deep, somewhat poorly drained, slowly permeable soils formed in calcareous Wisconsinan glacial till on flats, low knolls, and low rises on till plains. Slopes range from 0 to 6 percent.

Bennington soils are similar to Condit soils and are commonly adjacent to Amanda, Centerburg, Condit, and Pewamo soils. The well drained Amanda and moderately well drained Centerburg soils are on knolls, ridges, and dissected side slopes. The poorly drained Condit soils are in slight depressions. Pewamo soils have a mollic epipedon. They are on flats and in depressions.

Typical pedon of Bennington silt loam, 2 to 6 percent slopes, about 3.2 miles northwest of Jersey; in Jersey Township; about 220 yards south and 770 yards east of the northwest corner of sec. 15, T. 2 N., R. 15 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak medium granular structure; very friable; many fine roots; about 3 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; common fine roots; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; about 3 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 6/1) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; few faint grayish brown (10YR 5/2) clay films on faces of peds; many distinct light brownish gray (10YR 6/2) coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 3 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—18 to 24 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 5/1) and light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very firm; few fine roots; common distinct grayish brown (10YR 5/2) and dark gray (10YR 4/1) clay films on faces of peds; many distinct grayish brown (10YR 5/2) coatings on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; slightly acid; clear wavy boundary.

Bt3—24 to 29 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct gray (10YR 5/1) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; very firm; few fine roots; common distinct grayish brown (10YR 5/2) clay films on faces of peds; many distinct grayish brown (10YR 5/2) coatings on faces of peds; about 10 percent coarse fragments; neutral; clear wavy boundary.

BC—29 to 34 inches; dark yellowish brown (10YR 4/4) loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) coatings on faces of peds; common fine prominent light gray (10YR 7/2) weathered limestone fragments; about 10 percent coarse fragments; slight effervescence in spots; mildly alkaline; clear wavy boundary.

C1—34 to 39 inches; brown (10YR 4/3) loam; common coarse distinct gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; few fine prominent light gray (10YR 7/2) weathered limestone fragments; about 10 percent coarse fragments; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—39 to 80 inches; brown (10YR 4/3) loam; common medium distinct gray (10YR 5/1) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 28 to 48 inches. The depth to carbonates ranges from 26 to 46 inches. The content of coarse fragments ranges from 0 to 5 percent in the upper part of the solum, from 2 to 10 percent in the lower part, and from 3 to 15 percent in the C horizon.

The Ap horizon has chroma of 1 or 2. The Bt horizon generally has chroma of 3 to 6. In some pedons, however, it has a dominant chroma of 2 within a depth of 30 inches. It is dominantly silty clay loam or clay loam, but some pedons have subhorizons of silty clay. The C horizon has value of 4 or 5 and chroma of 1 to 4. It is dominantly loam but is clay loam or silty clay loam in some pedons.

Berks Series

The Berks series consists of moderately deep, well drained, moderately permeable or moderately rapidly permeable soils, mainly on unglaciated ridgetops and hillsides. These soils formed in material weathered from shale, siltstone, and fine grained sandstone. Slopes range from 2 to 18 percent.

Berks soils are similar to Brownsville soils and are commonly adjacent to Brownsville, Coshocton, and Rigley soils. Brownsville soils are deep over bedrock. They are commonly on the steeper part of hillsides below the Berks soils on ridgetops. Coshocton soils are moderately well drained. Rigley soils have more sand throughout than the Berks soils. Coshocton and Rigley soils are on hillsides and ridgetops.

Typical pedon of Berks channery silt loam, 2 to 6 percent slopes, about 2.8 miles northeast of Jacksontown; in Licking Township; 140 yards south and 530 yards west of the northeast corner of quarter township 4, T. 1 N., R. 12 W.

Ap—0 to 7 inches; brown (10YR 4/3) channery silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; about 25 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bw—7 to 15 inches; yellowish brown (10YR 5/4) very channery silt loam; weak medium subangular blocky structure; friable; common fine roots; about 55 percent coarse fragments; medium acid; clear smooth boundary.

BC—15 to 25 inches; yellowish brown (10YR 5/4) extremely channery silt loam; weak medium subangular blocky structure; friable; few fine roots; about 75 percent coarse fragments; medium acid; gradual smooth boundary.

R—25 to 30 inches; yellowish brown (10YR 5/4) thinly bedded, rippable fine grained sandstone.

The thickness of the solum ranges from 18 to 40 inches. The depth to bedrock ranges from 20 to 40 inches. The bedrock is commonly fractured siltstone, fine grained sandstone, or shale. The content of coarse fragments ranges from 10 to 50 percent in the Ap horizon and from 15 to 75 percent in individual subhorizons of the B horizon. These are angular siltstone, fine grained sandstone, and shale fragments.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. It is typically channery silt loam but is very channery silt loam or silt loam in some pedons. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. In the fine-earth fraction, it is typically silt loam but is loam or silty clay loam in some pedons. Some pedons have a C horizon. This horizon is very channery, extremely channery, very shaly, or extremely shaly silt loam or loam. The content of coarse fragments in this horizon ranges from 35 to 90 percent.

Brownsville Series

The Brownsville series consists of deep, well drained, moderately permeable or moderately rapidly permeable soils formed in colluvium and material weathered from siltstone and fine grained sandstone. These soils are commonly on the tops and sides of prominent unglaciated hills. Slopes range from 6 to 70 percent.

Brownsville soils are similar to Berks and Hazleton soils and are commonly adjacent to Clarksburg, Coshocton, and Orrville soils. Berks soils are moderately deep over bedrock. Clarksburg, Coshocton, and Orrville soils have a lower content of coarse fragments in the subsoil than the Brownsville soils. Clarksburg soils are on colluvial foot slopes at the lower elevations. Coshocton soils are generally on hillsides and ridgetops at the higher elevations. Orrville soils are on flood plains. Hazleton soils have more sand throughout than the Brownsville soils.

Typical pedon of Brownsville channery silt loam, 18 to 25 percent slopes, about 4.5 miles north of Brownsville; in Hopewell Township; about 1,440 yards south and 2,970 yards east of the northwest corner of quarter township 2, T. 1 N., R. 10 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) channery silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; many fine, common medium, and few coarse roots; about 20 percent coarse fragments; very strongly acid; abrupt smooth boundary.

E—2 to 6 inches; brown (10YR 4/3) channery silt loam, pale brown (10YR 6/3) dry; moderate medium platy structure parting to moderate fine granular; friable; common fine and few medium and coarse roots; about 20 percent coarse fragments; very strongly acid; clear smooth boundary.

Bw1—6 to 19 inches; yellowish brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; friable; common fine roots; about 30 percent coarse fragments; strongly acid; clear smooth boundary.

Bw2—19 to 30 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films in old root channels; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

Bw3—30 to 41 inches; yellowish brown (10YR 5/4) very channery loam; weak fine subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films in old root channels; about 55 percent coarse fragments; strongly acid; clear smooth boundary.

C—41 to 51 inches; yellowish brown (10YR 5/4) very channery silt loam; few fine distinct gray (N 6/0) and strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; about 40 percent coarse fragments; medium acid; abrupt smooth boundary.

R—51 to 53 inches; yellowish brown (10YR 5/4), fractured, hard siltstone bedrock; intervals of 4 to 10 inches between fractures; cannot be dug with a spade but can be chipped with a spud bar.

The thickness of the solum ranges from 24 to 55 inches. The depth to bedrock ranges from 40 to 72 inches. The content of coarse fragments ranges from 5 to 35 percent in the A horizon, from 15 to 70 percent in individual subhorizons of the B horizon, and from 30 to 90 percent in the C horizon. These are angular siltstone or fine grained sandstone fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly the channery, flaggy, very channery, or extremely channery analogs of silt loam or loam, but some pedons have subhorizons with silty clay loam in the fine-earth fraction. The C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is the channery, very channery, extremely channery, flaggy, very flaggy, or extremely flaggy analogs of silt loam or loam. The R horizon is commonly fractured siltstone or fine grained sandstone bedrock.

Carlisle Series

The Carlisle series consists of deep, very poorly drained, moderately slowly permeable to moderately rapidly permeable soils formed in organic material that accumulated in topographically depressed kettle holes and swampy areas. These soils are on Wisconsinan lake plains, outwash terraces, and till plains. Slopes are 0 to 2 percent.

Carlisle soils are commonly adjacent to the mineral Luray, Ockley, Wallkill, and Westland soils. Luray and Westland soils are on wide, low flats and in depressions on lake plains and terraces along streams. Ockley soils are on flats, slight rises, knolls, and dissected side slopes on outwash terraces. Wallkill soils are in depressions on flood plains. Westland soils are on flats and in depressions on outwash terraces.

Typical pedon of Carlisle muck, about 3.2 miles southeast of Utica; in Washington Township; about 730 yards south and 1,700 yards east of the northwest corner of quarter township 4, T. 4 N., R. 12 W.

Op—0 to 10 inches; sapric material, black (10YR 2/1) broken face and rubbed, very dark grayish brown (10YR 3/2) dry; about 5 percent fiber, less than 2 percent rubbed; weak medium granular structure; very friable; common medium roots; medium acid; abrupt smooth boundary.

Oa1—10 to 18 inches; sapric material, dark reddish brown (5YR 2/2) broken face and rubbed; about 10 percent fiber, less than 2 percent rubbed; weak medium granular structure; very friable; few fine roots; few woody fragments; medium acid; clear smooth boundary.

Oa2—18 to 36 inches; sapric material, dark reddish brown (5YR 3/2) broken face, dark reddish brown (5YR 2/2) rubbed; about 45 percent fiber, 10 percent rubbed; weak thick platy structure; very friable; medium acid; abrupt smooth boundary.

Oa3—36 to 60 inches; sapric material, dark reddish brown (5YR 3/3) broken face, dark reddish brown (5YR 2/2) rubbed; about 5 percent fiber, less than 2 percent rubbed; weak thick platy structure; very friable; slightly acid.

The organic material is more than 51 inches thick. It is dominantly sapric, but thin layers of hemic material are in some pedons. The surface tier has hue of 5YR to 10YR or is neutral in hue. It has chroma of 0 to 2. Hue of 10YR is typical in the upper part, and hue of 5YR or 7.5YR is common in the lower part. The subsurface tier has hue of 5YR to 10YR or is neutral in hue. It has chroma of 0 to 3. Woody fragments are common in this tier. The bottom tier has hue of 5YR to 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The redder hues of the less decomposed material commonly become darker when the material is briefly exposed to air.

Centerburg Series

The Centerburg series consists of deep, moderately well drained, moderately slowly permeable soils formed in calcareous Wisconsinan glacial till that in places has a thin mantle of loess. These soils are on till plains. Slopes range from 2 to 12 percent.

Centerburg soils are similar to Amanda and Hickory soils and are commonly adjacent to Amanda, Bennington, and Pewamo soils. The well drained Amanda and Hickory soils are on knolls, ridges, and dissected side slopes. Bennington soils are somewhat poorly drained and are on flats and low knolls. Pewamo soils are very poorly drained and are in depressions, in swales, and on flats.

Typical pedon of Centerburg silt loam, 2 to 6 percent slopes, about 1 mile north-northeast of Alexandria; in St. Albans Township; about 1,890 yards south and 1,370 yards east of the northwest corner of quarter township 1, T. 2 N., R. 14 W.

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

Bt1—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; few faint brown (10YR 5/3) clay films and silt coatings on faces of peds; few fine roots; about 2 percent coarse fragments; strongly acid; abrupt wavy boundary.

Bt2—12 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films and silt coatings on faces of peds; about 4 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—16 to 23 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; many faint yellowish brown (10YR 5/4) clay films on faces of peds; common faint brown (10YR 5/3) silt coatings on faces of peds; about 3 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—23 to 29 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent coarse fragments; medium acid; gradual wavy boundary.

BC—29 to 35 inches; dark yellowish brown (10YR 4/4) clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine prominent black (10YR 2/1) stains (iron and manganese oxide); about 2 percent coarse fragments; mildly alkaline; clear wavy boundary.

C1—35 to 40 inches; brown (10YR 4/3) loam; common fine and medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; few fine prominent white (10YR 8/2) limestone remnants; about 8 percent coarse fragments; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—40 to 80 inches; brown (10YR 4/3) loam; common medium distinct gray (10YR 5/1), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6) mottles; massive; firm; about 8 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 28 to 55 inches. The depth to carbonates ranges from 26 to 55 inches. The content of coarse fragments ranges from 0 to 10 percent in the Ap horizon and the upper part of the Bt horizon, from 2 to 15 percent in the lower part of the Bt horizon, and from 3 to 15 percent in the C horizon. These are mostly sandstone fragments, but some are igneous pebbles and some are limestone fragments. Also, shale fragments are in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. Value of 5 and chroma of 4 are commonly in eroded pedons. The Bt horizon has chroma of 3 to 6. It is silty clay loam, silt loam, or clay loam in the upper part and clay loam or loam in the lower part. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is dominantly loam but is silt loam in some pedons.

Chili Series

The Chili series consists of deep, well drained, moderately rapidly permeable soils formed in glacial outwash low in content of lime. These soils are on Wisconsinan outwash terraces and kames. Slopes range from 0 to 18 percent.

Chili soils are similar to Fox and Negley soils and are commonly adjacent to Brownsville, Mentor, and Tioga soils. Brownsville soils have a higher content of coarse fragments throughout the solum than the Chili soils. They are on hillsides and ridgetops at the higher elevations. Fox soils have a solum that is thinner than that of the Chili soils. They are on slope breaks. Mentor soils have a lower content of sand throughout the solum than the Chili soils. They are on low rises, knolls, and side slopes. Negley soils have a solum that is thicker than that of the Chili soils. They are on the side slopes of high terraces. Tioga soils do not have an argillic horizon. They are on flood plains.

Typical pedon of Chili loam, 0 to 2 percent slopes, about 0.3 mile east of Toboso; in Hanover Township; 800 yards south and 1,770 yards west of the northeast corner of quarter township 4, T. 2 N., R. 10 W.

Ap—0 to 10 inches; brown (10YR 4/3) loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; friable; common fine roots; about 10 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/6) loam; weak fine subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) silt coatings on faces of peds; about 10 percent coarse fragments; medium acid; clear smooth boundary.

Bt1—14 to 22 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate fine and medium subangular blocky structure; friable; few fine roots; common faint brown (7.5YR 4/4) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—22 to 31 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam; weak medium subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; about 15 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—31 to 40 inches; brown (7.5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear smooth boundary.

BC—40 to 55 inches; brown (7.5YR 4/4) gravelly sandy loam; massive; friable; about 25 percent coarse fragments; medium acid; clear smooth boundary.

C—55 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grained; loose; about 25 percent coarse fragments; medium acid.

The thickness of the solum ranges from 40 to 70 inches. The content of coarse fragments generally varies with increasing depth because of stratification. It ranges from 2 to 15 percent in the A horizon, from 15 to 35 percent in the Bt horizon, and from 25 to 60 percent in the C horizon.

The Ap horizon has chroma of 3 or 4. It is typically loam but is silt loam or gravelly loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is typically the gravelly analogs of sandy clay loam, sandy loam, loam, or clay loam. In some pedons, however, the fine-earth fraction is silt loam within a depth of 24 inches. The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is the gravelly or very gravelly analogs of sand or loamy sand.

Cincinnati Series

The Cincinnati series consists of deep, well drained soils on ridgetops and side slopes on till plains. These soils formed in loess and in the underlying Illinoian glacial till. They have a fragipan. Permeability is moderate above the fragipan and slow or moderately slow in the fragipan. Slopes range from 2 to 12 percent.

Cincinnati soils are similar to Homewood soils and are commonly adjacent to Alford, Coshocton, and Homewood soils. The similar and adjacent soils are in positions on the landscape similar to those of the Cincinnati soils. Alford and Coshocton soils do not have a fragipan. Homewood soils have a higher content of sand and coarse fragments in the upper part than the Cincinnati soils.

