SOIL SURVEY OF

Miami County, Ohio

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

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967-72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Miami Soil and Water Conservation District. The Miami County Commissioners provided some funds and facilities for this survey.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Miami County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the county are discussed in relation to trees.

Wildlife managers and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife Habitat."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the section "Soils and Land Use Planning for Town and Country Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Miami County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover: **This well-managed sod waterway conducts rainwater from the field and helps to control erosion. The soil is Brookston silty clay loam.**

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SOIL SURVEY OF MIAMI COUNTY, OHIO

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF LANDS AND SOIL, AND THE OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

MIAMI COUNTY is in the west-central part of Ohio (fig. 1). It is in the second tier of counties east of the Indiana state line and the fourth county north of the Ohio River. It is bounded on the west by Darke County, on the south by Montgomery County, on the east by Clark and Champaign Counties, and on the north by Shelby County. It covers about 260,352 acres, or 407 square miles. The county consists of 12 townships.

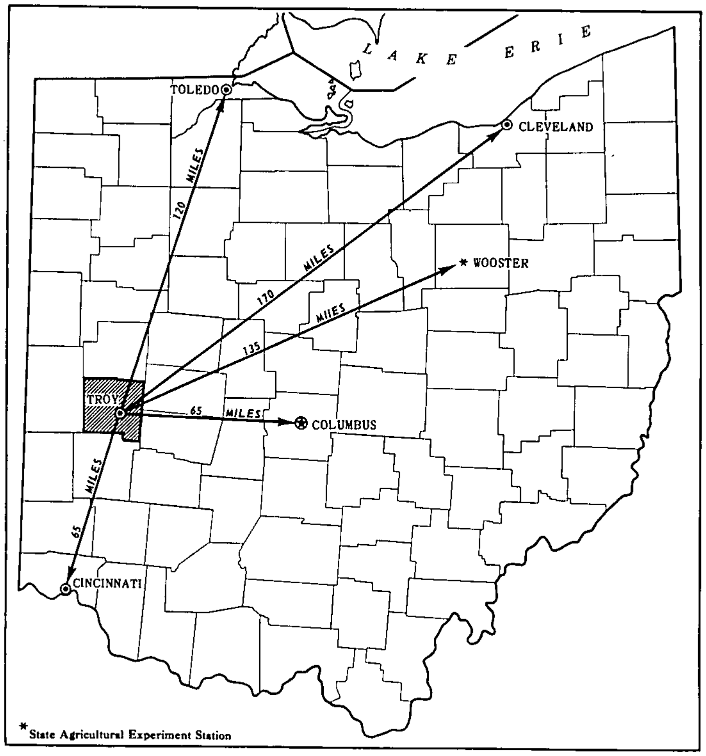

Figure 1.—Location of Miami County in Ohio.

The population of the county in 1970 was 84,342. Troy, the county seat and the second largest city in the county, is near the center of the county. It had a population of 17,186 in 1970. Piqua, the largest city, had a population of 20,741 and Tipp City, 5,090. The largest villages are Bradford, Casstown, Covington, Fletcher, Laura, Pleasant Hill, and West Milton.

[1] Assisting in the fieldwork were V. L. SIEGENTHALER, FRANCISCO MATANZO, and ROMELIO LEIGH, Soil Conservation Service.

Miami County lies in the Wisconsin Age glaciated region of Ohio. The topography is broad, level to gently rolling till plains dissected by two major rivers and their tributaries. Elevation ranges from 770 to 1,155 feet above sea level. Miami County is well suited to farming because there are large areas of deep, fertile, level soils. Corn, wheat, soybeans, and hay are the principal crops.

Miami County is only a few miles north of the expanding metropolitan area of Dayton. Consequently, an increased acreage, particularly in the southern part of the county, is being diverted to nonfarm use.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Miami County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide. uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a soil survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Milton and Eldean, for example, are locally named soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Miamian silt loam, 2 to 6 percent slopes, is one of several phases within the Miamian series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing soil boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Miami County: soil complexes and undifferentiated soil groups.

A soil complex consists of areas of two or more soils, so intericately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Eldean-Miamian complex, 2 to 6 percent slopes, is an example.

An undifferentiated soil group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Miamian and Hennepin silt loams, 18 to 25 percent slopes, is an example.

In most areas surveyed there are places where the soil material has been disturbed by mining, highway construction, or other activity. These areas are identified on the detailed soil map by a special symbol. Gravel pits and Made land are examples.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, and covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Miami County. A soil association is a landscape that has a distinctive pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to locate large tracts that may be suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in general planning for engineering works, recreation facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting a site for a road, building, or other structure because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The general soil map for Miami County also shows the glacial boulder belt. This is an area where the melting glaciers left numerous boulders on the surface and in the soils during the last glacial period.

It should be noted that the soil associations shown on the general soil map of this county do not exactly match those on the general soil maps of Champaign County, Clark County, and Montgomery County. The major soils are similar or the same, but they occur in a slightly different pattern. Each of the soil associations is described in the following pages.

1. Crosby-Brookston association

Somewhat poorly drained and very poorly drained, deep, nearly level to gently sloping soils that formed in loam glacial till; on uplands

This association is extensive and is mainly in the western part of the county. It makes up about 35 percent of the county. It is about 56 percent Crosby soils, 25 percent Brookston soils, and 19 percent minor soils.

Crosby soils are light colored, are somewhat poorly drained, and are on broad flats and low knolls. They are surrounded by dark-colored, very poorly drained Brookston soils that are in broad, level areas or in depressions. In cultivated areas, the soils form striking dark-colored and light-colored patterns (fig. 2).

Among the minor soils in the association are the well drained Miamian and the moderately well drained Celina soils. These soils typically are on crests of a few higher lying knolls.

Most areas of this association are farmed intensively. A small acreage is wooded or is used for pasture. A seasonal high water table causes wetness, which is the main limitation to use. Artificially drained areas of Crosby and Brookston soils dry out more quickly in spring than undrained areas, so they are well suited to crops commonly grown in the county. Undrained areas are not well suited to farming and are severely limited for many nonfarm uses.

2. *Crosby-Miamian-Brookston association*

Well-drained to very poorly drained, deep, nearly level to sloping soils that formed in loam glacial till; on uplands

The most extensive area of this association is in the eastern part of Miami County, and a small area is in the western part around Bradford. The association makes up about 29 percent of the county. It is about 37 percent Crosby soils, 20 percent Miamian soils, 15 percent Brookston soils, and 28 percent minor soils.

Crosby soils are light colored, somewhat poorly drained, and nearly level to gently sloping. Miamian soils are also light colored, and they are well drained and mainly gently sloping to sloping. Brookston soils are dark colored and very poorly drained, and they are in depressions and drainageways.

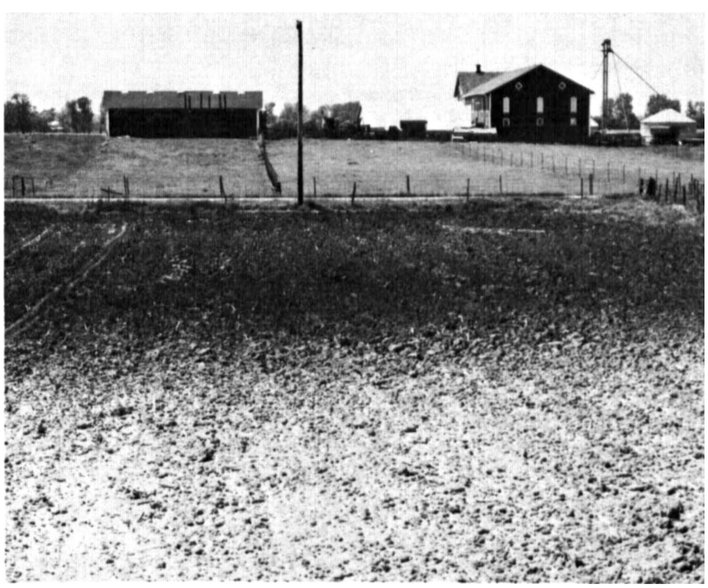

Figure 2.—**Light-colored Crosby soils are in the foreground, and darker Brookston soils are in the background.**

Among the minor soils in the association are the moderately well drained Celina soils, the somewhat poorly drained Odell soils on uplands, and the somewhat poorly drained Shoals soils on flood plains.