Typical pedon of Cincinnati silt loam, 6 to 12 percent slopes, eroded, about 0.8 mile south of Amsterdam; in Bowling Green Township; about 1,260 yards north and 980 yards east of the southwest corner of sec. 11, T. 19 N., R. 17 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; many fine and common medium roots; about 5 percent strong brown (7.5YR 5/6) subsoil material; medium acid; clear smooth boundary.

BE—6 to 10 inches; strong brown (7.5YR 5/6) silt loam; weak fine subangular blocky structure; friable; few fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt1—10 to 15 inches; strong brown (7.5YR 5/6) silt loam; moderate fine subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—15 to 23 inches; strong brown (7.5YR 5/6) silt loam; moderate fine subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few medium distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear wavy boundary.

Bt3—23 to 33 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; many distinct light yellowish brown (10YR 6/4) silt coatings on vertical faces of peds; brown (10YR 5/3) zones of degradation; few medium distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

2Btx1—33 to 41 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm; brittle; few fine roots between prisms; few faint grayish brown (10YR 5/2) clay films on faces of peds; many distinct grayish brown (10YR 5/2) silt coatings on vertical faces of prisms; yellowish brown (10YR 5/6) zones adjacent to silt coatings; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; strongly acid; clear smooth boundary.

2Btx2—41 to 51 inches; yellowish brown (10YR 5/6) clay loam; common medium prominent grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to moderate medium platy; very firm; brittle; few faint grayish brown (10YR 5/2) clay films on faces of peds; many distinct grayish brown (10YR 5/2) silt coatings on vertical faces of prisms; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; strongly acid; clear smooth boundary.

2Bt—51 to 58 inches; yellowish brown (10YR 5/6) clay loam; common medium prominent grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; firm; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; medium acid; clear smooth boundary.

2BC—58 to 87 inches; yellowish brown (10YR 5/4) clay loam; few medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; about 5 percent coarse fragments; medium acid; gradual wavy boundary.

2C—87 to 99 inches; dark yellowish brown (10YR 4/4) loam; massive; firm; about 10 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 60 to 100 inches. The thickness of the loess mantle ranges from

18 to 40 inches. Depth to the fragipan ranges from 18 to 38 inches. The content of coarse fragments ranges from 5 to 15 percent in the part of the solum that weathered in till.

The Ap horizon has 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. It is silt loam or silty clay loam. The 2Btx horizon has hue of 7.5YR or 10YR and value of 4 or 5. It is clay loam, loam, or silty clay loam. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam.

Clarksburg Series

The Clarksburg series consists of deep, moderately well drained soils formed in colluvium derived from fine grained sandstone, siltstone, and shale. In places loess is mixed with the colluvium. These soils are on foot slopes. They have a fragipan. Permeability is moderate above the fragipan and slow or moderately slow in and below the fragipan. Slopes range from 6 to 18 percent.

Clarksburg soils are similar to Homewood and Titusville soils and are commonly adjacent to Brownsville and Mentor soils. The well drained Brownsville soils are on ridgetops and side slopes at the higher elevations. Homewood soils have a lower content of angular coarse fragments in the lower part of the subsoil and in the substratum than the Clarksburg soils. Mentor soils are on terraces. They have a lower content of coarse fragments in the lower part than the Clarksburg soils. Titusville soils have low-chroma mottles in the upper 10 inches of the argillic horizon.

Typical pedon of Clarksburg silt loam, 12 to 18 percent slopes, eroded, about 5.6 miles north of Hanover; in Perry Township; 160 yards north and 470 yards east of the southwest corner of sec. 4, T. 3 N., R. 10 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; common fine roots; about 25 percent yellowish brown (10YR 5/6) subsoil material; many distinct brown (10YR 4/3) organic coatings in old root channels; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

BE—6 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—11 to 17 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—17 to 24 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—24 to 31 inches; yellowish brown (10YR 5/6) silty clay loam; few medium prominent gray (10YR 6/1) and few medium faint yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Btx1—31 to 37 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm; brittle; few fine roots between prism faces; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; many distinct light brownish gray (2.5Y 6/2) silt coatings on vertical prism faces surrounded by yellowish brown (10YR 5/8) zones; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; strongly acid; gradual wavy boundary.

Btx2—37 to 52 inches; yellowish brown (10YR 5/6) channery silty clay loam; common medium prominent gray (10YR 6/1) and common medium faint yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm; brittle; few fine roots between prism faces; common faint brown (10YR 5/3) clay films on vertical faces of peds; many distinct light brownish gray (2.5Y 6/2) silt coatings on vertical prism faces surrounded by yellowish brown (10YR 5/8) zones; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 25 percent coarse fragments; strongly acid; gradual wavy boundary.

BC—52 to 61 inches; yellowish brown (10YR 5/4) channery silty clay loam; common medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure;

firm; few faint light brownish gray (2.5Y 6/2) clay films on vertical faces of peds; many distinct light brownish gray (2.5Y 6/2) silt coatings on vertical faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 30 percent coarse fragments; strongly acid; gradual wavy boundary.

C—61 to 80 inches; yellowish brown (10YR 5/4) channery silt loam; common fine distinct gray (10YR 6/1) and few fine distinct yellowish brown (10YR 5/8) mottles; massive; firm; about 30 percent coarse fragments; medium acid.

The thickness of the solum ranges from 50 to 70 inches. Depth to the fragipan ranges from 24 to 36 inches. The content of coarse fragments ranges from 0 to 15 percent in the A horizon, from 0 to 20 percent in the part of the Bt horizon above the fragipan, from 5 to 30 percent in the Btx horizon, and from 5 to 60 percent in the C horizon. These are fine grained sandstone or siltstone fragments.

The Ap horizon has value of 4 or 5. The A horizon is typically silt loam but is channery silt loam in some pedons. The Bt and Btx horizons are silt loam, silty clay loam, or the channery analogs of those textures. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. The Btx horizon has value of 4 or 5 and chroma of 4 to 6. The C horizon has value of 4 or 5. It is silt loam, silty clay loam, or the channery or very channery analogs of those textures.

Condit Series

The Condit series consists of deep, poorly drained, slowly permeable soils formed in calcareous Wisconsinan glacial till. These soils are in slight depressions and on flats on till plains. Slopes are 0 to 2 percent.

Condit soils are similar to Bennington soils and are commonly adjacent to Bennington and Pewamo soils. Bennington soils are somewhat poorly drained and are on slight rises and low knolls. Pewamo soils are very poorly drained and have a mollic epipedon. They are on broad flats and in depressions.

Typical pedon of Condit silt loam, about 4 miles west-northwest of Pataskala; in Lima Township; about 1,940 yards west and 490 yards south of the northeast corner of quarter township 3, T. 1 N., R. 15 W.

Ap—0 to 11 inches; grayish brown (10YR 5/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; about 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

Btg1—11 to 16 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct brown (10YR 4/3) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few faint dark gray (10YR 4/1) clay films on faces of peds; many distinct gray (10YR 5/1) silt coatings on faces of peds; about 2 percent coarse fragments; medium acid; abrupt wavy boundary.

Btg2—16 to 23 inches; dark gray (10YR 4/1) silty clay loam; common medium faint gray (10YR 5/1) and common medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; firm; few fine roots; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common distinct grayish brown (10YR 5/2) silt coatings on faces of peds; about 2 percent coarse fragments; medium acid; clear wavy boundary.

Btg3—23 to 31 inches; dark gray (10YR 4/1) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common distinct dark gray (10YR 4/1) and grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent coarse fragments; medium acid; clear wavy boundary.

Bt—31 to 38 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; few fine roots; common faint dark gray (10YR 4/1) clay films on faces of peds; about 5 percent coarse fragments; slightly acid; abrupt wavy boundary.

C1—38 to 55 inches; brown (10YR 4/3) loam; many medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; firm; about 10 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

C2—55 to 80 inches; brown (10YR 4/3) loam; common medium distinct gray (10YR 5/1) mottles; massive; firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 35 to 55 inches. The content of coarse fragments ranges from 0 to 5 percent in the A horizon, from 2 to 10 percent in the Bt horizon, and from 3 to 15 percent in the C horizon. These are dominantly sandstone and igneous fragments, but some limestone and shale fragments are in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y or is neutral in hue. It has chroma of 0 to 6. Chromas of 3 to

6 are below a depth of 30 inches. The C horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly loam but is clay loam or silty clay loam in some pedons.

Coshocton Series

The Coshocton series consists of deep, moderately well drained, slowly permeable or moderately slowly permeable soils formed in colluvium and in material weathered from shale and siltstone. These soils are mainly on unglaciated ridgetops and hillsides. Slopes range from 2 to 25 percent.

Coshocton soils are similar to Guernsey and Keene soils and are commonly adjacent to Brownsville and Rigley soils. Brownsville soils are well drained. They have a higher content of coarse fragments throughout than the Coshocton soils. They are on hillsides, generally downslope from the Coshocton soils. Guernsey soils have more clay in the subsoil than the Coshocton soils. Keene soils have a lower content of sand and coarse fragments in the upper part than the Coshocton soils. Rigley soils are well drained. They have more sand and less clay throughout than the Coshocton soils. They generally are on knolls or broad ridgetops, but in places they are on the steeper slope breaks on hillsides between less sloping areas of the Coshocton soils.

Typical pedon of Coshocton silt loam, 6 to 12 percent slopes, eroded, about 4.9 miles northwest of Gratiot; in Hopewell Township; about 1,880 yards south and 2,230 yards east of the northwest corner of quarter township 2, T. 1 N., R. 10 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many fine roots; about 10 percent yellowish brown (10YR 5/6) subsoil material; about 10 percent coarse fragments; medium acid; abrupt smooth boundary.

Bt1—6 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; firm; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; about 10 percent coarse fragments; medium acid; clear wavy boundary.

Bt2—10 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—15 to 21 inches; strong brown (7.5YR 5/6) silty clay loam; common fine prominent pale brown (10YR 6/3) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; many distinct yellowish brown (10YR 5/4) coatings on faces of peds; about 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt4—21 to 26 inches; light yellowish brown (2.5Y 6/4) silty clay loam; many fine prominent gray (10YR 6/1) and many medium prominent yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint light gray (10YR 7/2) clay films on faces of peds; many distinct light brownish gray (10YR 6/2) coatings on faces of peds; about 10 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt5—26 to 33 inches; light brownish gray (10YR 6/2) silty clay; few fine distinct light yellowish brown (2.5Y 6/4) and common medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint light gray (10YR 7/2) clay films on faces of peds; many distinct yellowish brown (10YR 5/4) coatings on faces of peds; about 2 percent coarse fragments; very strongly acid; abrupt wavy boundary.

Bt6—33 to 36 inches; brown (7.5YR 4/2) silty clay; common medium prominent yellowish red (5YR 4/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; black (10YR 2/1) seam at a depth of about 33 inches; common faint brown (7.5YR 4/2) clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—36 to 44 inches; light brownish gray (10YR 6/2) silty clay loam; many coarse prominent reddish yellow (7.5YR 6/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; about 5 percent coarse fragments; extremely acid; gradual wavy boundary.

C1—44 to 61 inches; pale brown (10YR 6/3) silty clay loam; few medium distinct gray (10YR 6/1) and many medium distinct brownish yellow (10YR 6/6) mottles; massive; firm; few fine roots; about 5 percent coarse fragments; extremely acid; clear wavy boundary.

C2—61 to 67 inches; grayish brown (10YR 5/2) silty clay loam; few fine prominent brownish yellow (10YR 6/6) mottles; massive; firm; about 5 percent coarse fragments; extremely acid; clear wavy boundary.

Cr—67 to 69 inches; dark grayish brown (10YR 4/2), weathered, soft shale bedrock.

The thickness of the solum ranges from 35 to more than 50 inches. The depth to soft bedrock is 40 to more than 72 inches. The content of coarse fragments generally is 2 to 15 percent in the A, Bt, and C horizons but is as much as 35 percent in the lower part of the Bt horizon and as much as 60 percent in the C horizon.

The Ap horizon has chroma of 2 to 4. Some pedons in uncultivated areas have A and E horizons. The upper part of the Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is typically silt loam and silty clay loam but is clay loam in some pedons. The lower part of this horizon has value of 4 to 6 and chroma of 2 to 6. It is typically silty clay loam or silty clay but is loam or channery silty clay loam in some pedons. It has thin coal blossoms in some pedons. The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 2 to 6. It is typically silty clay loam or silty clay but is channery or very channery loam in some pedons.

Crane Series

The Crane series consists of deep, somewhat poorly drained soils on terraces. These soils formed in Wisconsinan outwash. Permeability is moderate in the subsoil and very rapid in the substratum. Slopes are 0 to 2 percent.

Crane soils are similar to Westland soils and are commonly adjacent to Ockley, Sleeth, Sloan, and Westland soils. Ockley and Sleeth soils have an ochric epipedon. They are on flats, slight rises, and side slopes. Sloan and Westland soils are very poorly drained. Sloan soils are on flood plains. Westland soils are on flats and in depressions on outwash terraces.

Typical pedon of Crane silt loam, 0 to 2 percent slopes, about 1 mile southwest of Heath; in Newark Township; 1,780 yards east and 380 yards south of the northwest corner of quarter township 2, T. 1 N., R. 12 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; about 5 percent coarse fragments; neutral; abrupt smooth boundary.

A—8 to 13 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine and medium subangular blocky structure parting to moderate medium granular; friable; few fine roots; about 5 percent coarse fragments; neutral; clear irregular boundary.

Bt1—13 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; common medium faint yellowish brown (10YR 5/4) and few fine prominent dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent coarse fragments; neutral; clear smooth boundary.

Bt2—20 to 26 inches; yellowish brown (10YR 5/4) clay loam; many medium faint yellowish brown (10YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent coarse fragments; neutral; clear smooth boundary.

Bt3—26 to 35 inches; yellowish brown (10YR 5/4) clay loam; common medium faint yellowish brown (10YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 10 percent coarse fragments; neutral; clear smooth boundary.

2Btg—35 to 40 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam; many medium prominent yellowish brown (10YR 5/6) and common medium faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 20 percent coarse fragments; neutral; clear smooth boundary.

2BCg—40 to 55 inches; dark grayish brown (10YR 4/2) gravelly sandy loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on vertical faces of peds; about 30 percent coarse fragments; neutral; clear smooth boundary.

2C—55 to 80 inches; brown (10YR 4/3) very gravelly loamy sand; single grained; loose; about 35 percent coarse fragments; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 15 inches. The content of coarse fragments ranges from 0 to 10 percent in the A and Bt horizons and from 5 to 25 percent in the 2Bt horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is loam, silt loam, clay loam, or silty clay loam. The 2Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 6. It is loam, clay loam, sandy clay loam, sandy loam, or the gravelly analogs of those textures. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is gravelly or very gravelly loamy sand or sand.

Fairpoint Series

The Fairpoint series consists of deep, well drained, moderately slowly permeable soils in surface-mined areas. These soils formed in a mixture of partly weathered fine-earth material and fragments of shale, sandstone, siltstone, and coal. Slopes range from 8 to 25 percent.

Fairpoint soils are commonly adjacent to Cincinnati, Coshocton, and Homewood soils in unmined areas. The adjacent soils have a lower content of coarse fragments throughout than the Fairpoint soils.

Typical pedon of Fairpoint silty clay loam, 8 to 25 percent slopes, about 1 mile southwest of Brownsville; in Bowling Green Township; 400 yards south and 758 yards west of the northeast corner of sec. 10, T. 18 N., R. 16 W.

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silty clay loam; strong medium platy structure parting to weak medium subangular blocky; firm; common fine roots; about 10 percent siltstone fragments; slightly acid; abrupt smooth boundary.

C1—6 to 15 inches; very dark gray (N 3/0) very shaly silty clay loam; massive; very firm; few fine roots in the upper 6 inches; about 45 percent shale fragments; slightly acid; clear smooth boundary.

C2—15 to 60 inches; about 40 percent pale brown (10YR 6/3), 30 percent yellowish brown (10YR 5/6), and 30 percent gray (N 5/0) very gravelly silty clay loam; massive; very firm; about 30 percent sandstone fragments, 10 percent shale fragments, and a few coal fragments; slightly acid.

Generally, the coarse shale, siltstone, sandstone, and coal fragments are less than 10 inches in size. The content of these fragments ranges from 10 to 15 percent in the A horizon and from 35 to 70 percent in the C horizon.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is typically silty clay loam but is silt loam, loam, and clay loam in some pedons. The C horizon has hue of 7.5YR to 2.5Y or is neutral in hue. It has value of 3 to 6 and chroma of 0 to 8. In the fine-earth fraction, it is silty clay loam, clay loam, or loam.

Fitchville Series

The Fitchville series consists of deep, somewhat poorly drained, moderately slowly permeable soils formed in silty Wisconsinan glaciolacustrine sediments. These soils are on slack-water terraces and on lake plains. Slopes range from 0 to 6 percent.

Fitchville soils are similar to Sebring soils and are commonly adjacent to Glenford and Luray soils. The moderately well drained Glenford soils are on flats, knolls, and foot slopes. The very poorly drained Luray soils are on flats and in depressions. Sebring soils are poorly drained.

Typical pedon of Fitchville silt loam, 0 to 2 percent slopes, about 3.5 miles northwest of Newark; in Newark Township; about 1,830 yards south and 1,650 yards west of the northeast corner of quarter township 2, T. 2 N., R. 12 W.

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

Bt1—10 to 19 inches; brown (10YR 4/3) silt loam; many medium faint dark grayish brown (10YR 4/2) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; many faint dark grayish brown (10YR 4/2) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—19 to 27 inches; brown (10YR 4/3) silty clay loam; common medium faint dark grayish brown (10YR 4/2) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; many faint dark grayish brown (10YR 4/2) clay films on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

Bt3—27 to 37 inches; brown (10YR 5/3) silty clay loam; common medium distinct dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure, firm; few fine roots; many faint dark grayish brown (10YR 4/2) clay films on vertical faces of peds; few faint dark grayish brown (10YR 4/2) clay films on horizontal faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

Bt4—37 to 50 inches; brown (10YR 5/3) silty clay loam; few fine distinct dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on vertical faces of peds; few faint dark grayish brown (10YR 4/2) clay films on horizontal faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

Bt5—50 to 62 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on vertical faces of peds; few faint dark grayish brown (10YR 4/2) clay films on horizontal faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

C—62 to 70 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 2 percent coarse fragments; medium acid.

The thickness of the solum ranges from 40 to 65 inches. The Ap horizon has value of 4 or 5. The Bt horizon has chroma of 1 to 6. It is typically silt loam or silty clay loam, but some pedons have thin subhorizons of loam. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is dominantly silt loam or silty clay loam but has thin strata of loam, fine sandy loam, fine sand, or silty clay in some pedons.

Fox Series

The Fox series consists of deep, well drained soils formed in calcareous Wisconsinan glacial outwash. These soils are on the side slopes of terraces and on a few kames. Permeability is moderate in the solum and rapid or very rapid in the substratum. Slopes range from 12 to 25 percent.

Fox soils are similar to Chili soils and are commonly adjacent to Ockley and Rush soils. The similar and adjacent soils have a solum that is thicker than that of the Fox soils. Ockley and Rush soils are commonly on the flatter parts of terraces.

Typical pedon of Fox gravelly loam, 12 to 18 percent slopes, eroded, about 1.3 miles northeast of Homer; in Burlington Township; 600 yards south and 2,020 yards west of the northeast corner of quarter township 1, T. 4 N., R. 13 W.

Ap—0 to 4 inches; brown (10YR 4/3) gravelly loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many fine and few medium roots; about 15 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—4 to 8 inches; dark yellowish brown (10YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; common fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; common distinct brown (10YR 4/3) organic coatings in old root channels; about 20 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—8 to 12 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; common fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; medium acid; clear smooth boundary.

Bt3—12 to 20 inches; reddish brown (5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; about 25 percent coarse fragments; slightly acid; clear smooth boundary.

Bt4—20 to 26 inches; brown (10YR 4/3) gravelly loam; weak medium subangular blocky structure; friable; few fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; about 25 percent coarse fragments; neutral; clear smooth boundary.

BC—26 to 29 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; weak medium subangular blocky structure; very friable; about 40 percent coarse fragments; few fine roots; slight effervescence; mildly alkaline; abrupt irregular boundary.

C—29 to 60 inches; brown (10YR 5/3) very gravelly sand; single grained; loose; about 40 percent coarse fragments; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to calcareous sand and gravel range from 24 to 40 inches. The content of coarse fragments ranges from 15 to 25 percent in the A horizon, from 15 to 30 percent in the Bt horizon, and from 30 to 60 percent in the C horizon.

The Ap horizon has value of 4 or 5. It is typically gravelly loam but is loam or silt loam in some pedons. The Bt horizon has value of 3 or 4. It is gravelly loam, gravelly clay loam, or gravelly sandy clay loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is gravelly or very gravelly sand.

Frankstown Variant

The Frankstown Variant consists of moderately deep, well drained, moderately permeable soils on unglaciated ridgetops. These soils formed in a mixture of loess and material weathered from flint. Slopes range from 2 to 6 percent.

Frankstown Variant soils are commonly adjacent to Guernsey and Mertz soils. The adjacent soils are deep.

They are on ridgetops and hillsides.

Typical pedon of Frankstown Variant silt loam, in an area of Frankstown Variant-Mertz complex, 2 to 6 percent slopes, very stony, about 2.9 miles north of Brownsville; in Hopewell Township; 250 yards north and 3,450 yards east of the southwest corner of quarter township 2, T. 1 N., R. 10 W.

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

E—3 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak medium platy structure parting to weak fine granular; friable; common fine and medium roots; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

BE—6 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; few fine and medium roots; few distinct yellowish brown (10YR 5/4) silt coatings on faces of peds; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

Bt1—13 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate fine subangular blocky structure; firm; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—20 to 25 inches; strong brown (7.5YR 5/6) cherty silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; about 25 percent coarse fragments; strongly acid; abrupt wavy boundary.

R—25 to 30 inches; flint.

The depth to flint bedrock ranges from 20 to 40 inches. The content of coarse chert fragments ranges from 5 to 15 percent in the A horizon and the upper part of the Bt horizon and from 20 to 50 percent in the lower part of the Bt horizon.

The A horizon has value of 2 or 3. The upper part of the Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam or silty clay loam. The lower part has hue of 7.5YR or 10YR. It is the cherty or very cherty analogs of silt loam or silty clay loam.

Glenford Series

The Glenford series consists of deep, moderately well drained, moderately slowly permeable soils formed in silty glaciolacustrine sediments. These soils are on slack-water terraces and on lake plains. Slopes range from 0 to 6 percent.

Glenford soils are similar to Mentor soils and are commonly adjacent to Fitchville, Luray, Mentor, and Sebring soils. The somewhat poorly drained Fitchville soils are on flats, in slight depressions, on low knolls, and on foot slopes. The very poorly drained Luray and poorly drained Sebring soils are on flats and in depressions. The well drained Mentor soils are on flats, knolls, and side slopes.

Typical pedon of Glenford silt loam, 0 to 2 percent slopes, about 3.2 miles north of Boston; in Perry Township; about 3,100 yards north and 120 yards east of the southwest corner of quarter township 4, T. 3 N., R. 10 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; few medium and many fine roots; medium acid; abrupt smooth boundary.

BE—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; many fine roots; few faint yellowish brown (10YR 5/4) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—13 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—18 to 30 inches; yellowish brown (10YR 5/6) silt loam; common fine prominent light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; many faint pale brown (10YR 6/3) coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

Bt3—30 to 39 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; firm; brittle in 30 percent of matrix; few fine roots; many faint pale brown (10YR 6/3) clay films and coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

Bt4—39 to 47 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light brownish gray (10YR 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; common faint pale brown (10YR 6/3) clay films and many faint pale brown (10YR 6/3) coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

BC—47 to 52 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; many faint pale brown (10YR 6/3) coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

C—52 to 60 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light brownish gray (10YR 6/2) and common medium faint yellowish brown (10YR 5/4) mottles; massive; firm; many faint pale brown (10YR 6/3) silt coatings on a few vertical seams; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); slightly acid.

The thickness of the solum ranges from 30 to 60 inches. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has value of 4 or 5. The C horizon has chroma of 4 to 6. It is dominantly silt loam or silty clay loam but has thin strata of loam, fine sandy loam, or silty clay in some pedons.

Guernsey Series

The Guernsey series consists of deep, moderately well drained, slowly permeable or moderately slowly permeable soils on unglaciated uplands. These soils formed in a thin mantle of loess and in the underlying material weathered from slightly acid to calcareous shale and siltstone. Slopes range from 2 to 18 percent.

Guernsey soils are similar to Coshocton soils and are commonly adjacent to Coshocton, Frankstown Variant, Keene, Mertz, and Rigley soils. The similar and adjacent soils have less clay in the subsoil than the Guernsey soils. Coshocton, Keene, and Rigley soils are in positions on the landscape similar to those of the Guernsey soils. Frankstown Variant and Mertz soils are on ridgetops.

Typical pedon of Guernsey silt loam, 2 to 6 percent slopes, about 2.8 miles northwest of Gratiot; in Hopewell Township; about 820 yards south and 210 yards west of the northeast corner of sec. 13, T. 1 N., R. 10 W.

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

BE—7 to 11 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/6) silt coatings on faces of peds; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—11 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; common fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; many faint yellowish brown (10YR 5/6) silt coatings on faces of peds; about 4 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt2—16 to 25 inches; brownish yellow (10YR 6/6) silty clay; many medium prominent light brownish gray (10YR 6/2) and many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint brownish yellow (10YR 6/6) clay films on faces of peds; many faint brownish yellow (10YR 6/6) silt coatings on faces of peds; about 4 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt3—25 to 30 inches; brownish yellow (10YR 6/6) silty clay; common medium prominent light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; very firm; few fine roots; few faint brownish yellow (10YR 6/6) clay films on faces of peds; many faint brownish yellow (10YR 6/6) silt coatings on faces of peds; about 4 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt4—30 to 37 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very firm; few fine roots; few faint brownish yellow (10YR 6/6) clay films on faces of peds; many faint brownish yellow (10YR 6/6) silt coatings on faces of peds; about 4 percent coarse fragments; slightly acid; clear wavy boundary.

2Bt5—37 to 42 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent light gray (10YR 7/2) mottles; weak coarse subangular blocky structure; very firm; few fine roots; few faint brownish yellow (10YR 6/6) clay films on faces of peds; many faint brownish yellow (10YR 6/6) silt coatings on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; slightly acid; clear wavy boundary.

2BC—42 to 51 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very firm; few fine roots; few faint brownish yellow (10YR 6/6) silt coatings on faces of peds; about 5 percent coarse fragments; neutral; clear wavy boundary.

2C1—51 to 60 inches; gray (10YR 5/1) silty clay; massive; very firm; about 5 percent coarse fragments; neutral; diffuse wavy boundary.

2C2—60 to 71 inches; gray (10YR 5/1) silty clay; massive; very firm; about 10 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

2Cr—71 to 73 inches; soft siltstone bedrock.

The thickness of the solum ranges from 36 to 55 inches. The depth to free carbonates is more than 30 inches. The depth to bedrock ranges from 50 to 80 inches. The content of coarse fragments ranges from 2 to 15 percent in the A and Bt horizons, from 2 to 20 percent in the 2Bt horizon, and from 5 to 20 percent in the 2C horizon.

The Ap horizon has chroma of 2 or 3. Some pedons have A and E horizons. The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has value of 4 to 6 and chroma of 2 to 6. It is silty clay loam, silty clay, or shaly silty clay loam. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay, silty clay loam, or the shaly analogs of those textures.

Hazleton Series

The Hazleton series consists of deep, well drained, moderately rapidly permeable or rapidly permeable soils on hillsides in the uplands. These soils formed in colluvium and material weathered from medium and coarse grained sandstone. Slopes range from 25 to 70 percent.

Hazleton soils are similar to Brownsville soils and are commonly adjacent to Brownsville and Orrville soils. Brownsville soils have more silt and less sand in the subsoil than the Hazleton soils. They are on ridgetops and hillsides. Orrville soils are somewhat poorly drained and are on flood plains.

Typical pedon of Hazleton channery sandy loam, in an area of Hazleton-Rock outcrop complex, 25 to 70 percent slopes, about 1.8 miles south-southeast of Hanover; in Hanover Township; 120 yards east and 300 yards north of the southwest corner of sec. 13, T. 2 N., R. 10 W.

Oi—1 inch to 0; dark brown (7.5YR 3/2) recent leaf litter.

A—0 to 2 inches; black (10YR 2/1) channery sandy loam, black (10YR 2/1) dry; weak fine granular structure; very friable; common fine and few medium roots; about 30 percent coarse fragments; very strongly acid; clear wavy boundary.

E—2 to 5 inches; brown (10YR 4/3) channery sandy loam; weak fine granular structure; very friable; common fine and few medium roots; about 30 percent coarse fragments; very strongly acid; clear wavy boundary.

Bw1—5 to 14 inches; yellowish brown (10YR 5/6) very channery sandy loam; weak fine subangular blocky structure; very friable; few fine and medium roots; about 35 percent coarse fragments; very strongly acid; clear smooth boundary.

Bw2—14 to 27 inches; yellowish brown (10YR 5/4) very channery sandy loam; weak fine subangular blocky structure; very friable; few fine roots; about 40 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—27 to 54 inches; yellowish brown (10YR 5/4) very channery sandy loam; massive; very friable; few fine roots; about 45 percent coarse fragments; very strongly acid; abrupt wavy boundary.

R—54 to 56 inches; yellowish brown (10YR 5/4) sandstone bedrock.

The thickness of the solum ranges from 25 to 45 inches. The depth to bedrock ranges from 40 to more than 72 inches. The content of sandstone and siltstone fragments ranges from 15 to 35 percent in the A horizon, from 15 to 60 percent in the Bw horizon, and from 35 to 80 percent in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value of 5 or 6 and chroma of 4 to 6. It is channery or very channery sandy loam. The C horizon has value of 5 or 6. It is the very channery or extremely channery analogs of sandy loam or loamy sand.

Hickory Series

The Hickory series consists of deep, well drained, moderately permeable soils formed in calcareous Illinoian glacial till. These soils are on ridges, knolls, and dissected side slopes on till plains. Slopes range from 6 to 18 percent.

Hickory soils are similar to Amanda and Centerburg soils and are commonly adjacent to Brownsville and Homewood soils. Amanda and Centerburg soils have coarse fragments that are dominantly sandstone. Centerburg soils are moderately well drained. Brownsville soils have a higher content of coarse fragments throughout than the Hickory soils. They are in unglaciated areas, generally at the higher elevations. Homewood soils have a fragipan. They are in positions on the landscape similar to those of the Hickory soils.

Typical pedon of Hickory silt loam, 6 to 12 percent slopes, eroded, about 1.5 miles north of Purity; in Eden Township; about 900 yards south and 580 yards west of the northeast corner of sec. 7, T. 4 N., R. 11 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine and common medium roots; about 5 percent yellowish brown (10YR 5/6) subsoil material; about 5 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—7 to 12 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine and few medium roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; brown (10YR 4/3) organic coatings in old root channels; about 5 percent coarse fragments; slightly acid; clear smooth boundary.

Bt2—12 to 19 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine and few medium roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; slightly acid; clear smooth boundary.

Bt3—19 to 25 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt4—25 to 35 inches; yellowish brown (10YR 5/4) clay loam; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; very firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; medium acid; clear smooth boundary.

BC—35 to 40 inches; yellowish brown (10YR 5/4) clay loam; weak coarse prismatic structure parting to moderate coarse subangular blocky; very firm; few fine roots; about 5 percent coarse fragments; neutral; clear wavy boundary.