Most areas of this association have been cleared and are used for crops or pasture. A few areas are wooded. The seasonal wetness of Crosby and Brookston soils and the hazard of erosion on Miamian soils are the main limitations to use. The moderately slow permeability of the Miamian soils is an additional limitation for some nonfarm uses. Where slope is not a limitation, Miamian soils are suitable for homesites because natural drainage is good. Crosby and Brookston soils can be farmed intensively if they are artificially drained. The eastern part of this association is characterized by glacial boulders on the surface and in the soils. These boulders hinder farming and construction.

3. *Milton-Miamian, limestone substratum-Randolph association*

Well-drained and somewhat poorly drained, moderately deep and deep, nearly level to moderately steep soils that formed in glacial till underlain by limestone bedrock; on uplands

This association is in several areas close to either the Great Miami River or the Stillwater River. It makes up about 8 percent of the county. It is about 41 percent Milton soils; 23 percent Miamian, limestone substratum, soils; 18 percent Randolph soils; and 18 percent minor soils.

Milton soils are nearly level to moderately steep, are well drained, and are 20 to 40 inches deep to limestone bedrock. Miamian, limestone substratum, soils are nearly level to sloping, are well drained, and are 40 to 80 inches deep to limestone bedrock. Randolph soils are nearly level to gently sloping, are somewhat poorly drained, and are 20 to 40 inches deep to limestone bedrock.

Among the minor soils in the association are the dark-colored, very poorly drained Millsdale soils and the light-colored, well drained Ritchey soils. These soils are underlain by limestone at a depth of less than 40 inches. Limestone outcropping is common in the steeper areas. Some soils in a few areas on narrow flood plains are also minor soils.

Most of the nearly level and gently sloping soils of this association are used for crops. Some of the more sloping and moderately steep soils are wooded or are used for pasture. Nursery crops are grown to some extent near Tipp City in the southeastern part of Miami County. Erosion is a major concern on Milton soils and Miamian, limestone substratum, soils. Wetness caused by a seasonal high water table is the main limitation to use of the Randolph soils. The soils underlain by limestone are suitable for farming, but the shallow depth to the limestone, particularly in Milton and Randolph soils, severely limits some nonfarm uses. The moderately slow permeability of the soils is an additional limitation for some nonfarm uses.

4. *Miamian-Celina association*

Well drained and moderately well drained, deep, gently sloping to steep soils that formed in loam glacial till; on uplands

This association is in the steepest areas of the county and parallels the rivers and major streams. It makes up about 12 percent of the county. It is about 58 percent Miamian soils, 13 percent Celina soils, and 29 percent minor soils.

Miamian soils are well drained and mainly gently sloping to steep. Celina soils are moderately well drained and mainly gently sloping.

Among the minor soils are the somewhat poorly drained Crosby soils; the well drained, moderately deep Milton soils; and the well drained, steep to very steep Hennepin soils.

Because of the many steep slopes, most of the acreage is in permanent pasture or is wooded. Some of the less sloping soils are used for crops. The steep slopes and the severe hazard of erosion are the main limitations to farming. The steep slopes and moderately slow permeability limit Miamian and Celina soils for many nonfarm uses, but in less sloping areas these soils are suitable for homesites. Steep areas have potential for use as hiking and nature trails. Some areas of the association are within the boulder belt and have glacial boulders on the surface and below. These boulders hinder cultivation and construction.

5. *Eldean-Genesee-Ross association*

Well-drained, deep, level to gently sloping soils that formed in glacial outwash and alluvium; on outwash terraces and flood plains

This association is along the Great Miami River and the Stillwater River and their larger tributaries. It makes up about 10 percent of the county. It is about 46 percent Eldean soils, 14 percent Genesee soils, 10 percent Ross soils, and 30 percent minor soils.

Eldean soils are moderately deep to sand and gravel, are well drained, and are mainly nearly level to gently sloping. Well drained Genesee soils and dark-colored, well-drained Ross soils are on level to nearly level flood plains.

Among the minor soils are the dark-colored, very poorly drained Montgomery and Westland soils; the somewhat poorly drained Shoals soils; and the well drained Ockley soils.

Large areas of this association are used intensively for the crops commonly grown in the county. A few areas are used for specialty crops and nursery plants. Droughtiness caused by the moderate depth to sand and gravel is a main limitation of the Eldean soils for crops, but all the major soils in the association can be irrigated. Seasonal flooding severely limits the Genesee and Ross soils for many nonfarm uses. Because natural drainage is good and topography is favorable, Eldean soils have few limitations for most nonfarm uses. The sand and gravel underlying the Eldean soils are suitable for commercial use.

6. *Blount-Glynwood-Pewamo association*

Moderately well drained to very poorly drained, deep, nearly level to sloping soils that formed in clay loam or silty clay loam glacial till; on uplands

This association is in the northwestern corner of Miami County. It makes up about 5 percent of the county. It is about 52 percent Blount soils, 35 percent Glynwood soils, 9 percent Pewamo soils, and 4 percent minor soils.

Blount soils are light colored, somewhat poorly drained, and nearly level to gently sloping. Glynwood soils are light colored, moderately well drained, and mainly gently sloping to sloping. Pewamo soils are dark colored, very poorly drained, and nearly level; they are in depressions.

Among the minor soils in the association are the somewhat poorly drained to poorly drained Algiers soils, the somewhat poorly drained Shoals soils, and the moderately well drained Eel soils. These soils are on narrow flood plains of small streams that dissect the association.

Most of this association is used intensively for cultivated crops. A few areas are in permanent pasture or are wooded. The seasonal wetness of Blount and Pewamo soils and the hazard of erosion on Glynwood soils are the main limitations to farming. Unless artificially drained, Blount and Pewamo soils dry out slowly in spring. The slow or moderately slow permeability of the major soils and the wetness of Blount and Pewamo soils severely limit the soils for some nonfarm uses. Where slope is not a limitation, Glynwood soils have fewer limitations for use as building sites than Blount and Pewamo soils.

7. *Montgomery-Westland-Shoals association*

Very poorly drained and somewhat poorly drained, deep, level to nearly level soils that formed in alluvium and outwash material; on old glacial lake beds, stream terraces, and flood plains

This association is along Honey and Indian Creeks in the southeastern part of Miami County. It makes up about 1 percent of the county. It is about 37 percent Montgomery soils, 18 percent Westland soils, 15 percent Shoals soils, and 30 percent minor soils.

Montgomery soils formed in clayey sediment that was deposited in glacial lakes or ponds. They are dark colored, very poorly drained, and clayey. Westland soils formed in loamy material underlain by sand and gravel at a depth of more than 40 inches. These soils are on low terraces. They are dark colored, very poorly drained, and less clayey than Montgomery soils. Shoals soils formed in loamy sediment that was deposited by floodwater. These soils are on flood plains. They are light colored and somewhat poorly drained.

The light-colored, well-drained Genesee soils and the light-colored, somewhat poorly drained to poorly drained Algiers soils are among the minor soils in this association. They are in small areas on flood plains. The black, very poorly drained Edwards muck soils are also minor soils.

This association is farmed intensively. If the seasonal high water table is lowered by artificial drainage, the major soils are well suited to corn and soybeans. Much of the association, particularly areas of Shoals soils, is subject to seasonal flooding. Fall-seeded small grains are generally not grown on the major soils because of flooding and excessive wetness in winter and early in spring. The wetness and flooding severely limit the soils for many nonfarm uses.