C—40 to 80 inches; yellowish brown (10YR 5/4) clay loam; massive; very firm; about 10 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 60 inches. The content of coarse fragments ranges from 2 to 8 percent in the solum and from 5 to 15 percent in the C horizon. These are dominantly igneous pebbles in the solum, but some are sandstone fragments. Also, shale fragments and limestone pebbles are in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The upper part of this horizon is silty clay loam or clay loam. The lower part is dominantly clay loam but has individual subhorizons of loam in some pedons. The C horizon has chroma of 3 or 4. It is dominantly clay loam but is loam in some pedons.

Homewood Series

The Homewood series consists of deep, moderately well drained and well drained soils formed in Illinoian glacial till. These soils are on knolls, ridges, and dissected hillsides on till plains. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 2 to 25 percent.

Homewood soils are similar to Cincinnati, Clarksburg, and Titusville soils and are commonly adjacent to Brownsville and Coshocton soils. Brownsville and Coshocton soils do not have a fragipan. They are typically on the steeper parts of hillsides at the higher elevations. Cincinnati soils have more silt in the upper part than the Homewood soils. Clarksburg soils have a higher content of angular coarse fragments in the lower part of the subsoil and in the substratum than the Homewood soils. Titusville soils have low-chroma mottles in the upper 10 inches of the argillic horizon.

Typical pedon of Homewood silt loam, 2 to 6 percent slopes, about 2.5 miles east of Utica; in Washington Township; about 590 yards south and 2,390 yards east of the northwest corner of quarter township 1, T. 4 N., R. 12 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; common fine roots; about 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about

2 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—14 to 24 inches; yellowish brown (10YR 5/6) clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common fine roots; common distinct yellowish brown (10YR 5/4) clay films on faces of peds; common distinct yellowish brown (10YR 5/6) silt coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 4 percent coarse fragments; very strongly acid; clear wavy boundary.

Btx1—24 to 38 inches; yellowish brown (10YR 5/6) clay loam; moderate very coarse prismatic structure parting to moderate thick platy; very firm; brittle; few fine roots between prisms; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

Btx2—38 to 51 inches; yellowish brown (10YR 5/6) clay loam; moderate very coarse prismatic structure parting to weak coarse subangular blocky; very firm; brittle; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

BC—51 to 65 inches; strong brown (7.5YR 5/6) clay loam; weak coarse subangular blocky structure; firm; common faint dark yellowish brown (10YR 4/4) clay films on vertical faces of peds; few medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; strongly acid; abrupt wavy boundary.

C—65 to 80 inches; yellowish brown (10YR 5/4) loam; few fine distinct gray (10YR 6/1) mottles; massive; firm; about 10 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 50 to more than 90 inches. Depth to the fragipan ranges from 16 to 33 inches. Some pedons have a loess mantle, which is as much as 16 inches thick. The content of coarse fragments ranges from 0 to 5 percent in the Ap horizon, from 0 to 10 percent in the Bt horizon, and from 5 to 15 percent in the Btx and C horizons.

The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam, but some pedons have individual subhorizons of silty clay loam or loam. The Btx and C horizons are clay loam or loam. The Btx horizon has chroma of 4 to 6. The C horizon has value of 4 or 5 and chroma of 3 or 4.

Keene Series

The Keene series consists of deep, moderately well drained soils on unglaciated ridgetops and hillsides on uplands. These soils formed in loess and in the underlying material weathered from interbedded shale and siltstone. Permeability is moderate or moderately slow in the upper silty material and slow or moderately slow in the underlying material. Slopes range from 2 to 18 percent.

Keene soils are similar to Coshocton soils and are commonly adjacent to Coshocton, Guernsey, and Rigley soils. The similar and adjacent soils are in positions on the landscape similar to those of the Keene soils. Coshocton soils have less silt and a higher content of coarse fragments in the upper part than the Keene soils. Guernsey soils have more clay in the upper part of the subsoil than the Keene soils. The well drained Rigley soils have more sand in the subsoil than the Keene soils.

Typical pedon of Keene silt loam, 12 to 18 percent slopes, eroded, 2.2 miles south of Toboso; in Hopewell Township; about 120 yards south and 410 yards east of the northwest corner of sec. 1, T. 1 N., R. 10 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; friable; few medium and fine roots; about 10 percent yellowish brown (10YR 5/4) subsoil material; strongly acid; abrupt smooth boundary.

BE—7 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; few medium and fine roots; common faint yellowish brown (10YR 5/4) silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt1—14 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few medium and fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; few faint pale brown (10YR 6/3) coatings on faces of peds; few medium distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

2Bt2—21 to 33 inches; yellowish brown (10YR 5/6) silty clay loam; common medium prominent grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; many distinct light brownish gray (10YR

6/2) silt coatings on faces of peds; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt3—33 to 38 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; about 10 percent coarse fragments; very strongly acid; clear wavy boundary.

2Bt4—38 to 54 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/6) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; clear wavy boundary.

2BC—54 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; very strongly acid; abrupt wavy boundary.

2C1—60 to 64 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent coarse fragments; very strongly acid; clear wavy boundary.

2C2—64 to 72 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; firm; about 10 percent coarse fragments; very strongly acid; clear smooth boundary.

2C3—72 to 76 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent coarse fragments; very strongly acid; clear smooth boundary.

2Cr—76 to 78 inches; soft siltstone.

The thickness of the solum ranges from 35 to 60 inches. The depth to bedrock is 40 to 84 inches. The thickness of the silty mantle ranges from 20 to 36 inches. The content of coarse fragments ranges from 0 to 5 percent in the A and Bt horizons, from 5 to 15 percent in the 2Bt horizon, and from 5 to 25 percent in the 2C horizon.

The Ap horizon has chroma of 2 or 3. Some pedons have A and E horizons. The Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silty clay. The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is silty clay loam, silty clay, or the shaly analogs of those textures.

Killbuck Series

The Killbuck series consists of deep, poorly drained, moderately slowly permeable soils on flood plains. These soils formed in recent alluvium underlain by a buried soil that has a dark surface layer. Slopes are 0 to 2 percent.

Killbuck soils are similar to Algiers and Melvin soils and are commonly adjacent to Chili, Glenford, and Luray soils. Algiers soils are somewhat poorly drained. Chili soils are well drained, and Glenford soils are moderately well drained. Both of these soils are on terraces. Luray soils are very poorly drained and have a mollic epipedon. They are on lake plains. Melvin soils formed entirely in alluvium.

Typical pedon of Killbuck silt loam, frequently flooded, about 5.3 miles northeast of Newark; in Mary Ann Township; about 350 yards south and 1,520 yards west of the northeast corner of sec. 16, T. 3 N., R. 11 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, pale brown (10YR 6/3) dry; common fine distinct brown (7.5YR 4/4) mottles, mainly along root channels; weak fine granular structure; friable; many fine and medium roots; medium acid; clear smooth boundary.

Cg1—6 to 12 inches; grayish brown (10YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/4) and few fine prominent brown (7.5YR 4/4) mottles; massive; friable; many fine and common medium roots; slightly acid; clear smooth boundary.

Cg2—12 to 20 inches; grayish brown (10YR 5/2) silt loam; common fine faint brown (10YR 5/3) and common medium prominent brown (7.5YR 4/4) mottles; massive; friable; common fine and few medium roots; medium acid; abrupt smooth boundary.

2Ab—20 to 28 inches; black (10YR 2/1) silty clay loam; weak medium prismatic structure parting to weak medium angular blocky; firm; few fine roots; medium acid; abrupt smooth boundary.

2Bgb1—28 to 32 inches; gray (10YR 5/1) silty clay loam; few fine prominent yellowish red (5YR 4/6) and common fine prominent brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; slightly acid; clear smooth boundary.

2Bgb2—32 to 52 inches; gray (10YR 5/1) silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; slightly acid; clear smooth boundary.

2Cg—52 to 60 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent brown (7.5YR 4/4) mottles; massive; firm; few fine roots; slightly acid.

The thickness of the silty alluvium ranges from 15 to 36 inches. The content of coarse fragments ranges from 0 to 2 percent in the A and Cg horizons and from 0 to 10 percent in the 2Ab, 2Bgb, and 2Cg horizons.

The Ap and Cg horizons have value of 4 or 5 and chroma of 1 or 2. The 2Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam or silty clay. The 2Bgb and 2Cg horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. They are dominantly silty clay loam but are silt loam in some pedons.

Luray Series

The Luray series consists of deep, very poorly drained, moderately slowly permeable soils formed in lacustrine deposits. These soils are on lake plains and on terraces along streams. Slopes are 0 to 2 percent.

Luray soils are similar to Pewamo soils and are commonly adjacent to Algiers, Fitchville, and Glenford soils. Algiers soils formed in recent alluvium underlain by a buried soil. They are on flood plains. The somewhat poorly drained Fitchville and moderately well drained Glenford soils are higher on the landscape than the Luray soils. Pewamo soils have more clay in the subsoil and a higher content of coarse fragments throughout than the Luray soils.

Typical pedon of Luray silty clay loam, about 2.3 miles southwest of Hebron; in Union Township; about 460 yards south and 30 yards east of the northwest corner of sec. 15, T. 17 N., R. 18 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

Btg1—12 to 22 inches; dark gray (10YR 4/1) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; few faint very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—22 to 33 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark gray (10YR 4/1) clay films on faces of peds; slightly acid; clear smooth boundary.

BCg—33 to 40 inches; dark grayish brown (10YR 4/2) silt loam; many medium distinct dark yellowish brown (10YR 4/4) and common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; few faint dark gray (10YR 4/1) clay films on vertical faces of peds; neutral; clear smooth boundary.

Cg—40 to 60 inches; dark grayish brown (10YR 4/2) silt loam; many medium prominent yellowish brown (10YR 5/6) and common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; thin strata of loam and fine sandy loam; neutral.

The thickness of the solum ranges from 40 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is typically silty clay loam but is silt loam in some pedons. The Btg horizon has hue of 10YR to 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. Mottles that have chroma of 1 to 6 are below a depth of 30 inches. This horizon is dominantly silty clay loam or silt loam, but some pedons have subhorizons of silty clay. The C horizon has value of 4 or 5 and chroma of 1 to 6. It is dominantly silt loam or silty clay loam, but it has thin strata of loam, fine sandy loam, or sandy loam in some pedons.

Mechanicsburg Series

The Mechanicsburg series consists of deep, well drained, moderately permeable soils formed in glacial till and in the underlying material weathered from fine grained sandstone and siltstone bedrock. These soils are on the tops and sides of prominent sandstone hills that were glaciated but retained a bedrock-controlled topography. Slopes range from 2 to 25 percent.

Mechanicsburg soils are commonly adjacent to Amanda, Brownsville, and Homewood soils. Amanda and Homewood soils formed in 60 or more inches of glacial till. They have a lower content of coarse fragments in the lower part of the subsoil and in the substratum than the Mechanicsburg soils. They are commonly on the lower parts of some hillsides. Brownsville soils have a higher content of coarse fragments in the upper part than the Mechanicsburg soils. They are in positions on the landscape similar to those of the Mechanicsburg soils.

Typical pedon of Mechanicsburg silt loam, 12 to 18 percent slopes, eroded, about 1.5 miles northwest of Granville; in Granville Township; about 900 yards north and 2,970 yards east of the southwest corner of quarter township 2, T. 2 N., R. 13 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; about 10 percent yellowish brown (10YR 5/4) subsoil material; about 10 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—7 to 12 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common fine roots; few faint brown (10YR 5/3) silt coatings on faces of peds; about 10 percent coarse fragments; medium acid; clear smooth boundary.

Bt1—12 to 19 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—19 to 29 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

2Bt3—29 to 35 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear smooth boundary.

2BC—35 to 51 inches; yellowish brown (10YR 5/4) very channery silt loam; weak coarse subangular blocky structure; friable; few fine roots; about 55 percent coarse fragments; strongly acid; gradual smooth boundary.

2C—51 to 60 inches; brown (10YR 5/3) extremely channery silt loam; massive; friable; about 85 percent coarse fragments; strongly acid; gradual smooth boundary.

2R—60 to 62 inches; brown (10YR 5/3), fractured siltstone bedrock.

The thickness of the solum ranges from 30 to more than 60 inches. The depth to material weathered from fractured bedrock ranges from 20 to 36 inches. The depth to bedrock ranges from 40 to 72 inches. The content of coarse fragments ranges from 2 to 10 percent in the Ap horizon, from 5 to 20 percent in the Bt horizon, from 15 to 50 percent in the 2Bt horizon, and from 60 to 90 percent in the 2C horizon.

The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR and value of 4 or 5. It is loam, silt loam, silty clay loam, clay loam, or the gravelly analogs of those textures. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is the channery or very channery analogs of loam or silt loam. The 2C horizon has hue of 10YR or 2.5Y and chroma of 3 or 4. It is the extremely channery analogs of silt loam or loam.

Medway Series

The Medway series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in recent alluvium. Slopes are 0 to 2 percent.

Medway soils are commonly adjacent to Fox, Ockley, and Shoals soils. Fox and Ockley soils have an argillic horizon. They are on Wisconsinan glacial outwash terraces and kames. The somewhat poorly drained Shoals soils are in the lower positions on flood plains.

Typical pedon of Medway silt loam, occasionally flooded, about 1 mile northwest of Alexandria; in St. Albans Township; about 1,440 yards north and 3,310 yards east of the southwest corner of quarter township 2, T. 2 N., R. 14 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many fine roots; about 4 percent coarse fragments; neutral; abrupt smooth boundary.

A—8 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; common fine roots; about 4 percent coarse fragments; neutral; clear wavy boundary.

Bw1—16 to 22 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine roots; many distinct very dark grayish brown (10YR 3/2) organic coatings in old root channels; about 2 percent coarse fragments; neutral; clear wavy boundary.

Bw2—22 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 2 percent coarse fragments; neutral; clear smooth boundary.

Bw3—30 to 36 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; about 2 percent coarse fragments; neutral; clear smooth boundary.

BC—36 to 47 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; about 2 percent coarse fragments; neutral; abrupt smooth boundary.

C—47 to 60 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; common fine distinct yellowish brown (10YR 5/4) and dark grayish brown (10YR 4/2) mottles; massive; friable; about 30 percent coarse fragments; neutral.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 24 inches. The content of coarse fragments ranges from 0 to 15 percent in the Ap and Bw horizons and from 0 to 35 percent in the C horizon.

The A horizon has chroma of 1 to 3. It is typically silt loam but is loam in some pedons. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is dominantly silt loam, loam, or silty clay loam, but some pedons have individual subhorizons of sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is sandy loam, loam, silt loam, or the gravelly analogs of those textures.

Melvin Series

The Melvin series consists of deep, poorly drained, moderately permeable soils on flood plains. These soils formed in recent alluvium. Slopes are 0 to 2 percent.

Melvin soils are similar to Killbuck soils and are commonly adjacent to Chili, Fitchville, and Mentor soils. The well drained Chili soils are on glacial outwash terraces and kames. The somewhat poorly drained Fitchville soils are on slack-water terraces and on lake plains. Killbuck soils formed in recent alluvium underlain by a dark buried soil. The well drained Mentor soils are on terraces and lake plains.

Typical pedon of Melvin silt loam, frequently flooded, about 2.2 miles southwest of Brownsville; in Bowling Green Township; about 750 yards north and 580 yards west of the southeast corner of sec. 15, T. 18 N., R. 16 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; common medium prominent yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; few medium and many fine roots; about 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bg—9 to 24 inches; gray (10YR 6/1) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; about 1 percent coarse fragments; slightly acid; clear smooth boundary.

Cg1—24 to 34 inches; gray (10YR 6/1) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; about 1 percent coarse fragments; few thin strata of lighter colored material; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); slightly acid; clear smooth boundary.

Cg2—34 to 55 inches; gray (10YR 6/1) silt loam; common medium prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; about 1 percent coarse fragments; few thin strata of lighter colored material; slightly acid; clear smooth boundary.

Cg3—55 to 60 inches; gray (N 6/0) silt loam; many medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; about 1 percent coarse fragments; weakly stratified; few thin strata of lighter colored material; slightly acid.

The thickness of the solum ranges from 20 to 40 inches. The content of coarse fragments ranges from 0 to 5 percent within a depth of 40 inches and from 0 to 15 percent below a depth of 40 inches.

The Ap horizon has chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y and value of 4 to 6. It is silt loam or silty clay loam. The Cg horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is dominantly silt loam but is silty clay loam in some pedons.

Mentor Series

The Mentor series consists of deep, well drained, moderately permeable soils formed in silty glaciolacustrine sediments on Wisconsinan terraces and lake plains. Slopes range from 0 to 18 percent.

Mentor soils are similar to Alford, Glenford, and Parke soils and are commonly adjacent to Clarksburg, Fitchville, and Luray soils. Alford soils do not have bedding planes in the lower part. Clarksburg soils have a fragipan. They are on foot slopes. The somewhat poorly drained Fitchville and very poorly drained Luray soils are on flats and in depressions. Glenford soils are moderately well drained. Parke soils have a higher content of sand and coarse fragments in the lower part than the Mentor soils.

Typical pedon of Mentor silt loam, 2 to 6 percent slopes, about 4.3 miles northeast of Hanover; in Perry Township; 1,040 yards east and 260 yards south of the northwest corner of quarter township 4, T. 3 N., R. 10 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate fine and medium granular structure; friable; many fine and common medium roots; about 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

BE—9 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine and few medium roots; few faint brown (10YR 5/3) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—14 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—21 to 28 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—28 to 35 inches; yellowish brown (10YR 5/6) silt loam; few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint yellowish brown (10YR 5/4) clay films on faces of peds; strongly acid; clear smooth boundary.

BC—35 to 48 inches; yellowish brown (10YR 5/6) silt loam; few medium distinct light yellowish brown (2.5Y 6/4) mottles; weak medium subangular blocky structure parting to platy along bedding planes; friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on vertical faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct grayish brown (10YR 5/2) and light yellowish brown (2.5Y 6/4) mottles; massive; friable; medium acid.

The thickness of the solum ranges from 40 to 55 inches. The content of coarse fragments ranges from 0 to 2 percent in the Ap and Bt horizons and the upper part of the C horizon and from 0 to 10 percent in the part of the C horizon below a depth of 50 inches.

The Ap horizon has value of 4 or 5. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The C horizon has value of 4 or 5 and chroma of 3 to 6. It is dominantly silt loam or silty clay loam, but some pedons have strata of loam, sandy loam, or fine sandy loam.

Mertz Series

The Mertz series consists of deep, well drained, moderately slowly permeable soils formed in material weathered from flinty limestone. Slopes range from 2 to 35 percent.

Mertz soils are commonly adjacent to Frankstown Variant and Guernsey soils. The moderately deep Frankstown Variant soils are on narrow to wide ridgetops. The moderately well drained Guernsey soils are on ridgetops and hillsides.

Typical pedon of Mertz very cherty silt loam, in an area of Frankstown Variant-Mertz complex, 2 to 6 percent slopes, very stony, about 3 miles north of Brownsville; in Hopewell Township; about 370 yards north and 3,270 yards east of the southwest corner of quarter township 2, T. 1 N., R. 10 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) very cherty silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common medium and many fine roots; about 45 percent coarse fragments; slightly acid; abrupt smooth boundary.

E—3 to 5 inches; brown (10YR 5/3) very cherty silt loam; weak medium platy structure parting to moderate fine granular; friable; common medium and many fine roots; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak medium subangular blocky structure; friable; common medium and fine roots; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

Bt1—10 to 18 inches; yellowish brown (10YR 5/6) very cherty silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/6) clay films on faces of peds; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

Bt2—18 to 28 inches; strong brown (7.5YR 5/6) very cherty silt loam; weak medium subangular blocky structure; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; about 40 percent coarse fragments; strongly acid; clear smooth boundary.

Bt3—28 to 40 inches; yellowish red (5YR 5/8) very cherty silty clay loam; weak medium subangular blocky structure; firm; few fine roots; few faint yellowish red (5YR 5/8) clay films on faces of peds; about 45 percent coarse fragments; strongly acid; clear smooth boundary.

Bt4—40 to 51 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; weak coarse subangular blocky structure; firm; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; about 50 percent coarse fragments; strongly acid; clear smooth boundary.

C—51 to 68 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; massive; firm; about 40 percent coarse fragments; very strongly acid.

The thickness of the solum ranges from 40 to 65 inches. The content of coarse fragments ranges from 35 to 50 percent in the A horizon and from 30 to 70 percent in the Bt and C horizons. These are mainly chert fragments, but some are angular sandstone fragments, particularly in the lower horizons.

The A horizon has chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 4 to 8. The C horizon has hue of 7.5YR or 10YR and chroma of 3 to 6. In the fine-earth fraction, it is silt loam or silty clay loam.

Negley Series

The Negley series consists of deep, well drained, moderately permeable or moderately rapidly permeable soils formed in Illinoian glacial outwash. These soils are on kames and high outwash terraces. Slopes range from 6 to 70 percent.

Negley soils are similar to Chili soils and are commonly adjacent to Alford and Parke soils. Alford and Parke soils have more silt in the upper part than the Negley soils. Alford soils are on wide terrace flats at the higher elevations. Parke soils are on the less sloping side slopes, commonly above the steeper areas of the Negley soils. Chili soils have a solum that is thinner than that of the Negley soils.

Typical pedon of Negley loam, 12 to 18 percent slopes, eroded, about 1 mile northeast of Marne; in Madison Township; 1,915 yards north and 750 yards west of the southeast corner of quarter township 1, T. 2 N., R. 11 W.

Ap—0 to 6 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; many fine and common medium roots; some yellowish brown (10YR 5/6) subsoil material throughout; about 10 percent coarse fragments; neutral; abrupt smooth boundary.

BE—6 to 14 inches; yellowish brown (10YR 5/6) loam; weak fine subangular blocky structure; friable; common fine roots; few faint yellowish brown (10YR 5/4) silt coatings on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—14 to 20 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—20 to 29 inches; strong brown (7.5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish red (5YR 5/8) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—29 to 40 inches; yellowish red (5YR 5/8) gravelly clay loam; moderate medium subangular blocky structure; friable; few fine roots; common faint yellowish red (5YR 5/8) clay films on faces of peds; about 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bt4—40 to 63 inches; strong brown (7.5YR 5/6) gravelly clay loam; weak medium subangular blocky structure; friable; few fine roots; common faint strong brown (7.5YR 5/6) clay films on faces of peds; about 20 percent coarse fragments; strongly acid in the upper part and medium acid in the lower part; gradual wavy boundary.

Bt5—63 to 75 inches; strong brown (7.5YR 5/6) clay loam; weak medium subangular blocky structure; friable; common faint strong brown (7.5YR 5/6) clay films on faces of peds; about 10 percent coarse fragments; medium acid; clear wavy boundary.

BC—75 to 80 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; about 5 percent coarse fragments; medium acid.

The solum is more than 80 inches thick. The content of coarse fragments ranges from 5 to 15 percent in the A horizon and from 5 to 35 percent in the Bt horizon.

The Ap horizon has chroma of 3 or 4. It is typically loam but is silt loam or gravelly loam in some pedons. Some pedons have A and E horizons. The Bt horizon has value of 4 or 5 and chroma of 4 to 8. It is dominantly clay loam, loam, sandy clay loam, or the gravelly analogs of those textures. In some pedons, however, it has thin subhorizons of sandy loam or gravelly sandy loam.

Ockley Series

The Ockley series consists of deep, well drained soils formed in a thin mantle of loess and in the underlying Wisconsinan glacial outwash (fig. 19). These soils generally are on outwash terraces. In a few areas, however, they are on kames. Permeability is moderate in the subsoil and very rapid in the substratum. Slopes range from 0 to 12 percent.

Ockley soils are similar to Rush soils and are commonly adjacent to Fox and Sleeth soils. Fox soils have a solum that is thinner than that of the Ockley soils. They are on slope breaks between different terrace levels. Rush soils have a silty mantle that is thicker than that of the Ockley soils. The somewhat poorly drained Sleeth soils are on flats and slight rises.

Typical pedon of Ockley silt loam, 0 to 2 percent slopes, about 1.5 miles east of Granville; in Granville Township; 1,170 yards south and 1,160 yards west of the northeast corner of quarter township 4, T. 2 N., R. 13 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; very friable; common fine roots; about 2 percent coarse fragments; neutral; abrupt smooth boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; few fine roots; common faint brown (10YR 5/3) silt coatings on faces of peds; about 2 percent coarse fragments; slightly acid; clear wavy boundary.

Bt1—14 to 19 inches; yellowish brown (10YR 5/6) silty clay loam; moderate fine and medium subangular blocky structure; firm; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 2 percent coarse fragments; medium acid; clear wavy boundary.

2Bt2—19 to 32 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 2 percent coarse fragments; medium acid; clear wavy boundary.

2Bt3—32 to 37 inches; brown (7.5YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 4 percent coarse fragments; medium acid; clear wavy boundary.

Figure 19.—Profile of Ockley soils, which formed in glacial outwash. Dark tongues of weathered soil material are in the outwash sand and gravel.

2Bt4—37 to 49 inches; dark yellowish brown (10YR 4/4) sandy clay loam; weak coarse subangular blocky structure; friable; few fine roots; clay bridges between sand grains; about 10 percent coarse fragments; neutral; clear wavy boundary.

2Bt5—49 to 56 inches; brown (10YR 4/3) gravelly clay loam; massive; friable; clay bridges between sand grains; about 30 percent coarse fragments; slight effervescence in spots; mildly alkaline; abrupt irregular boundary.

2C—56 to 80 inches; brown (10YR 5/3) very gravelly sand; single grained; loose; common light gray (10YR 7/2) coatings on weathered limestone pebbles; about 40 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to calcareous sand and gravel range from 40 to 70 inches. The thickness of the loess mantle ranges from 0 to 20 inches. The content of coarse fragments ranges from 0 to 10 percent in the A and Bt horizons and the upper part of the 2Bt horizon, from 10 to 35 percent in the lower part of the 2Bt horizon, and from 30 to 60 percent in the 2C horizon.

The Ap horizon has chroma of 2 or 3. It is typically silt loam but is loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon is clay loam, sandy clay loam, or the gravelly analogs of those textures. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is the gravelly or very gravelly analogs of sand or loamy sand.

Orrville Series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in strongly acid to slightly acid recent alluvium. Slopes are 0 to 2 percent.

Orrville soils are similar to Shoals soils and are commonly adjacent to Chili, Glenford, and Tioga soils. The well drained Chili and moderately well drained Glenford soils are on terraces. Shoals soils are less acid throughout than the Orrville soils. The well drained Tioga soils are on the wider flood plains.

Typical pedon of Orrville silt loam, occasionally flooded, about 1.4 miles northeast of Purity; in Eden Township; about 210 yards south and 190 yards east of the northwest corner of sec. 12, T. 4 N., R. 11 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common medium and many fine roots; about 1 percent coarse fragments; medium acid; clear smooth boundary.

Bg—7 to 13 inches; dark gray (10YR 4/1) silt loam; common medium distinct grayish brown (10YR 5/2) and common fine prominent reddish brown (5YR 4/4) mottles; weak fine subangular blocky structure parting to weak fine granular; friable; few medium and common fine roots; about 1 percent coarse fragments; medium acid; clear smooth boundary.

Bw1—13 to 17 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) and few fine prominent reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine roots; many distinct dark grayish brown (10YR 4/2) organic coatings in old root channels; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Bw2—17 to 25 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; many distinct dark grayish brown (10YR 4/2) organic coatings in old root channels; about 2 percent coarse fragments; strongly acid; clear smooth boundary.

Bw3—25 to 37 inches; brown (10YR 5/3) loam; common medium faint grayish brown (10YR 5/2) and common medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; friable; about 4 percent coarse fragments; strongly acid; clear smooth boundary.

C1—37 to 44 inches; brown (10YR 5/3) sandy loam; common medium distinct grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; about 4 percent coarse fragments; strongly acid; clear smooth boundary.

C2—44 to 48 inches; brown (10YR 5/3) sandy loam; many medium distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; about 2 percent coarse fragments; strongly acid; abrupt smooth boundary.

C3—48 to 60 inches; dark yellowish brown (10YR 4/4) loamy sand; massive; very friable; about 10 percent coarse fragments; medium acid.

The thickness of the solum ranges from 24 to 45 inches. The content of coarse fragments ranges from 0 to 5 percent in the A horizon, from 0 to 15 percent in the B horizon, and from 0 to 25 percent in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is dominantly loam or silt loam but has thin subhorizons of sandy loam in some pedons. The C horizon has hue of 10YR or 2.5Y and chroma of 1 to 4. It is sandy loam, loamy sand, loam, silt loam, or the gravelly analogs of those textures.

Parke Series

The Parke series consists of deep, well drained, moderately permeable soils on high outwash terraces. These soils formed in loess and the underlying Illinoian glacial outwash. Slopes range from 6 to 12 percent.

Parke soils are similar to Mentor soils and are commonly adjacent to Alford and Negley soils. Alford and Mentor soils have a lower content of sand and coarse fragments in the lower part than the Parke soils. Alford soils are commonly on terrace flats above the Parke soils. Negley soils have a higher content of sand and coarse fragments in the upper part of the solum than the Parke soils. They are on the steeper parts of side slopes, commonly downslope from the Parke soils.

Typical pedon of Parke silt loam, 6 to 12 percent slopes, eroded, about 0.5 mile west of Marne; in Madison Township; about 590 yards east and 1,060 yards north of the southwest corner of quarter township 1, T. 2 N., R. 11 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine granular structure; friable; common medium and many fine roots; some strong brown (7.5YR 5/6) subsoil material throughout; strongly acid; abrupt smooth boundary.

Bt1—7 to 16 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; friable; few medium and many fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—16 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 2 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—26 to 35 inches; strong brown (7.5YR 5/6) silt loam; weak coarse subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent coarse fragments; strongly acid; clear wavy boundary.

2Bt4—35 to 48 inches; strong brown (7.5YR 5/6) loam; weak coarse subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; gradual wavy boundary.

2Bt5—48 to 60 inches; reddish brown (5YR 4/4) gravelly sandy loam; weak coarse subangular blocky structure; very friable; clay bridges between sand grains; about 20 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 60 to more than 120 inches. The thickness of the silty mantle ranges from 20 to 40 inches. The content of coarse fragments ranges from 0 to 3 percent in the Bt horizon and from 5 to 20 percent in the 2Bt horizon.

The Bt horizon has hue of 7.5YR or 10YR and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, clay loam, sandy clay loam, sandy loam, or the gravelly analogs of those textures.

Pewamo Series

The Pewamo series consists of deep, very poorly drained, moderately slowly permeable soils formed in Wisconsinan glacial till. These soils are in depressions, on broad flats, and in small drainageways on till plains. Slopes are 0 to 2 percent.

Pewamo soils are similar to Luray soils and are commonly adjacent to Bennington and Centerburg soils. Bennington soils are somewhat poorly drained, and Centerburg soils are moderately well drained. Both of these soils are on slight rises and low knolls. Luray soils have less clay in the subsoil and a lower content of coarse fragments throughout than the Pewamo soils.

Typical pedon of Pewamo silty clay loam, about 3.5 miles northwest of Johnstown; in Monroe Township; about 160 yards south and 120 yards west of the northeast corner of sec. 6, T. 3 N., R. 15 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; many fine roots; about 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; firm; common fine roots; about 2 percent coarse fragments; slightly acid; clear smooth boundary.

Btg1—12 to 18 inches; dark gray (10YR 4/1) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; few faint dark gray (10YR 4/1) clay films on faces of peds; common faint very dark gray (10YR 3/1) organic coatings on horizontal faces of peds and many faint very dark gray (10YR 3/1) organic coatings on vertical faces; about 2 percent coarse fragments; neutral; clear smooth boundary.