Use and Management of the Soils

This section contains information about the management of soils used for crops and pasture, trees, wildlife, selected engineering purposes, and town and country planning. It gives estimated yields of the principal crops grown in the county.

General Management of the Soils for Farming

In this section, general practices of management are discussed, the system of capability classification is described, the capability units are described, and a table lists estimated yields of principal crops grown under two levels of management.

According to the 1969 census of agriculture about 72 percent of Miami County is used for cultivated crops, mainly corn, soybeans, and wheat and other small grains, and for forage crops, mainly clover, alfalfa, and grass. Less than 10 percent of the county is in permanent pasture.

Management for crops

Although the soils in Miami County vary in their suitability for specific crops and require widely different management, some basic, or general, management practices are needed on most of the soils. This section describes the basic practices of maintaining soil fertility, utilizing crop residues, improving drainage, and controlling erosion. Also, suitable cropping systems are given. The management of specified groups of soils is discussed in the section "Management by capability units," but specific information can be obtained from the Soil Conservation Service or the Ohio Cooperative Extension Service.

Maintaining fertility.—Lime and fertilizer should be added to the soils in this county, particularly the light-colored ones, because many of them are naturally acid and medium to low in content of plant nutrients. The amount of lime and fertilizer applied should be based on results of soil tests, on the crops grown, and on the crop growth desired. The Ohio Cooperative Extension Service provides information on the kinds and amounts of fertilizer and lime to apply.

Using crop residue.—To offset the naturally low content of organic matter of many of the soils, particularly the light-colored ones, all crop residue should be returned to the soil. If soybeans or other crops that produce little residue are grown, cover crops and sod crops should be included in the cropping system. Maintaining the content of organic matter in the soils helps insure good soil structure and tilth.

Drainage.—About 54 percent of the soils in the county are limited in their suitability for farm crops by wetness. The wetness is caused mainly by a seasonal high water table or periodic flooding. Some of the clayey, very poorly drained soils are subject to ponding. Most of the soils on uplands are seasonally wet. They have moderately slow or slow permeability in the underlying material; thus, the upper 2 or 3 feet of these soils is saturated in winter and spring. Tile can be used to drain most of the wet soils if the dense, compact till underlying the soils is at a sufficient depth to permit proper drainage. Tile, open ditches, and land smoothing are the most commonly used practices in draining the soils. A combination of these is needed in some areas. Artificial drainage generally is not needed on the moderately well drained and well drained soils.

Controlling erosion.—In this county, erosion is a hazard on gently sloping to very steep soils. Much of the acreage that is suitable for cultivation has a potential hazard of erosion. Many soils in Miami County have a surface layer that is fairly high in silt content and low in organic-matter content. Such a surface layer is highly susceptible to erosion by running water. Erosion-control practices commonly used in the county are contour tillage, minimum or no tillage, waterways, diversion terraces, using crop residues, and planting close-growing crops.

Cropping systems.—A cropping system is a combination of a sequence of crops and cultural and management measures. In some cropping systems, grasses and legumes are included in the rotation.

A good cropping system helps improve or maintain the physical condition of the soil, helps protect the soil from erosion, and helps control weeds, insects, and plant diseases. The more often row crops are used in the cropping system, the greater the need for conservation measures.

It is impractical to list all the possible cropping systems for any particular soil. A satisfactory cropping system on sloping soils might be a 4-year rotation of a row crop and small grain and 2 years of meadow.

Management for pasture

Most pasture in the county is on soils that are subject to erosion. The soils, generally, are eroded, are low in natural fertility, and have poor tilth. Some pasture is on soils that need artificial drainage. Soils that need artificial drainage for optimum growth of row crops also need it for optimum growth of pasture. The following general management suggestions apply to most soils in the county.

Erosion control is particularly important because many soils used for pasture are already eroded. The need for erosion control is most critical during pasture seeding. Mulch seeding or use of a nurse crop can help to control further erosion.

Drainage, if needed, must be as well planned and carried out as it is for row crops.

The need for lime and fertilizer should be determined by soil tests, and adequate amounts should be applied to meet growth requirements.

Soil compaction, caused by grazing when the soils are wet, results in decreased growth of pasture. Harvesting methods, such as those for hay, silage, or soilage, increase plant growth and reduce soil compaction. Tillage at the optimum moisture content also reduces soil compaction.

The ability of a pasture to produce and to provide surface protection to the soils is influenced by the number of livestock allowed to graze, the length of time they graze, the season they graze, and the availability of water. Practices that contribute to good pasture management are using stocking rates that maintain key forage plants; rotating and deferring grazing; allowing grazing only at proper season; fertilizing; and supplying ample and strategically located water.

Management for special crops [2]

Special crops grown for commercial use in Miami County include nursery plants (fig. 3), tobacco, vegetables, strawberries, and apples. The principal nursery plants are spruce and various species of yews and arborvitae. But a wide variety of trees and flowering shrubs are grown. Some of the vegetables grown are sweet corn, melons, and tomatoes.

Well drained soils on outwash terraces, such as Eldean, Ockley, Warsaw, and Wea soils, are especially well suited to vegetables and strawberries. These soils have good internal drainage, and they warm early in spring. If moisture is favorable throughout the growing season, the crops can be harvested early. Genesee and Ross soils on bottom lands are also well suited to vegetables and strawberries if they are protected from flooding. A good source of underground water for irrigation is commonly available on these terraces and flood plains. Irrigation is well suited to these soils and is being practiced in some areas.

Nursery plants are grown on well drained soils on bottom lands and outwash terraces. Some nursery plants are also grown on well drained soils on uplands, such as the Miamian and Milton soils.

Many well drained soils in the county, including Miamian, Milton, Eldean, Ockley, and Wea soils, are suited to orchard crops. Sloping soils should be planted on the contour to help control erosion.

Tobacco growers in the county prefer the deep, dark-colored, very poorly drained Brookston and Montgomery soils. These soils are artificially drained before tobacco is grown.

Management practices for special crops are not given in this survey, but the latest and most complete information can be obtained from the Ohio Cooperative Extension Service or the Soil Conservation Service.

Irrigation

In Miami County, irrigation is increasing in importance, particularly where special crops are grown. In 1969, 751 acres were irrigated as compared to 260 acres in 1964. Some soils in the county are well suited to irrigation, but others are poorly suited. The features affecting the use of soils for irrigation are discussed in the section "Engineering Uses of the Soils" and are shown for each soil in table 4.

For a soil to be suited to irrigation, the surface layer should be sufficiently porous to absorb water readily. The soil should have a favorable available water capacity, and water and air movement in the subsoil or underlying material should be sufficient to prevent waterlogging.

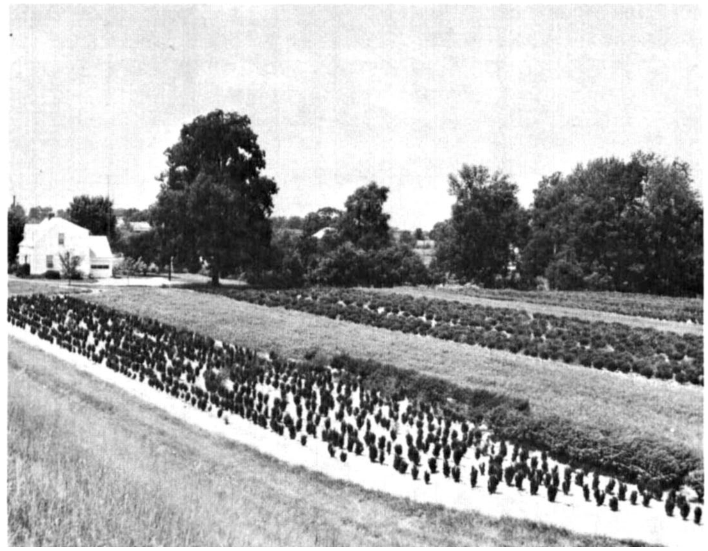

Figure 3.—**Nursery stock on Crosby and Brookston soils.**

Well-drained soils on outwash terraces, such as Eldean, Warsaw, Wea, and Ockley soils, are well suited to irrigation. Eldean and Warsaw soils dry quickly and warm early in spring, but both have limited available water capacity and are likely to have insufficient moisture during the growing season, unless they are irrigated. Most nearly level and gently sloping, well-drained soils on uplands, such as Miamian and Milton soils, are moderately suited to irrigation. Eel, Genesee, Medway, and Ross soils on bottom lands are well suited to irrigation if they are protected from flooding.