Btg2—18 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint dark gray (10YR 4/1) clay films on horizontal faces of peds and many faint dark gray (10YR 4/1) clay films on vertical faces; common faint very dark gray (10YR 3/1) organic coatings on vertical faces of peds; about 2 percent coarse fragments; neutral; clear smooth boundary.

Btg3—27 to 36 inches; grayish brown (10YR 5/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint dark gray (10YR 4/1) clay films on horizontal faces of peds and patchy clay films on vertical faces; about 4 percent coarse fragments; neutral; clear wavy boundary.

Bt1—36 to 49 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct gray (10YR 5/1) and common fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint dark gray (10YR 4/1) clay films on faces of peds; about 4 percent coarse fragments; neutral; clear wavy boundary.

Bt2—49 to 55 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; few faint gray (10YR 5/1) clay films on faces of peds; about 4 percent coarse fragments; neutral; clear wavy boundary.

BC—55 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; few fine roots; about 4 percent coarse fragments; neutral.

The thickness of the solum ranges from 46 to 70 inches. The thickness of the mollic epipedon ranges from 10 to 15 inches. The content of coarse fragments ranges from 0 to 5 percent in the A horizon and from 0 to 10 percent in the Bt horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silty clay loam but is silt loam in some pedons. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. It is dominantly silty clay loam but is clay loam or silty clay in some pedons.

Rigley Series

The Rigley series consists of deep, well drained, moderately rapidly permeable soils on unglaciated ridgetops and hillsides. These soils formed in colluvium and residuum derived from weakly consolidated sandstone. Slopes range from 6 to 35 percent.

Rigley soils are commonly adjacent to Coshocton and Guernsey soils. The adjacent soils are moderately well drained. They are in positions on the landscape similar to those of the Rigley soils.

Typical pedon of Rigley fine sandy loam, 18 to 25 percent slopes, about 3.5 miles north of Brownsville; in Hopewell Township; about 1,240 yards north and 2,170 yards east of the southwest corner of quarter township 2, T. 1 N., R. 10 W.

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

E—3 to 8 inches; brown (10YR 4/3) fine sandy loam; weak medium platy structure parting to weak fine granular; very friable; common fine and medium roots; about 10 percent coarse fragments; strongly acid; clear smooth boundary.

BE—8 to 13 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; few fine and common medium roots; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt1—13 to 20 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; few fine and medium roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt2—20 to 31 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt3—31 to 43 inches; yellowish brown (10YR 5/6) sandy loam; weak coarse subangular blocky structure; very friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bt4—43 to 50 inches; brownish yellow (10YR 6/6) sandy loam; weak coarse subangular blocky structure; very friable; few fine roots; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; strongly acid; clear wavy boundary.

C—50 to 70 inches; brownish yellow (10YR 6/6) channery sandy loam; massive; very friable; about 20 percent coarse fragments; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 60 inches. The content of sandstone fragments ranges from 5 to 35 percent in the A and Bt horizons and from 10 to 60 percent in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is typically fine sandy loam but is sandy loam or channery sandy loam in some pedons. The Bt horizon is dominantly sandy loam but is loam, channery sandy loam, or channery loam in some pedons. The C horizon has value of 5 or 6 and chroma of 4 to 6. It is dominantly channery sandy loam but is sandy loam, very channery sandy loam, or channery loamy sand in some pedons.

Rush Series

The Rush series consists of deep, well drained soils on terraces. These soils formed in a mantle of loess and in the underlying Wisconsinan outwash. Permeability is moderate in the subsoil and very rapid in the substratum. Slopes are 0 to 2 percent.

Rush soils are similar to Ockley soils and are commonly adjacent to Fox soils. The mantle of loess in Ockley soils is thinner than that in the Rush soils. Fox soils are on slope breaks between different terrace levels. Their solum is thinner than that of the Rush soils.

Typical pedon of Rush silt loam, 0 to 2 percent slopes, about 1.5 miles south of Vanatta; in Newark Township; 300 yards south and 3,470 yards east of the northwest corner of quarter township 2, T. 2 N., R. 12 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

BE—10 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; few fine roots; few faint yellowish brown (10YR 5/4) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—14 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear smooth boundary.

Bt2—20 to 28 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; clear smooth boundary.

Bt3—28 to 38 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint brown (7.5YR 4/4) clay films on faces of peds; strongly acid; abrupt smooth boundary.

2Bt4—38 to 48 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 30 percent coarse fragments; strongly acid; clear smooth boundary.

2Bt5—48 to 57 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 30 percent coarse fragments; medium acid; clear smooth boundary.

2Bt6—57 to 68 inches; brown (10YR 4/3) very gravelly sandy clay loam; weak coarse subangular blocky structure; friable; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 45 percent coarse fragments; slightly acid; clear irregular boundary.

2C—68 to 80 inches; brown (10YR 5/3) very gravelly loamy sand; single grained; loose; about 55 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to calcareous sand and gravel range from 48 to 70 inches. The thickness of the loess mantle ranges from 27 to 45 inches. The content of coarse fragments ranges from 10 to 45 percent in the 2Bt horizon and from 30 to 60 percent in the 2C horizon.

The Ap horizon has 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 and 2C horizons have value of 4 or 5. The 2Bt horizon is clay loam, sandy clay loam, or the gravelly or very gravelly analogs of those textures. The 2C horizon is the gravelly or very gravelly analogs of sand or loamy sand.

Sebring Series

The Sebring series consists of deep, poorly drained, moderately slowly permeable soils formed in Wisconsinan slack-water deposits. These soils are on lake plains and on terraces along streams. Slopes are 0 to 2 percent.

The Sebring soils in this county do not have the increase in content of clay in the subsoil that is definitive for the series. This difference, however, does not affect the use or behavior of the soils.

Sebring soils are similar to Fitchville soils and are commonly adjacent to Fitchville, Glenford, and Luray soils. The somewhat poorly drained Fitchville and moderately well drained Glenford soils are in the higher positions on the landscape. The very poorly drained Luray soils are in positions on the landscape similar to those of the Sebring soils.

Typical pedon of Sebring silt loam, about 4.5 miles north of Gratiot; in Hopewell Township; about 590 yards south and 380 yards west of the northeast corner of sec. 2, T. 1 N., R. 10 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

Bg1—8 to 12 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable, common fine roots; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few medium distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; abrupt wavy boundary.

Bg2—12 to 18 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct light yellowish brown (10YR 6/4) and gray (10YR 6/1) mottles; moderate medium subangular blocky structure; friable; few fine roots; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; abrupt wavy boundary.

Bg3—18 to 23 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) and light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; abrupt wavy boundary.

Btg1—23 to 32 inches; gray (10YR 6/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few faint gray (10YR 6/1) clay films on vertical faces of peds and lining root channels; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); strongly acid; abrupt wavy boundary.

Btg2—32 to 37 inches; gray (10YR 5/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few faint gray (10YR 6/1) clay films on vertical faces of peds and lining root channels; many distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); medium acid; clear wavy boundary.

Btg3—37 to 50 inches; gray (10YR 6/1) silty clay loam; many medium prominent strong brown (7.5YR 5/6) and many medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; few faint gray (10YR 6/1) clay films and many distinct gray (10YR 6/1) silt coatings on vertical faces of peds; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); neutral; clear wavy boundary.

Cg—50 to 80 inches; gray (10YR 6/1) silt loam; many medium prominent strong brown (7.5YR 5/6) and many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; few fine distinct black (10YR 2/1) stains (iron and manganese oxide); neutral.

The thickness of the solum ranges from 35 to 55 inches. The content of coarse fragments ranges from 0 to 3 percent in the Bg and Btg horizons and from 0 to 5 percent in the C horizon.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. The Bg and Btg horizons have hue of 10YR or 2.5Y and value of 4 to 6. They have chroma of 1 or 2 within a depth of 30 inches and chroma of 1 to 6 below a depth of 30 inches. They are typically silt loam or silty clay loam, but some pedons have thin strata of loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is stratified. It is dominantly silt loam, but some pedons have strata of silty clay loam, loam, or sandy loam.

Shoals Series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in slightly acid to mildly alkaline recent alluvium. Slopes are 0 to 2 percent.

Shoals soils are similar to Orrville soils and are commonly adjacent to Sloan and Stonelick soils. Orrville soils are more acid throughout than the Shoals soils. The very poorly drained Sloan soils are commonly in high water channels and other low areas. The well drained Stonelick soils are commonly adjacent to stream channels.

Typical pedon of Shoals silt loam, occasionally flooded, about 6 miles north of Johnstown; in Hartford Township; about 610 yards north and 1,960 yards west of the southeast corner of quarter township 1, T. 4 N., R. 15 W.

Ap—0 to 13 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; about 1 percent coarse fragments; neutral; abrupt smooth boundary.

C1—13 to 20 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine roots; many distinct gray (10YR 5/1) silt coatings on faces of peds; about 1 percent coarse fragments; neutral; clear wavy boundary.

C2—20 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few fine roots; many distinct gray (10YR 5/1) silt coatings on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 1 percent coarse fragments; neutral; clear wavy boundary.

C3—28 to 36 inches; yellowish brown (10YR 5/4) loam; many medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; many distinct grayish brown (10YR 5/2) silt coatings on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 2 percent coarse fragments; neutral; gradual wavy boundary.

C4—36 to 47 inches; yellowish brown (10YR 5/4) loam; many medium distinct gray (10YR 5/1) mottles; massive; friable; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 2 percent coarse fragments; mildly alkaline; clear wavy boundary.

C5—47 to 56 inches; gray (10YR 5/1) loam; many medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; common coarse distinct black (10YR 2/1) stains (iron and manganese oxide); about 4 percent coarse fragments; mildly alkaline; clear wavy boundary.

C6—56 to 60 inches; gray (10YR 5/1) gravelly loam; many medium distinct yellowish brown (10YR 5/4) mottles; massive; friable; about 20 percent coarse fragments; mildly alkaline.

The Ap horizon has value of 4 or 5. The part of the C horizon within a depth of 40 inches has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silt loam, silty clay loam, loam, or clay loam. The part of the C horizon below a depth of 40 inches has chroma of 1 to 4. It is loam, silt loam, sandy loam, or the gravelly analogs of those textures.

Sleeth Series

The Sleeth series consists of deep, somewhat poorly drained soils on terraces. These soils formed in Wisconsinan glacial outwash. Permeability is moderate in the solum and very rapid in the substratum. Slopes are 0 to 2 percent.

Sleeth soils are commonly adjacent to Algiers, Ockley, and Westland soils. Algiers soils formed in recent alluvium underlain by a buried soil. They are on flood plains. The well drained Ockley soils are on slight rises, knolls, and side slopes. The very poorly drained Westland soils are on flats and in depressions.

Typical pedon of Sleeth silt loam, 0 to 2 percent slopes, about 0.6 mile southwest of Luray; in Union Township; about 400 yards south and 100 yards west of the northeast corner of sec. 8, T. 17 N., R. 18 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine roots; about 5 percent coarse fragments; medium acid; abrupt smooth boundary.

BE—9 to 12 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; common faint grayish brown (10YR 5/2) silt coatings on faces of peds; about 10 percent coarse fragments; medium acid; abrupt smooth boundary.

Bt1—12 to 15 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine roots; few faint grayish brown (10YR 5/2) clay films on faces of peds; many distinct grayish brown (10YR 5/2) coatings on faces of peds; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; slightly acid; clear smooth boundary.

Bt2—15 to 24 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct yellowish brown (10YR 5/6) and common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint grayish brown (10YR 5/2) clay films on faces of peds; many distinct grayish brown (10YR 5/2) coatings on faces of peds; about 10 percent coarse fragments; slightly acid; clear smooth boundary.

Btg1—24 to 32 inches; dark grayish brown (10YR 4/2) gravelly clay loam; common medium distinct yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 20 percent coarse fragments; slightly acid; clear smooth boundary.

Btg2—32 to 42 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam; common fine distinct yellowish brown (10YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; about 20 percent coarse fragments; slightly acid; gradual smooth boundary.

BCg—42 to 55 inches; grayish brown (10YR 5/2) gravelly sandy clay loam; common fine distinct yellowish brown (10YR 5/4) and many fine faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; very few faint dark grayish brown (10YR 4/2) clay films on vertical faces of peds; about 20 percent coarse fragments; neutral; abrupt wavy boundary.

Cg—55 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grained; loose; about 20 percent coarse fragments; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. It is generally the same as the depth to calcareous sand and gravel. The content of coarse fragments ranges from 2 to 7 percent in the Ap horizon, from 5 to 10 percent in the upper part of the Bt horizon, from 10 to 30 percent in the lower part of the Bt horizon, and from 20 to 40 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. The Bt horizon has chroma of 1 to 4. It is clay loam, loam, or silty clay loam in the upper part and clay loam, loam, sandy clay loam, or the gravelly analogs of those textures in the lower part. The C horizon has value of 4 or 5 and chroma of 2 or 3. It is sand, loamy coarse sand, or the gravelly or very gravelly analogs of those textures.

Sloan Series

The Sloan series consists of deep, very poorly drained, moderately permeable or moderately slowly permeable soils on flood plains. These soils formed in recent alluvium. Slopes are 0 to 2 percent.

Sloan soils are commonly adjacent to Medway and Shoals soils. The adjacent soils are in the slightly higher positions on flood plains. Medway soils are moderately well drained, and Shoals soils are somewhat poorly drained.

Typical pedon of Sloan silt loam, frequently flooded, about 2.1 miles east of Alexandria, in St. Albans Township; 850 yards north and 210 yards west of the southeast corner of quarter township 1, T. 2 N., R. 14 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common fine roots; about 2 percent coarse fragments; slightly acid; abrupt smooth boundary.

A1—9 to 14 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; few fine roots; about 2 percent coarse fragments; slightly acid; clear smooth boundary.

A2—14 to 19 inches; very dark gray (10YR 3/1) clay loam, grayish brown (10YR 5/2) dry; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 4 percent coarse fragments; slightly acid; clear smooth boundary.

Bg1—19 to 24 inches; dark gray (10YR 4/1) loam; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; common faint very dark gray (10YR 3/1) organic coatings on vertical faces of peds; common fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; slightly acid; clear smooth boundary.

Bg2—24 to 31 inches; dark grayish brown (10YR 4/2) loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; common fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; slightly acid; clear smooth boundary.

Bg3—31 to 36 inches; dark grayish brown (10YR 4/2) loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; few fine roots; common fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 5 percent coarse fragments; neutral; abrupt smooth boundary.

Cg1—36 to 42 inches; dark grayish brown (10YR 4/2) gravelly loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; common fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 20 percent coarse fragments; neutral; abrupt smooth boundary.

Cg2—42 to 60 inches; gray (10YR 5/1) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; common fine distinct black (10YR 2/1) stains (iron and manganese oxide); about 1 percent coarse fragments; neutral.

The thickness of the solum ranges from 30 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 24 inches. The content of coarse fragments ranges from 0 to 5 percent in the Ap and Bg horizons and from 0 to 20 percent in the Cg horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is typically silt loam but is silty clay loam in some pedons. The B horizon has hue of 10YR or 2.5Y and value of 4 or 5. It is loam, silty clay loam, clay loam, or silt loam. The C horizon has hue of 10YR or 2.5Y. It is stratified silt loam, loam, clay loam, silty clay loam, sandy loam, or the gravelly analogs of those textures.

Stonelick Series

The Stonelick series consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in stratified, calcareous recent alluvium. Slopes are 0 to 2 percent.

Stonelick soils are similar to Tioga soils and are commonly adjacent to Shoals and Sloan soils. Shoals soils are somewhat poorly drained, and Sloan soils are very poorly drained. Both of these soils are commonly on narrow flood plains and in low areas on wide flood plains. Tioga soils are more acid throughout than the Stonelick soils.

Typical pedon of Stonelick loam, occasionally flooded, about 1 mile southwest of Marne; in Madison Township; 640 yards south and 1,030 yards east of the northwest corner of quarter township 4, T. 2 N., R. 11 W.

Ap—0 to 9 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine and medium roots; about 5 percent coarse fragments; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—9 to 14 inches; brown (10YR 4/3) loam; massive; friable; common fine and few medium roots; about 5 percent coarse fragments; slight effervescence; mildly alkaline; clear smooth boundary.

C1—14 to 26 inches; dark yellowish brown (10YR 4/4) fine sandy loam; massive; friable; few fine roots; about 5 percent coarse fragments; thin strata of loam; slight effervescence; mildly alkaline; clear smooth boundary.

C2—26 to 43 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; very friable; few fine roots; about 2 percent coarse fragments; thin strata of loam; strong effervescence; moderately alkaline; abrupt smooth boundary.

C3—43 to 60 inches; dark yellowish brown (10YR 4/4), stratified silt loam, fine sandy loam, and loamy sand; generally massive but single grained in the loamy sand; generally very friable but loose in the loamy sand; about 2 percent coarse fragments; strong effervescence; moderately alkaline.

The content of coarse fragments ranges from 0 to 10 percent in the Ap horizon, from 0 to 20 percent in the part of the C horizon within a depth of 40 inches, and from 0 to 60 percent below a depth of 40 inches. The Ap and A horizons have chroma of 2 or 3. They are typically loam but are silt loam or sandy loam in some pedons. The C horizon has chroma of 2 to 4. It is stratified loam, silt loam, fine sandy loam, sandy loam, sand, loamy sand, or the gravelly or very gravelly analogs of those textures.

Tioga Series

The Tioga series consists of deep, well drained soils on flood plains. These soils formed in loamy and sandy recent alluvium. Permeability is moderate or moderately rapid in the subsoil and rapid in the substratum. Slopes are 0 to 2 percent.

Tioga soils are similar to Stonelick soils and are commonly adjacent to Chili and Orrville soils. Chili soils have an argillic horizon. They are on terraces at the higher elevations. The somewhat poorly drained Orrville soils are on narrow flood plains and in the slightly lower positions on wide flood plains. Stonelick soils are calcareous throughout.

Typical pedon of Tioga fine sandy loam, occasionally flooded, about 1.8 miles northwest of Hanover; in Perry Township; 460 yards north and 850 yards east of the southwest corner of sec. 25, T. 3 N., R. 10 W.

Ap—0 to 8 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common medium and few fine roots; about 2 percent coarse fragments; medium acid; abrupt smooth boundary.

Bw1—8 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; very friable; few fine roots; about 2 percent coarse fragments; thin strata of sandy loam; medium acid; clear smooth boundary.

Bw2—17 to 23 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; very friable; few fine roots; about 2 percent coarse fragments; thin strata of sandy loam; medium acid; abrupt smooth boundary.

C—23 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy sand; single grained; loose; few fine roots; about 45 percent coarse fragments; medium acid.

The thickness of the solum ranges from 20 to 40 inches. The content of coarse fragments ranges from 0 to 15 percent in the Ap and B horizons and from 0 to 60 percent in the C horizon.

The Ap horizon has chroma of 2 or 3. It is typically fine sandy loam but is silt loam in some pedons. The B horizon has hue of 7.5YR or 10YR and chroma of 2 to 4. It is dominantly fine sandy loam, loam, or silt loam, but some pedons have individual subhorizons of loamy sand or sandy loam. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is stratified loam, silt loam, sandy loam, loamy sand, or the gravelly or very gravelly analogs of those textures.

Titusville Series

The Titusville series consists of deep, moderately well drained, slowly permeable soils on till plains. These soils have a fragipan. They formed in Illinoian glacial till. Slopes range from 2 to 12 percent.

Titusville soils are similar to Clarksburg and Homewood soils and are commonly adjacent to Brownsville and Homewood soils. Brownsville soils have a higher content of coarse fragments throughout than the Titusville soils. They are on hillsides and ridgetops, commonly at the higher elevations. Clarksburg and Homewood soils do not have low-chroma mottles within the upper 10 inches of the argillic horizon. Clarksburg soils typically have a higher content of coarse fragments in the lower part of the subsoil and in the substratum than the Titusville soils. Homewood soils are on ridgetops and dissected hillsides.

Typical pedon of Titusville silt loam, 2 to 6 percent slopes, about 4.5 miles northeast of St. Louisville; in Eden Township; about 110 yards south and 730 yards west of the northeast corner of sec. 17, T. 4 N., R. 11 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and common medium roots; about 5 percent coarse fragments; slightly acid; abrupt smooth boundary.

BE—9 to 14 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; few faint brown (10YR 5/3) silt coatings on vertical faces of peds; about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt1—14 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt2—18 to 23 inches; yellowish brown (10YR 5/6) silt loam; few fine prominent grayish brown (10YR 5/2) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent coarse fragments; medium acid; clear smooth boundary.

Bt3—23 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (2.5Y 6/2) and many medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; many faint light brownish gray (10YR 6/2) clay films and silt coatings on vertical prism faces; few faint yellowish brown (10YR 5/4) clay films on faces of peds; about 10 percent coarse fragments; medium acid; abrupt smooth boundary.

Btx1—28 to 35 inches; yellowish brown (10YR 5/6) gravelly loam; common medium prominent light brownish gray (2.5Y 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm; brittle; few fine roots between vertical prism faces; many faint light brownish gray (10YR 6/2) clay films along vertical prism faces; many medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 20 percent coarse fragments; strongly acid; clear smooth boundary.

Btx2—35 to 48 inches; yellowish brown (10YR 5/6) clay loam; common medium prominent light brownish gray (2.5Y 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium platy; very firm; brittle; few fine roots between vertical prism faces; many faint light brownish gray (10YR 6/2) clay films along vertical prism faces; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; strongly acid; clear smooth boundary.

BC—48 to 54 inches; yellowish brown (10YR 5/6) loam; common medium prominent light brownish gray

(2.5Y 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; common medium distinct black (10YR 2/1) stains (iron and manganese oxide); about 10 percent coarse fragments; medium acid; gradual wavy boundary.

C—54 to 80 inches; yellowish brown (10YR 5/6) loam; few medium prominent light brownish gray (2.5Y 6/2) and few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; about 10 percent coarse fragments; slightly acid.

The thickness of the solum ranges from 50 to 90 inches. Depth to the fragipan ranges from 18 to 28 inches. The content of coarse fragments ranges from 5 to 10 percent in the Bt horizon and from 5 to 20 percent in the Btx and C horizons.

The Ap horizon has chroma of 2 or 3. The Bt and Btx horizons have value of 4 to 6 and chroma of 3 to 6. The Bt horizon is silt loam, silty clay loam, loam, or clay loam. The Btx horizon is loam, clay loam, or the gravelly analogs of those textures. The C horizon has value of 4 or 5 and chroma of 3 to 6. It is dominantly loam or clay loam but in some pedons is the gravelly analogs of those textures.

Wallkill Series

The Wallkill series consists of deep, very poorly drained soils on flood plains. These soils formed in recent alluvium and in the underlying organic material over lacustrine clay. Permeability is moderate in the upper silty material and slow in the underlying clay. Slopes are 0 to 2 percent.

The Wallkill soils in this county have a lower content of sand in the subsoil than is definitive for the series. This difference, however, does not affect the use or behavior of the soils.

Wallkill soils are commonly adjacent to Algiers and Carlisle soils. Algiers soils formed in recent alluvium over a buried mineral soil. They are on broad flats. Carlisle soils are organic throughout. They are on till plains, outwash terraces, and lake plains.

Typical pedon of Wallkill silt loam, clayey substratum, frequently flooded, about 1.5 miles southwest of Luray; in Union Township; about 130 yards east and 475 yards north of the southwest corner of sec. 8, T. 17 N., R. 18 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine and medium roots; about 1 percent coarse fragments; slightly acid; clear smooth boundary.

Bg—7 to 15 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; friable; common fine and few medium roots; about 1 percent coarse fragments; neutral; clear smooth boundary.

Cg—15 to 24 inches; dark grayish brown (10YR 4/2) silt loam; few fine prominent yellowish red (5YR 4/6) and common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine roots; about 1 percent coarse fragments; neutral; abrupt irregular boundary.

2Oa—24 to 42 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 5 percent fiber when broken, 2 percent rubbed and pressed; moderate medium platy structure; friable, slightly sticky; few fine roots; neutral; clear smooth boundary.

3C—42 to 50 inches; organic-rich clay, black (10YR 2/1) broken face and rubbed; about 1 percent fiber when broken; massive; slightly sticky; slightly acid; clear smooth boundary.

3Cg—50 to 80 inches; gray (10YR 5/1) clay; massive; very sticky; slightly acid.

The thickness of the recent alluvium ranges from 16 to 40 inches. The Ap horizon has chroma of 1 or 2. The Bg and Cg horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. They are silt loam or silty clay loam. The 2Oa horizon has hue of 7.5YR or 10YR or is neutral in hue. It has chroma of 0 to 2.

Westland Series

The Westland series consists of deep, very poorly drained soils formed in Wisconsinan glacial outwash. These soils are on outwash terraces. Permeability is moderate in the solum and very rapid in the substratum. Slopes are 0 to 2 percent.

Westland soils are similar to Crane soils and are commonly adjacent to Crane, Ockley, and Sleeth soils. The somewhat poorly drained Crane soils are on broad flats and in depressions. The well drained Ockley soils are on flats, slight rises, knolls, and side slopes. The somewhat poorly drained Sleeth soils are on flats and slight rises.

Typical pedon of Westland silty clay loam, about 0.7 mile south of Hebron; in Union Township; about 860 yards south and 60 yards east of the northwest corner of sec. 11, T. 17 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; firm; many fine roots; about 3 percent coarse fragments; medium acid; abrupt smooth boundary.

A—8 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to moderate fine granular; firm; common fine roots; about 5 percent coarse fragments; slightly acid; clear wavy boundary.

Btg1—15 to 19 inches; dark gray (10YR 4/1) clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; few distinct very dark gray (10YR 3/1) clay films on faces of peds; many distinct black (10YR 2/1) organic coatings on vertical faces of peds; about 5 percent coarse fragments; neutral; clear wavy boundary.

Btg2—19 to 24 inches; gray (10YR 5/1) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few distinct dark gray (10YR 4/1) clay films on faces of peds; many distinct black (10YR 2/1) organic coatings on vertical faces of peds; about 10 percent coarse fragments; neutral; clear wavy boundary.

Btg3—24 to 29 inches; gray (10YR 5/1) clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few faint dark gray (10YR 4/1) clay films on faces of peds; few distinct black (10YR 2/1) organic coatings on vertical faces of peds; about 10 percent coarse fragments; neutral; clear wavy boundary.

Btg4—29 to 42 inches; gray (10YR 5/1) loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few faint gray (10YR 5/1) clay films on faces of peds; about 10 percent coarse fragments; neutral; clear smooth boundary.

BCg—42 to 55 inches; dark gray (10YR 4/1) gravelly sandy loam; weak coarse subangular blocky structure; very friable; about 30 percent coarse fragments; neutral; gradual smooth boundary.

Cg—55 to 60 inches; dark gray (10YR 4/1) very gravelly loamy coarse sand; single grained; loose; about 40 percent coarse fragments; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to calcareous sand and gravel range from 40 to 60 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The content of coarse fragments ranges from 0 to 3 percent in the Ap horizon, from 0 to 5 percent in the upper part of the Btg horizon, from 5 to 15 percent in the lower part of the Btg horizon, and from 30 to 50 percent in the C horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is typically silty clay loam but is silt loam in some pedons. The Btg horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. The upper part of this horizon is dominantly clay loam, but in some pedons it is loam or silty clay loam. The lower part is dominantly loam or clay loam, but in some pedons it is sandy clay loam. The C horizon has value of 4 or 5 and chroma of 1 to 4. It is the gravelly or very gravelly analogs of loamy coarse sand or coarse sand.

Formation of the Soils

This section relates the factors of soil formation to the soils in Licking County and explains the processes of soil formation.

Factors of Soil Formation

A soil is a three-dimensional natural body consisting of mineral and organic material that can support plant growth. The nature of any soil at a given site is the result of the interaction of five general factors—parent material, climate, plants and animals, relief, and time. Climate and plants and animals have an effect on parent material that is modified by relief over time. Theoretically, if all these factors were identical at different sites, the soils at these sites would be identical. Differences among the soils are caused by variations in one or more of these factors.

Parent Material

Parent material is the raw material acted on by the soil-forming processes. It largely determines soil texture, which, in turn, affects other properties, such as natural soil drainage and permeability. The physical and chemical composition of parent material has an important effect on the kind of soil that forms.

The soils in Licking County formed in many different kinds of parent material. Many of the soils formed in material deposited by the glaciers that covered much of the survey area thousands of years ago or by the meltwater from these glaciers. Other soils formed in loess, or silty windblown material, or in alluvium, which is material recently deposited by streams. In unglaciated areas, the soils formed in material that was either weathered from bedrock in place or moved by gravity. A few soils formed in organic material that resulted from the slow accumulation of plant residue in marshes or ponds over thousands of years.

Glacial till is material that was deposited directly by glacial ice with little or no water action. It typically has particles that vary in size, including sand, silt, clay, and some pebbles, cobblestones, and larger coarse fragments. The smaller coarse fragments generally are angular. The composition of the till depends on the nature of the area over which the ice passed before the till was deposited. Some of the material was transported great distances by the ice, but most of the till was of local origin. Most of the till in the western and west-central parts of the county was deposited during the latest major glaciation, the Wisconsinan Glaciation. Most of the till in the east-central and eastern parts of the county was deposited during an earlier major glaciation, the Illinoian Glaciation.

The glacial till plains in Licking County are either ground moraines or end moraines. The soils that formed in these two types of deposits have different properties, reflecting variations in the method and rate of till deposition.

Till deposits on ground moraines generally are massive, compact, and dense. They make up the nearly level and gently undulating till plains in Licking County. The soils that formed in this kind of till generally are compact and are slowly or moderately slowly permeable. Bennington, Condit, and Pewamo soils typically formed in ground moraine till of Wisconsinan age. Homewood and Titusville soils formed in ground moraine till of Illinoian age.

Till deposits on end moraines can vary more in texture than those on ground moraines. In some areas they are stratified and tend to be less dense. They make up the moderately rolling bands of ridges that trend in a roughly north-south direction through the central part of the county. The soils that formed in this kind of till generally are less compact and more permeable than the soils on ground moraines. Amanda and Centerburg soils typically formed in till of Wisconsinan age on end moraines. Homewood soils and, in some areas, Negley soils formed in till of Illinoian age on end moraines.

Outwash deposits, laid down by moving water, and lacustrine deposits, laid down in still water, are two general kinds of meltwater deposits. The size of the particles that can be carried suspended in water depends on the speed of the moving water. When the water slows to a given speed, the suspended particles that are larger than a given size will settle in the water. Water slows wherever a stream loses grade or flows into a body of still water. At that time, the coarser sand and gravel particles settle near the mouth of the stream and the silt and fine clay particles are carried farther into the lake, where they slowly settle.

The soils that formed in outwash deposits are of moderate extent in Licking County. They formed in deposits laid down as surging meltwater poured from the glacier, depositing sand and gravel as outwash terraces, deltas, kames, and kame terraces. The meltwater washed away the smaller particles of silt and clay, leaving behind sand and gravel. The soils that formed in outwash generally are permeable. Outwash of both Wisconsinan age and Illinoian age is deposited in Licking County.

The amount of natural lime and the proportion of shale, sandstone, limestone, and igneous pebbles in the glacial outwash are determined by the source of the outwash. The Wisconsinan outwash deposits along the major terraces in Licking County were derived from limestone-influenced glacial drift. Ockley and Westland soils formed in limy glacial outwash of Wisconsinan age. Some Wisconsinan outwash deposits along terraces in the eastern part of the county were derived from drift that was influenced very little by limestone. Chili soils typically formed in the more acid Wisconsinan outwash that was significantly influenced by sandstone and was influenced very little by limestone.

The older Illinoian outwash is deposited at higher elevations than the Wisconsinan outwash. The outwash deposits generally have a mantle of loess. The thickness of the loess on the outwash terraces varies inversely with the slope. The nearly level to sloping Alford soils formed in a thick deposit of loess. The sloping Parke soils formed in thinner deposits of loess, partly because of erosion. The sloping to very steep Negley soils formed in sandy or gravelly deposits in areas where the loess mantle is very thin or does not occur.