Soils that have slopes of more than 6 percent are generally not suited to irrigation. If sloping soils are irrigated, however, the rate of water application must be regulated to control runoff and erosion. A lack of good sources of water limits irrigation in some parts of the county. Generally, the soils on bottom lands and outwash terraces have a good supply of underground water for irrigation.

Crop yields on many of the soils in Miami County can be improved by supplemental irrigation in dry periods during the growing season. Soil characteristics should be studied carefully before an irrigation system is installed. In addition, a qualified engineer should carefully evaluate the water supply, the crop or crops to be irrigated, the cost of equipment, and the economy of the operation. Additional information on irrigation is available from local representatives of the Cooperative Extension Service and the Soil Conservation Service.

Capability Grouping

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond

[2] RALPH GRAY, district conservationist, Soil Conservation Service, helped prepare this section.

to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or to other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when they are used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or for engineering.

In the capability system, all the kinds of soil are grouped at three levels; the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use.

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, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation areas, wildlife habitat, or water supply or to esthetic purposes. (None in Miami County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony: and *c*, shows that the chief limitation is climate that is too cold to too dry. (Subclass *c* is not used in Miami County.)

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about the management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Miami County are described and suggestions for the use and management of the soils are given.

Management by capability units

The soils in Miami County have been placed in 26 capability units. The soils in each unit have about the same limitations, are subject to similar risks of damage, need about the same kind of management, and respond to management in about the same way. In the following pages each capability unit is described and management of the soils in each unit is discussed. The mention of the soil series in the description of each capability unit does not mean that all the soils of the series mapped in the county are in the unit. The "Guide to Mapping Units" at the back of this survey gives the capability unit for each soil.

In describing the capability units, improved and optimum levels of management are mentioned for crops and pasture. These levels are defined in the section "Estimated Yields."

The depth of the root zone refers to the depth to which roots can penetrate the soil. Bedrock, compact till, or other material restricts the growth of roots.

In this section, specific suggestions or recommendations are not given for overcoming limitations of the soils. Many different methods or combinations of practices can help control erosion or provide drainage on any given kind of soil. For specific information regarding erosion control, artificial drainage, selecting crop varieties, or other management practices, contact the nearest office of the Soil Conservation Service or the Ohio Cooperative Extension Service.

CAPABILITY UNIT I-1

This unit consists of moderately well drained and well drained, level to nearly level soils on uplands and stream terraces. The root zone is moderately deep or deep. Permeability is moderate or moderately slow. The soils have few limitations that restrict use.

These soils are suited to all field crops, hay, and pasture plants commonly grown in the county. They can be used year after year for cultivated crops and for special crops if optimum management is used. Most are well suited to irrigation.

Maintaining good soil structure, tilth, and high fertility are the main concerns. There is little or no hazard of erosion. Proper use of crop residues helps maintain good tilth and the organic-matter content.

CAPABILITY UNIT IIe-1

This unit consists of moderately well drained or well drained, gently sloping soils on uplands and outwash terraces. The surface layer is mainly silt loam, but it is loam in a few areas. There is little evidence of erosion. The root zone is moderately deep or deep. The underlying material is mainly sand and gravel or glacial till. In some areas these soils are underlain by limestone bedrock. The available water capacity is moderate to high, and the capacity to store and release plant nutrients is moderate to high. Permeability is moderate to slow.

These soils are suited to all crops commonly grown in the county. They are well suited to grasses and legumes grown for hay or pasture. Row crops can be grown intensively if optimum management is used.

Control of erosion and maintenance of soil structure and tilth are the main management concerns. The soils that have a surface layer of silt loam are more likely to crust than those that have a loam surface layer. Large amounts of crop residue should be returned to the soil to help maintain soil structure and control erosion, and if management is less than optimum, the cropping sequence should include small grain or other close-growing crops and sod crops.

CAPABILITY UNIT IIe-2

This unit consists of well drained, gently sloping soils on stream terraces and moraines on uplands. The soils have a surface layer of loam or silt loam. The root zone is moderately deep. The underlying material is sand and gravel or glacial till. The available water capacity is moderate to low, and the capacity to store and release plant nutrients is moderate. Permeability is mainly moderate in the upper part of the soils and rapid in the underlying material. In a few areas permeability is moderately slow. Some areas are moderately eroded.

The soils warm and dry early in spring, allowing for early planting of crops. These soil are suited to most field and special crops. Row crops can be grown intensively on uneroded soils that have slopes of less than 4 percent if optimum management is used. Special crops are commonly irrigated, and most of the soils are suited to irrigation.

The hazard of erosion is moderate. Moderately eroded areas have a lower capacity to absorb and retain moisture than uneroded areas, and they are more subject to crusting. These areas require management practices to prevent further erosion. Cropping systems should include small grain and sod crops to help control erosion, maintain tilth, and retain moisture.

Droughtiness is also a concern. Crops often are damaged by lack of moisture during the growing season. Crops that mature early grow best because more moisture is available early in the season.

CAPABILITY UNIT IIe-3

This unit consists of moderately well drained or well drained, gently sloping soils on uplands. These soils are moderately eroded, and the plow layer is a mixture of the original surface layer and some of the subsoil material. The root zone is moderately deep and is underlain by limestone bedrock or glacial till. The available water capacity is moderate, and the capacity to store and release plant nutrients is moderate. Permeability is moderately slow.

These soils are suited to most crops commonly grown in the county if erosion is controlled. They are well suited to grasses and legumes grown for hay and pasture.

Control of erosion and improvement of tilth are the main management concerns. Large amounts of crop residue should be returned to the soil or farm manure should be added to help control erosion and improve tilth. Small grain and sod crops are generally included in the cropping system.

The plow layer of these soils is lower in organic-matter content than that of uneroded soils. The capacity to absorb and retain moisture is reduced, and the soils are more subject to crusting.

CAPABILITY UNIT IIw-1

This unit consists of somewhat poorly drained to very poorly drained soils on bottom lands, stream terraces, and depressions on uplands. The surface layer is silt loam. The soils are subject to occasional flooding or ponding. The root zone is deep when the water table is low, but the water table is high for long periods in winter and spring. In some areas, the soils receive additional water from seepage in the adjacent uplands. The available water capacity is high. Permeability is moderate.

These soils are suited to most field crops commonly grown in the county if they are adequately drained. They can be cultivated frequently if optimum management is used.

Flooding is common in winter and early in spring, but it is infrequent during the growing season. Tiles or surface drains can be used to lower the seasonal high water table. Diversions are used to intercept runoff from higher, sloping soils. A few areas are difficult to drain artificially because outlets are inadequate.

Structure and tilth need to be maintained.

CAPABILITY UNIT IIw-2

This unit consists of level or gently sloping, somewhat poorly drained soils on uplands. The soils have a silt loam surface layer. The root zone is moderately deep. Permeability is moderate to slow. The available water capacity is moderate to high, and the capacity to store and release plant nutrients is also moderate to high. The soils have a seasonal high water table in winter and spring.

These soils are suited to most crops commonly grown in the county if they are adequately drained. They can be cultivated frequently if optimum management is used.

Seasonal wetness is the main limitation of the soils. The soils warm slowly and dry late in spring unless they are drained. All the soils can be drained by tile, but surface drainage is also needed in some places.

Control of erosion on the gently sloping soils is also a concern, and the surface layer is subject to crusting. Cropping systems that help control erosion are needed on the gently sloping soils. Large amounts of crop residue should be returned to the soil to help maintain good tilth.

CAPABILITY UNIT IIw-3

This unit consists of very poorly drained, level to nearly level soils. The soils are mainly in depressions on uplands, but they are on outwash terraces in a few areas. The surface layer is silty clay loam. The root zone is deep. The available water capacity is high, and the capacity to store and release plant nutrients is high. Permeability is moderate to moderately slow. Surface runoff is slow. The soils have a seasonal high water table in winter and spring. Some areas are subject to ponding. The surface layer is high in organic-matter content and is neutral or mildly alkaline.

These soils are among the most productive in the county and are well suited to the commonly grown field crops and forage plants if they are drained. They can be cultivated continuously if optimum management is used. Undrained areas are suited only to those plants that will tolerate wetness for long periods.

Seasonal wetness is the main limitation of the soils. If drainage outlets are available, tiles are effective in removing excess water. Diversion terraces are used in places to intercept and divert excess runoff from adjacent, higher soils.

Careful management is needed to maintain good tilth and structure of the surface layer. When the soils are wet they become compacted and cloddy if plowed or if grazed by cattle.

CAPABILITY UNIT IIw-4

This unit consists of moderately well drained and well drained, level to nearly level soils on flood plains. The surface layer is silt loam. It is mildly alkaline or moderately alkaline and seldom needs lime. The root zone is deep. The available water capacity is high, and the capacity to store and release plant nutrients is moderate to high. Permeability is moderate.

These soils are suited to all crops commonly grown in the county if they are protected from flooding. They are suited to grasses and legumes grown for hay or pasture. Row crops can be grown continuously, and special crops are grown in some areas. The soils are well suited to irrigation, and irrigation is used on some. Water is generally available nearby.

Occasional flooding is the main limitation of these soils for farming. Flooding late in winter or early in spring often damages winter grain crops. Dikes or levees are used to control flooding in some areas. Internal drainage is generally good, but a few of the soils have wet spots that need to be artificially drained.

CAPABILITY UNIT IIw-5

Linwood muck, the only soil in this capability unit, is 16 to 50 inches of muck underlain by loamy mineral material. This soil is in depressions and bogs on outwash terraces and moraines.

The soil has a seasonal high water table much of the time, especially from winter to early in summer. The root zone is deep when the water table is low. The capacity to store and release plant nutrients is high. The surface layer is mildly or moderately alkaline and seldom needs lime. Permeability is rapid; it is moderately slow in the underlying mineral. The muck is highly compressible and has low strength.

If this soil is adequately drained, it is well suited to many crops commonly grown in the county, especially row crops, which can be grown continually if optimum management is used. Muck is less suited to small grain because the grains lodge easily. If not drained, muck is not suited to field crops and is poorly suited to pasture.

Seasonal wetness is a limitation if this soil is used for crops, but it can be drained by tile and open ditches. In some places it is difficult to drain because drainage outlets are inadequate. The muck material is subject to subsidence where it has been drained. The water table should be controlled so that subsidence is minimized. When the soil is dry it is subject to soil blowing.

CAPABILITY UNIT IIs-1

This unit consists of well drained, level to nearly level soils on outwash terraces and uplands. The root zone is moderately deep and is underlain by bedrock or sand and gravel. The available water capacity is moderate to low, and the capacity to store and release plant nutrients is moderate. Permeability is moderate or moderately slow.

These soils are suited to the commonly grown field crops and to special crops. They are suited to grasses and legumes grown for hay and pasture. Row crops can be grown year after year if optimum management is used. Irrigation is effective where special crops are grown.

The hazard of drought is moderate. Crops are damaged by lack of moisture during most growing seasons. The soils warm and dry early in spring, allowing for early planting of crops.

There is little or no hazard of erosion. Large amounts of crop residue should be returned to the soil to improve tilth and retain moisture in the soil. The surface layer is more likely to crust if it is silt loam than if it is loam.

CAPABILITY UNIT IIs-2

Stonelick loam, the only soil in this unit, is a well drained, nearly level soil on bottom lands that are subject to occasional flooding. The surface layer is mildly alkaline. The root zone is moderately deep. The available water capacity is low, and the capacity to store and release plant nutrients is low. Permeability is moderately rapid.

The soil is suited to crops commonly grown in the county. It is suited to grasses and legumes grown for hay or pasture. The soil is suited to irrigation, and a good source of ground water is generally nearby.

The hazard of drought is moderate. Crops are damaged by lack of moisture during most growing seasons. Drought damage to crops can be avoided by planting early and growing early maturing crops. Large amounts of crop residue should be returned to the soil to help retain moisture and improve tilth.

The hazard of occasional flooding is also a concern. Fall-planted small grain is likely to be damaged by flooding in winter and early in spring. Dikes or levees are used in places to control flooding.

CAPABILITY UNIT IIIe-1

This unit consists of well drained, sloping soils on uplands. The root zone is moderately deep to deep and is underlain by glacial till, sand and gravel, or limestone bedrock. The available water capacity is moderate to low, and the capacity to store and release plant nutrients is moderate. Permeability is moderately slow or moderate. Runoff is rapid. Most of the soils are moderately eroded and are highly susceptible to further erosion.

These soils are suited to most crops commonly grown in the county. They are well suited to grasses and legumes grown for hay and pasture. Row crops can be grown frequently if optimum management is used. The cropping sequence should include grasses and legumes to help maintain tilth and control erosion.

Controlling erosion is the main management concern. Much of the surface layer has already been lost. Maintaining and improving tilth is also a concern. Returning large amounts of crop residue to the soil and maintaining fertility helps to improve tilth and control erosion. Some soils in this unit are subject to droughtiness.

CAPABILITY UNIT IIIe-2

This unit consists of moderately well drained, gently sloping and sloping soils on uplands. The surface layer is silt loam. The root zone is moderately deep. The available water capacity is moderate, and the capacity to store and release plant nutrients is moderate. Permeability is slow. Surface runoff is rapid, and the soils are highly susceptible to erosion. They are moderately eroded, and the surface layer is a mixture of the original surface layer and some of the subsoil.

These soils are suited to the commonly grown field crops. Row crops can be grown frequently if erosion is controlled and optimum management is used, especially on the gently sloping soils.

These soils often have poor tilth, and the surface layer is subject to crusting. Crop residue should be returned to the soil to help improve tilth and control erosion. The cropping system should include close-growing crops, grasses, and legumes. Tilling these soils and grazing on them should be avoided when the soils are wet.

CAPABILITY UNIT IIIe-3

Ritchey silt loam, 2 to 6 percent slopes, is the only soil in this unit. It is a well drained soil on uplands. The root zone is shallow and is underlain by limestone bedrock. The available water capacity is low, and the capacity to store and release plant nutrients is moderate. Permeability is moderate.

This soil is suited to field crops commonly grown in the county and to grasses and legumes grown for hay and pasture. Grasses and legumes, however, do not grow well in dry periods. Areas of this soil generally are small, and most are idle, are in pasture, or are managed with adjoining soils.

The hazards of erosion and drought are moderate. Because the soil is droughty, it is better suited to small grain and other early maturing crops than to crops that mature late in summer. Returning crop residue to the soils helps control erosion and retain moisture.

CAPABILITY UNIT IIIe-4

Blount silt loam, 2 to 6 percent slopes, moderately eroded, is the only soil in this unit. It is a somewhat poorly drained soil on uplands. The root zone is moderately deep. The available water capacity is moderate, and the capacity to store and release plant nutrients is moderate. The plow layer is a mixture of the original surface layer and some of the subsoil. Thus, the capacity of the soil to absorb and retain moisture has been reduced, and the soil tends to puddle and seal over after rain. A seasonal high water table restricts use.