Soils that formed in lacustrine deposits are of relatively minor extent throughout Licking County, although they are locally extensive in places. They formed in deposits laid down in scattered old glacial or post-glacial lakes. Fitchville, Glenford, Luray, Mentor, and Sebring soils formed in these silty deposits.

Loess is wind-deposited soil material. Soils that formed in loess are of minor extent throughout Licking County, although they are locally extensive in the east-central and southeastern parts. The loess was deposited as the outwash terraces were forming. Strong winds swept across these open, level terraces, picked up silt particles, and later deposited them, commonly on landforms at higher elevations. Alford and Parke soils formed mainly in loess that was deposited on high Illinoian outwash terraces. In the southeastern part of the county, Alford soils also formed in thick deposits of loess deposited over till or residuum. Cincinnati soils formed in thinner deposits of loess and in Illinoian till.

Soils that formed in colluvium and in material weathered from sedimentary rocks are extensive in the central and eastern parts of the county. Generally, coarse grained sandstone weathers to coarse sand or medium sand, the finer grained sandstone or siltstone weathers to material that ranges from fine sand or very fine sand to silt, and shale weathers to clay. The degree of cementation of individual rock fragments affects the content of coarse fragments in the soils. Brownsville soils formed in material weathered from strongly cemented, fine grained sandstone or siltstone of the Logan Formation. These soils generally have a silty fine-earth texture and a high content of channers.

Some areas in the central part of the county were glaciated, but the glacier had little or no influence on soil morphology, especially on the steeper slopes. Coshocton soils formed in material weathered from interbedded acid shale and siltstone of the Pottsville Formation. Rigley soils formed in material weathered from weakly cemented, coarse grained sandstone of the Pottsville Formation. Hazleton soils generally formed in material weathered from Blackhand Sandstone of the Cuyahoga Formation. In areas on Flint Ridge, Guernsey soils formed in material weathered from limestone-influenced clay shale and Frankstown Variant soils formed in material weathered partly from flint.

Recent alluvium is soil material deposited by floodwater along streams. The texture of the soil material varies, depending on the speed of the floodwater, the duration of flooding, and the distance from the streambank. Soils that formed in recent alluvium can be highly stratified. The soil horizons are weakly expressed because the soil-forming processes are interrupted with each new deposition. The source of the alluvium generally is material eroded from other soils farther upstream in the watershed. Medway, Shoals, Sloan, and Stonelick soils formed in slightly acid to calcareous recent alluvium derived from soils that formed in limy Wisconsinan glacial till and outwash. Orrville and Tioga soils formed in more acid alluvium derived from soils that formed in colluvium and residuum and in Illinoian till and outwash. Algiers, Killbuck, and Wallkill soils formed in recent alluvium over an older dark soil that was buried by the alluvium.

Organic soils formed in decomposed plant material that accumulated under water when ponds were filling with water. Ponds and marshes naturally age as they fill with organic material derived from algae, sedges, rushes, and other water-tolerant plants. The plant residue accumulates because the permanently wet condition of the soils prevents oxidation and slows decomposition. Freshly exposed organic material commonly has a reddish brown color that rapidly turns black when the material is exposed to the air. Carlisle soils and the lower part of Wallkill soils formed in decomposed plant material.

Climate

The climate in Licking County has significantly affected the soil-forming processes. Climatic factors, such as precipitation and temperature, have influenced the existing plant and animal communities and the physical and chemical weathering of the parent material.

During the colder glacial epoch, the advancing glaciers spread over the glaciated part of the county and buried the boreal forest and the underlying soils. The cold temperatures in the soil reduced the rate of chemical reactions in the existing soils and in the raw parent material *(27)*. Increased frost action, resulting from a periglacial climate, caused frost churning in some soils *(8)*. Strong winds swept across the recently deposited glacial parent material, which was largely devoid of vegetation, and carried away large amounts of silt-sized particles, which were later deposited as loess. When the glacial ice retreated and the climate gradually warmed, deciduous forests eventually succeeded the boreal vegetation. The vegetation of Cranberry Island is a relict of this age.

The county currently has a humid, temperate climate, which has persisted for thousands of years. In this climatic environment, physical and chemical weathering of the parent material can occur along with the accumulation of organic matter, the decomposition of minerals, the formation and translocation of clay, the leaching of soluble compounds, and alternating periods of freezing and thawing.

The microclimate in a given area can affect soil formation. Pewamo soils, which are in depressional or low lying areas, receive runoff from the higher adjacent slopes. The runoff creates a wet microclimate that results in prolonged saturation, the reduction of iron, and a gray subsoil. Sloping soils, such as Amanda soils, formed under a drier microclimate because of runoff. This better external drainage results in better aeration, the oxidation of iron, and a yellowish brown subsoil. Through its effect on the amount of sunlight and heat energy reaching the soil, the trees that grow on the soil, and the accumulation of organic matter in the soil, aspect also affects the microclimate.

Plants and Animals

The vegetation under which a soil forms influences soil properties, such as color, structure, reaction, and content and distribution of organic matter. Vegetation extracts water from the soil, recycles nutrients, and adds organic matter to the soil. Gases derived from root respiration combine with water to form acids that influence the weathering of minerals. Because of a lower content of organic matter, soils that formed under forest vegetation are generally lighter colored than those that formed under grasses.

At the time Licking County was settled, the native vegetation consisted mainly of hardwood forests. Red oak, white oak, sugar maple, and American beech commonly grew on the better drained soils on the Wisconsinan till plains. Pin oak, shagbark hickory, red maple, American elm, and white ash were common on the wetter soils on these till plains. White oak, red oak, hickory, and dogwood were common on the Illinoian till plains and in unglaciated areas. Water-tolerant reeds and sedges, willow, tamarack, and alder grew in scattered small fens or marshes.

Bacteria, fungi, and many other micro-organisms decompose organic matter and release nutrients to growing plants. They influence the formation of peds. Soil properties, such as drainage, temperature, and reaction, influence the type of micro-organisms that live in the soil. Fungi are generally more active in the more acid soils, while bacteria are more active in the less acid soils.

Earthworms, insects, and small burrowing animals mix the soil and create small channels that influence soil aeration and the percolation of water. Earthworms help to incorporate crop residue or other organic material into the soil. The organic material improves tilth. In areas that are well populated with earthworms, the leaf litter that accumulates on the soil in the fall is generally incorporated into the soil by the following spring. If the earthworm population is low, part of the leaf fall can remain on the surface of the soil for several years.

Human activities have significantly influenced soil formation. Native forests have been cleared and developed for farming and other uses. Cultivation has accelerated erosion on sloping soils, wet soils have been drained, and manure, lime, chemical fertilizer, and pesticides have been applied in cultivated areas. Cultivation has affected soil structure and compaction and lowered the content of organic matter. The development of land for urban uses or for mining has significantly influenced the soils in some areas.

Relief

Relief influences soil formation mainly through its effect on runoff and erosion. To a lesser extent, it also influences soil temperature, the plant cover, depth to the water table, and the accumulation and removal of organic matter.

Because it causes differences in external soil drainage, relief can differentiate soils that formed in the same kind of parent material. Water that runs off the more sloping soils can collect in depressions or swales. Amanda and Pewamo soils both formed in loamy till. The sloping to steep Amanda soils on knolls and side slopes are well drained. They are in areas where external drainage is good. The nearly level Pewamo soils are very poorly drained. They are in swales or depressions that receive runoff from the higher adjacent soils, such as Amanda soils.

Relief varies greatly in Licking County. On the ground moraines in the western part of the county, the soils generally are nearly level to gently undulating. Relief becomes more pronounced in the central part of the county, where undulating to rolling, dissected end moraines grade to the western edge of the Allegheny Plateau. Relief becomes even more pronounced in the eastern part of the county, in the unglaciated section of the Allegheny Plateau, where relief from the ridgetops to the flood plains can be about 250 to 300 feet.

Time

The length of time that the parent material has been exposed to soil-forming processes influences the nature of the soil that forms. The youngest soils in Licking County, such as Melvin, Orrville, Shoals, Stonelick, and Tioga soils, formed in recent alluvium. These soils can be stratified and have weakly expressed horizons because the soil-forming processes are interrupted with each new deposition.

Glaciers advanced over much of Licking County during the Wisconsinan Glaciation and the Illinoian Glaciation, possibly as much as 100,000 years apart. Glacial deposits of Wisconsinan age are geologically young, yet enough time has elapsed for the initially raw parent material to weather into soils that have distinct horizons. In most of the soils, including Amanda, Bennington, and Centerburg soils, carbonates have been leached to a depth of about 3 to 5 feet, clay has been translocated from the A horizon to the B horizon, and organic matter has accumulated in the A horizon.

Glacial deposits of Illinoian age are significantly older than those of Wisconsinan age. The soils that formed in Illinoian glacial drift, such as Cincinnati, Homewood, and Titusville soils, typically are more highly weathered or leached than the soils that formed in Wisconsinan till. Also, they have a thicker solum.

The residuum and some of the colluvium associated with the Allegheny Plateau are among the oldest of the parent materials in the county. Soils that formed in these parent materials have weakly expressed to well expressed horizons, depending on the nature of the parent material. Brownsville soils formed in colluvium and material weathered from resistant siltstone or fine grained sandstone. They have weakly expressed horizons. Coshocton soils formed in colluvium and residuum derived from softer shale and siltstone. They have well expressed horizons.

Processes of Soil Formation

Soil forms through complex processes that are grouped into four general categories. These are additions, removals, transfers, and transformations *(18)*. These processes affect soil formation, although in differing degrees.

The accumulation of organic matter in the A horizon of the mineral soils in Licking County is an example of an addition. This accumulation is the main reason for the dark color of the A horizon. The color of the raw parent material is uniform with increasing depth.

The leaching of lime from the upper 2 to 4 feet or more in many of the soils in Licking County that formed in till is an example of a removal. The parent material of these soils was initially limy, but the lime has been leached from the upper part of the profile by percolating water.

The translocation of clay from the A horizon to the B horizon in many soils on uplands in the county is an example of a transfer. The A horizon or an E horizon is a zone of eluviation, or loss. The B horizon is a zone of illuviation, or gain. In Bennington, Centerburg, and other soils, the B horizon has more clay than the parent material and the A horizon has less clay. In the B horizon of some soils, thin clay films are in pores and on faces of peds. This clay has been transferred from the A horizon.

An example of a tranformation is the reduction and solubilization of ferrous iron. This process takes place under wet, saturated conditions in which there is no molecular oxygen. Gleying, or the reduction of iron, is evident in Condit, Luray, and Pewamo soils, which have a dominantly gray subsoil. The gray color indicates the presence of reduced ferrous iron, which, in turn, implies wetness. Reduced iron is soluble, but it commonly has been moved short distances in the soils in Licking County, stopping either in the horizon where it originated or in an underlying horizon. Part of this iron can be reoxidized and segregated in the form of stains, concretions, or bright yellow and red mottles.

References

(1) Allan, P.F., L.E. Garland, and R. Dugan. 1963. Rating northeastern soils for their suitability for wildlife habitat. 28th North Am. Wildl. Nat. Resour. Conf. Wildl. Manage. Inst., pp. 247-261, illus.

(2) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(3) American Society for Testing and Materials. 1988. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(4) Carmean, Willard H. 1967. Soil survey refinements for predicting black oak site quality in southeastern Ohio. Soil Sci. Soc. Am. Proc. 31: 805-810, illus.

(5) Carter, Homer L., and George A. Hanuschak. 1985. Ohio agricultural statistics—1984. Ohio Crop Rep. Serv., Agdex 100/850, 58 pp., illus.

(6) Dennis, Donald D., and Thomas W. Birch. 1981. Forest statistics for Ohio—1979. U.S. Dep. Agric., Forest Service Resour. Bull. NE-68, 79 pp., illus.

(7) Dove, George D. 1960. Water resources of Licking County, Ohio. Bull. 36, 96 pp., illus.

(8) Everett, K.R., G.F. Hall, and L.P. Wilding. 1970. Wisconsin-age cryoturbation features in central Ohio. Geol. Soc. of Am. Bull. 82: 1407-1410, illus.

(9) Forsyth, Jane L. 1961. Dating Ohio's glaciers. Ohio Dep. of Nat. Resour., Div. of Geol. Surv., Inf. Circ. 30, 9 pp., illus.

(10) Forsyth, Jane L. 1966. Glacial map of Licking County, Ohio. Ohio Dep. of Nat. Resour., Div. of Geol. Surv., Rep. of Invest. 59.

(11) Franklin, George J. Geology of Licking County, Ohio. Unpublished Ph.D. dissertation, Ohio State Univ., 1961. 483 pp., illus.

(12) Fullerton, David S. 1986. Stratigraphy and correlation of glacial deposits from Indiana to New York to New Jersey. Quaternary Sci. Rev. 5: 23-37, illus.

(13) Hartzell, Glenn W. 1982. Ground-water resources of Licking County. Ohio Dep. of Nat. Resour., Div. of Water, 1 page map.

(14) Havlicek, Joseph, Jr., Homer L. Carter, and George Hanuschak. 1985. 1984 Ohio farm income. Ohio Agric. Res. and Dev. Cent., Dep. Ser. E.S.O. 1134, 26 pp., illus.

(15) Howe, Henry. 1896. Historical collections of Ohio. Vol. 2, 911 pp., illus.

(16) Miller, Fred P., D.E. McCormack, and J.R. Talbot. Soil surveys: Review of data collection methodologies, confidence limits, and uses. Nat. Acad. Sci. Transp. Res. Board, Transp. Res. Rec. 733: 57-65, illus.

(17) Ohio Cooperative Extension Service. 1985. Ohio agronomy guide. Ohio State Univ., Bull. 472, Agdex 100, 95 pp., illus.

(18) Simonson, Roy W. 1959. Outline of a generalized theory of soil genesis. Soil Sci. Soc. Am. Proc. 23: 152-156, illus.

(19) Thornbury, W.D. 1965. Regional geomorphology of the United States. 609 pp., illus.

(20) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(21) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(22) United States Department of Agriculture. 1965. Silvics of forest trees of the United States. U.S. Dep. Agric. Handb. 271, 762 pp., illus.

(23) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(24) United States Department of Agriculture. 1986. Licking County Soil and Water Conservation District resources inventory. Soil Conserv. Serv. and Econ. Res. Serv., 13 pp., illus.

(25) United States Department of Commerce, Bureau of the Census. 1982. 1980 census of population—general population characteristics. 449 pp., illus.

(26) Wildermuth, Robert, and others. 1938. Soil survey of Licking County, Ohio. U.S. Dep. Agric., Bur. of Chem. and Soils, 57 pp., illus.

(27) Yaalon, D.H. 1983. Climate, time, and soil development. *In* Pedogenesis and soil taxonomy, edited by L.P. Wilding, N.E. Smeck, and G.F. Hall, vol. 11A or I, chap. 8, pp. 233-251, illus.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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 (7.6 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.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The depth of the soil over bedrock. Deep soils are more than 40 inches deep over bedrock; moderately deep soils, 20 to 40 inches; and shallow soils, 10 to 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dissected. Cut up by valleys and ravines.

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.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

North aspects. North- and east-facing slopes, ranging from 355 to 95 degrees azimuth.

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 plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

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.

Periglacial climate. The climate in areas adjacent to the border of the Pleistocene ice sheet, characterized by low temperatures, many fluctuations above and below the freezing point, and strong winds during certain periods.

Perimeter drain. A drain installed around the perimeter of a septic tank absorption field. The drain lowers 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.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slack-water deposits (geologic). Material that was deposited in still water and exposed when the water level was lowered or when the elevation of the land was raised.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

South aspects. South- and west-facing slopes, ranging from 96 to 354 degrees azimuth.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

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 meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bar. A shallow trench and a mound of earth constructed at an angle across a road or trail to intercept and divert surface runoff and control erosion.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.