This soil is suited to most field crops commonly grown in the county, but a high level of management is needed to control erosion. Row crops can be grown frequently if erosion is controlled and if the soil is adequately drained.

The hazard of erosion is severe. Also, most areas of this soil need artificial drainage to alleviate wetness. Grasses and legumes used in the cropping system and crop residues and farm manure on the soil help to control erosion and to improve tilth in cultivated areas. If the soil is grazed when it is wet, excessive compaction and damage to pasture can result.

CAPABILITY UNIT IIIw-1

This unit consists of poorly drained and very poorly drained, nearly level to gently sloping soils. The soils are mainly in depressions on uplands. The surface layer is silty clay loam. The root zone is moderately deep and is underlain by limestone bedrock at a depth of 20 to 40 inches. The available water capacity is moderate, and the capacity to store and release plant nutrients is high. Permeability is moderately slow. The soils have a seasonal high water table for long periods during winter and spring if they are not artificially drained. Most areas receive additional water from seepage in the adjacent, higher, more sloping soils.

These soils are suited to most of the field crops commonly grown. Row crops can be grown continuously if the soils are artificially drained and optimum management is used.

Seasonal wetness and the moderate depth to limestone bedrock are the main limitations of the soils. When the soils are wet they become compacted or cloddy if tilled or if grazed by cattle. Tile drains are commonly used, but surface ditches are needed where the bedrock interferes with the installation of tile lines. Diversions can be used to intercept runoff from higher, more sloping soils, and they also help alleviate wetness.

Control of erosion on the gently sloping soils is also a concern.

CAPABILITY UNIT IIIw-2

This unit consists of level and gently sloping, somewhat poorly drained to very poorly drained soils on uplands. The root zone is moderately deep and is underlain by bedrock at a depth of 20 to 40 inches. The available water capacity is moderate, and the capacity to store and release plant nutrients is moderate or high. Permeability is moderately slow. The soils have a seasonal high water table during winter and spring.

These soils are suited to most of the commonly grown field crops. Row crops can be grown frequently if the soils are artificially drained. Both drained and undrained soils are suited to grasses and legumes grown for hay or pasture.

Seasonal wetness and the moderate depth to limestone bedrock are the main limitations. The soils can be drained by tile, but installation is difficult in places because of the bedrock. Surface ditches are used in some areas. Most of the soils are subject to puddling, and the surface layer is subject to crusting after rain.

The moderate hazard of erosion on the gently sloping soils is also a concern. Crop residue should be returned to the soil to help control erosion and maintain tilth.

CAPABILITY UNIT IIIw-3

Montgomery silty clay loam, the only soil in this unit, is nearly level and very poorly drained. It formed in water-laid deposits on terraces and in depressions on uplands. The root zone is deep when the water table is low. The available water capacity is high, and the capacity to store and release plant nutrients is high. Permeability is slow. The seasonal water table is at or near the surface in winter and spring, and in some areas the soil is ponded. Surface runoff is slow. The surface layer is high in organic-matter content, is neutral to mildly alkaline, and seldom needs lime.

This soil is suited to most field crops commonly grown in the county if it is artificially drained. It is suited to hay and pasture plants that can withstand wetness. If optimum management is used, row crops can be grown continuously. The soil is also suited to trees and other vegetation grown for wildlife habitat.

Excessive wetness is the main limitation of this soil. Artificial drainage is needed if it is used for crops. Tiles and open ditches commonly are used, and diversions are used in places to intercept and divert excess runoff from adjoining, higher soils. The surface layer becomes compacted and cloddy if tilled when wet. Pastures become excessively compacted if grazed when wet.

CAPABILITY UNIT IIIs-1

Ross silt loam, shallow variant, is the only soil in this unit. It is a well drained soil and has a shallow root zone. Limestone bedrock is at a depth of 10 to 20 inches. The available water capacity is low, and the capacity to store and release plant nutrients is moderate. Permeability is moderate. The surface layer is high in organic-matter content and is mildly or moderately alkaline.

This soil is suited to field crops commonly grown in the county and to grasses and legumes grown for hay or pasture, but grasses and legumes do not grow well in dry periods.

The hazard of drought is the main limitation. Crops are damaged by lack of moisture during the growing season in dry periods. Drought damage to crops can be avoided by planting early and growing early maturing crops. Proper use of crop residue helps retain moisture. Flooding is also a hazard, but floods are rare during the growing season.

CAPABILITY UNIT IVe-1

This unit consists of moderately well drained and well drained, sloping and moderately steep soils on uplands. The sloping soils are mostly severely eroded, and the moderately steep soils are moderately eroded. The root zone is shallow to moderately deep and is underlain by limestone bedrock or glacial till. The available water capacity is moderate to low, and the capacity to store and release plant nutrients is moderate. Permeability is moderate to slow.

These soils are suited to the commonly grown field crops. Grasses and legumes should be grown with cultivated crops.

The hazard of erosion is the main limitation of these soils. Runoff is very rapid, and all the soils are highly susceptible to erosion. A good cover of vegetation is needed to control erosion. Severely eroded soils have a surface layer of clay loam and are difficult to work. Preparing a seedbed is difficult. Large amounts of crop residue should be returned to the soils to help control erosion and maintain tilth.

CAPABILITY UNIT IVe-2

This unit consists only of Eldean-Casco gravelly loams, 6 to 12 percent slopes, moderately eroded. These are well drained, sloping soils on outwash terraces and moraines on uplands. The root zone is shallow to moderately deep and is underlain by sand and gravel. The available water capacity is moderate or low, and the capacity to store and release plant nutrients is low or moderate. Permeability is moderate in the upper part of the soils and rapid in the underlying sand and gravel.

These soils are used for field crops and for hay and pasture. They have short slopes, and many small areas are idle, are in pasture, or are managed with adjoining soils.

The hazards of erosion and drought are severe. Crops are damaged by lack of moisture during the growing season. The soils warm and dry early in spring, allowing for early planting of crops. Thus, drought damage to crops can be avoided by planting early and growing short-season crops. Large amounts of crop residue should be returned to the soil to help control erosion and retain moisture.

Only drought-resistant grasses and legumes should be grown for pasture and hay. Row crops can be used occasionally in the cropping system; they can be used more frequently if erosion is controlled and sufficient moisture is available.

CAPABILITY UNIT Vw-1

Shoals silt loam, moderately shallow variant, the only soil in this unit, is somewhat poorly drained and is on bottom lands that are frequently flooded. The root zone is moderately deep. Limestone bedrock is at a depth of 20 to 40 inches. The available water capacity is moderate, and the capacity to store and release plant nutrients is moderate. Permeability is moderate. The soil has a high water table for long periods in winter and early in summer. It often receives additional water as seepage from adjoining uplands. The surface layer is mildly alkaline and does not need lime.

This soil is suited to and is used for pasture, woodland, or wildlife habitat. It is not suited to cultivated crops because it is wet and is frequently flooded during the growing season.

Grazing of cattle on this soil when it is wet causes compaction. Drainage is difficult because of the underlying limestone bedrock and the lack of drainage outlets.

Only water-tolerant plants should be used for pasture.

CAPABILITY UNIT VIe-1

This unit consists of well drained, sloping to steep soils on outwash terraces and uplands. The soils are moderately eroded and severely eroded. The severely eroded soils are lighter in color than the moderately eroded soils and contain more clay in the surface layer. The root zone is mainly shallow, but in places it is moderately deep and is underlain by sand and gravel or glacial till. The available water capacity is moderate or low. Permeability is mainly moderate to slow, but in places it is rapid in the lower part of the soils.

These soils are not suited to cultivated crops, but they are suited to adapted grasses and legumes grown for permanent pasture or meadow. Soils that are too steep for machinery are best suited to trees. Some areas, especially next to the rivers, make excellent wildlife habitat.

The hazard of erosion is severe or very severe, especially if plant cover is not maintained. Controlled grazing of pasture helps maintain sufficient cover to control erosion. The trash mulch method of tillage helps control erosion when meadows are seeded or pasture is improved. Vegetation is more difficult to establish on the severely eroded soils.

Droughtiness is also a concern in some of the soils. Pasture generally becomes dormant late in summer because moisture is inadequate.

CAPABILITY UNIT VIw-1

Edwards muck, the only soil in this unit, is 16 to 48 inches of muck underlain by marl. This soil is in bogs and swamps that stay wet for long periods throughout the year. The surface layer and the nearby streams are at nearly the same elevation. The root zone is limited by a high water table and by the underlying marl. The available water capacity is high, and the capacity to store and release plant nutrients is high. Permeability is moderately rapid in the muck and is variable in the underlying marl. The surface layer is neutral or mildly alkaline and seldom needs lime. The soil is highly compressible and physically unstable.

This soil is too wet for crops. Some areas are used as permanent pasture during dry periods.

The very poor natural drainage and the high water table are the main limitations. Artificial drainage is restricted by a lack of suitable drainage outlets.

CAPABILITY UNIT VIIe-1

This unit consists of well drained, steep and very steep soils on uplands. The soils are mainly moderately eroded, but some are severely eroded. Some areas are gullied. Some of the soils are shallow and are underlain by limestone bedrock, and some are shallow to moderately deep and are underlain by loam till. The till, in places, is exposed at the surface in the severely eroded soils. The available water capacity is low to moderate. Permeability is moderate to moderately slow. Runoff is very rapid.

Because of the steep slopes, past erosion, and the very severe hazard of erosion, these soils are not suited to cultivated crops. They are suited to permanent pasture and to trees. Soils that are too steep for machinery are best suited to trees, and trees have been planted in places to help control erosion.

Controlled grazing of pasture helps maintain a good plant cover that, in turn, helps control erosion. Careful management is needed to establish plant cover in gullied and severely eroded areas. Erosion control is needed when pasture is renovated or reseeded.

CAPABILITY UNIT VIIs-1

This unit consists only of Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded. These are well drained, steep to very steep, gravelly soils on uplands. The root zone is shallow and is underlain by sand and gravel. The available water capacity is low, and the capacity to store and release plant nutrients is low. Permeability is moderate to moderately rapid in the upper part of the soils and rapid in the lower part. Surface runoff is rapid.

Because of the steep slopes, very severe droughtiness, and the severe hazard of erosion, these soils are not suited to cultivated crops. They are suited to permanent pasture. Pastures generally do well in spring and fall but not during dry periods.

Trees grow slowly on these soils, but drought-resistant plants and trees can be planted to help control erosion.

Estimated Yields

Table 1 shows, for most soils in the county, the estimated average yields per acre of principal crops. The yields are the averages expected over a period of several years under two levels of management, improved and optimum. In the A columns are estimates of yields obtained under the improved management practices commonly used in the county. In the B columns are estimates of yields obtained under optimum management. Under such management—

1. Practices are used that increase the intake of water and the available water capacity of the soils. Excess water is disposed of by appropriate practices.
2. Practices are used to help control erosion.
3. Suitable methods of plowing, preparing the seedbed, and cultivation are used.
4. Weeds, plant diseases, and insects are controlled.
5. Fertility is maintained at the highest practical level. Lime and fertilizer are applied according to soil tests and crop needs. The fertilizer contains trace elements (zinc, cobalt, manganese, copper) if they are needed.

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*

[Estimated yields in the A columns are based on improved management and those in the B columns are based on optimum management. Absence of a yield figure indicates that the crop is not suited to the soil or is not commonly grown on the soil]

Soil	Corn		Wheat		Oats		Soybeans		Alfalfa-grass hay	
	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Algiers silt loam	80	110	35	45	60	80	30	40	3.0	4.0
Blount silt loam, 0 to 2 percent slopes	75	100	35	45	55	75	25	35	2.5	3.5
Blount silt loam, 2 to 6 percent slopes	70	95	35	45	55	75	25	35	2.5	3.5
Blount silt loam, 2 to 6 percent slopes, moderately eroded	60	85	30	40	52	72	20	30	2.4	3.4
Brookston silty clay loam	90	130	35	45	60	80	30	40	3.0	5.0
Celina silt loam, 0 to 2 percent slopes	85	115	37	46	60	80	30	40	3.5	5.0
Celina silt loam, 2 to 6 percent slopes	80	110	35	45	55	75	28	38	3.0	5.0
Celina silt loam, 2 to 6 percent slopes, moderately eroded	75	100	35	45	55	75	25	35	2.8	4.5
Corwin silt loam, 0 to 2 percent slopes	85	120	35	48	60	80	30	40	3.5	5.0
Corwin silt loam, 2 to 6 percent slopes	80	110	35	45	60	80	28	38	3.0	5.0
Crosby silt loam, 0 to 2 percent slopes	85	115	35	45	60	80	30	40	3.0	5.0
Crosby silt loam, 2 to 6 percent slopes	80	110	35	45	60	80	28	38	3.0	5.0
Edwards muck										
Eel silt loam	80	115	32	40	60	80	28	35	3.0	5.0
Eldean loam, 0 to 2 percent slopes	70	110	30	43	50	75	22	30	2.5	4.0
Eldean loam, 2 to 6 percent slopes	70	100	30	40	50	75	20	28	2.5	4.0
Eldean loam, 2 to 6 percent slopes, moderately eroded	65	90	28	38	45	70	20	26	2.5	4.0
Eldean silt loam, 0 to 2 percent slopes	70	100	30	43	50	75	22	30	2.5	4.0
Eldean silt loam, 2 to 6 percent slopes	70	100	30	40	50	75	20	28	2.5	4.0
Eldean-Casco gravelly loams, 6 to 12 percent slopes, moderately eroded	55	75	28	35	40	60	18	25	2.5	3.5
Eldean-Casco gravelly loams, 12 to 18 percent slopes, moderately eroded									2.0	3.0
Eldean-Casco complex, 6 to 18 percent slopes, severely eroded									1.8	2.5
Eldean-Miamian complex, 2 to 6 percent slopes	75	100	35	45	45	75	22	30	3.0	4.5
Eldean-Miamian complex, 6 to 12 percent slopes	60	90	30	38	45	65	20	30	2.8	4.0
Genesee silt loam	80	115	32	40	60	80	30	40	3.0	5.0
Glynwood silt loam, 2 to 6 percent slopes	65	90	28	35	45	65	20	30	2.5	3.5
Glynwood silt loam, 2 to 6 percent slopes, moderately eroded	60	80	26	35	42	60	20	25	2.5	3.5
Glynwood silt loam, 6 to 12 percent slopes, moderately eroded	55	75	25	35	42	60	20	25	2.0	3.5
Glynwood silt loam, 12 to 18 percent slopes, moderately eroded	45	65	18	28	35	45			2.0	3.0
Glynwood clay loam, 6 to 12 percent slopes, severely eroded	40	60	18	25	35	45			1.8	2.8
Glynwood clay loam, 12 to 18 percent slopes, severely eroded									1.5	2.5
Linwood muck	95	115								
Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded									1.0	2.0

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats		Soybeans		Alfalfa-grass hay	
	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Martinsville and Ockley loams, till substratum, 2 to 6 percent slopes	75	105	35	45	55	75	28	38	3.0	5.0
Medway silt loam	80	115	30	50	55	80	28	38	3.0	5.0
Miamian silt loam, 0 to 2 percent slopes	85	115	37	46	60	80	30	40	3.5	5.0
Miamian silt loam, 2 to 6 percent slopes	80	100	35	45	55	75	28	38	3.0	5.0
Miamian silt loam, 2 to 6 percent slopes, moderately eroded	70	90	35	45	55	75	25	35	3.0	4.5
Miamian silt loam, 6 to 12 percent slopes, moderately eroded	60	85	30	38	45	65	20	30	2.8	4.5
Miamian silt loam, 12 to 18 percent slopes, moderately eroded	55	75	25	32	45	65	18	25	2.7	4.2
Miamian silt loam, limestone substratum, 0 to 2 percent slopes	85	110	37	46	60	80	30	40	3.5	5.0
Miamian silt loam, limestone substratum, 2 to 6 percent slopes	75	100	35	45	55	75	28	38	3.0	5.0
Miamian silt loam, limestone substratum, 2 to 6 percent slopes, moderately eroded	65	85	35	45	55	75	25	35	3.0	4.5
Miamian silt loam, limestone substratum, 6 to 12 percent slopes, moderately eroded	55	85	30	38	45	65	20	30	2.8	4.5
Miamian clay loam, 6 to 12 percent slopes, severely eroded	45	65	25	33	45	65	16	24	2.5	4.0
Miamian clay loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	----	----	1.5	2.5
Miamian and Hennepin silt loams, 18 to 25 percent slopes	----	----	----	----	----	----	----	----	2.0	3.0
Miamian and Hennepin silt loams, 25 to 50 percent slopes	----	----	----	----	----	----	----	----	1.5	2.5
Millsdale silt loam, 0 to 2 percent slopes	65	100	25	40	45	75	28	40	2.5	4.0
Millsdale silt loam, 2 to 6 percent slopes	63	98	25	40	45	75	28	38	2.5	4.0
Millsdale silty clay loam, 0 to 2 percent slopes	65	100	25	40	45	74	28	40	2.5	4.0
Millsdale silty clay loam, 2 to 6 percent slopes	60	98	24	40	42	75	25	38	2.4	4.0
Milton silt loam, 0 to 2 percent slopes	55	80	28	40	45	65	20	30	2.5	3.5
Milton silt loam, 2 to 6 percent slopes	55	80	28	40	45	65	20	30	2.5	3.5
Milton silt loam, 2 to 6 percent slopes, moderately eroded	50	75	25	38	42	62	18	28	2.4	3.4
Milton silt loam, 6 to 12 percent slopes, moderately eroded	40	65	18	25	35	52	15	25	2.2	3.3
Milton silt loam, 12 to 18 percent slopes, moderately eroded	38	62	15	24	32	50	14	24	2.0	3.0
Montgomery silty clay loam	80	110	35	45	----	----	30	40	3.0	4.5
Ockley silt loam, 0 to 2 percent slopes	85	112	35	50	60	85	30	40	3.5	5.0
Ockley silt loam, 2 to 6 percent slopes	75	110	35	50	60	85	28	38	3.5	5.0
Odell silt loam, 0 to 2 percent slopes	90	110	35	45	55	75	30	40	3.0	5.0
Odell silt loam, 2 to 6 percent slopes	85	105	35	45	55	75	28	38	3.0	5.0
Pewamo silty clay loam	85	115	35	45	60	80	30	40	3.0	5.0
Randolph silt loam, 0 to 2 percent slopes	80	105	25	35	50	70	25	35	2.5	3.5
Randolph silt loam, 2 to 6 percent slopes	75	95	25	35	50	70	22	33	2.5	3.5
Ritchey silt loam, 2 to 6 percent slopes	40	65	18	25	35	50	15	25	2.0	3.0

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats		Soybeans		Alfalfa-grass hay	
	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Ritchey silt loam, 6 to 18 percent slopes	----	------	-------	-----	-------	-----	-------	-----	1.5	2.5
Ritchey silt loam, 18 to 50 percent slopes	----	------	-------	-----	-------	-----	-------	-----	1.2	2.2
Ross silt loam	85	120	30	50	55	80	28	38	3.0	5.0
Ross silt loam, shallow variant	40	65	18	25	35	50	15	25	2.0	3.0
Shoals silt loam	80	105	24	30	50	70	25	38	2.5	4.0
Shoals silt loam, moderately shallow variant	----	------	-------	-----	-------	-----	-------	-----	1.2	3.0
Sleeth silt loam, 0 to 2 percent slopes	80	100	35	45	60	80	30	40	3.0	5.0
Stonelick loam	70	95	32	40	60	80	28	38	3.0	5.0
Wallkill silt loam	75	110	25	35	35	75	25	40	2.5	4.0
Warsaw silt loam, 0 to 2 percent slopes	75	100	30	40	50	75	25	35	2.5	4.0
Wea silt loam, 0 to 2 percent slopes	85	120	35	50	60	85	30	45	3.5	5.0
Westland silty clay loam	95	130	35	45	60	80	30	40	3.0	5.0

6. Crop varieties that are suited to the soil are selected.
7. All farming operations are done at the proper time and in the proper way.

Under improved management the farmer uses some, but not all of the optimum management practices, or the practices he uses are not adequate for the needs of the crops.

The yields given in table 1 do not apply to a specific field in any particular year, because the soils vary from place to place, management practices vary from farm to farm, and the weather is variable from year to year.

The yields in table 1 are intended only as a guide that shows relative productivity of the soils, the response of the soils to management, and the relationship of soils to each other. Although the general level of crop yields may change as new methods and new crop varieties are developed, the relationship of the soils to each other is not likely to change.

Pasture yields, in cow-acre-days, are not given in table 1. These yields, however, can be determined by multiplying the tons of alfalfa–grass hay by 2,000 to convert tons to pounds and then by dividing the number of pounds by 40 to determine cow-acre-days. For example, Genesee silt loam yields 5 tons of alfalfa–grass hay per acre under optimum management: 5 x 2,000 equals 10,000, and that divided by 40 equals 250, which is the estimated average number of days per year that one cow can graze an acre of Genesee silt loam without damage to the pasture.

The estimated yields given in table 1 are based primarily on information obtained from farmers and on observations and field trials made by the county agent and district conservationist of the Soil Conservation Service. They are also based on experiments made by the Ohio Agricultural Research and Development Center and on field observations made by the soil survey party.

Use of the Soils for Woodland[3]

Woodlands are relatively small in area and are in a scattered pattern across the county. Only about 4 percent of the total acreage in the county is still wooded.

When the first settlers arrived in 1798, Miami County was heavily timbered (*16*).[4] In the next 150 years a relentless and constant diminishing of the forest resource followed as more and more acreage was cleared for farming.

The first annual report of the Ohio Forestry Bureau in 1886 stated that half of the original forest cover had been removed by 1850. Forest cover had been reduced to 25 percent of the total acreage by 1875.

By 1941, the forest resource had been reduced to 3.4 percent. At that time, even this woodland was virtually devoid of seedlings and saplings as a result of the widespread, destructive practice of allowing livestock to graze in the woods. Also, 92 percent of the woodland in the county was in areas less than 21 acres in size. Most of the standing wood was being downgraded in general quality by repeated cutting of the best trees, leaving the lower quality specimens and species.

From 1941 to the present, stand condition has improved somewhat and total acreage of woodland has increased slightly. Most woodland in the county is on sloping Miamian soils, steep to very steep Miamian

[3] A. N. QUAM, woodland conservationist, Soil Conservation Service, helped prepare this section.

[4] Italic numbers in parentheses refer to Literature Cited, p. 98.

and Hennepin soils, and Lorenzo and Rodman soils along the major streams and tributaries. Many frequently flooded soils, such as Shoals, Eel, Medway, and Genesee soils and some areas of muck soils are still wooded. Farm woodlots are generally on the less accessible flat uplands. Brookston and Crosby soils are in these areas.

Income from the sale of wood products is small when compared to that from the sale of other farm products. Some good quality red oak, white oak, and black walnut are still being cut from well managed woodland, however, and these bring a good return when sold. Also, farm woodlots are still a source of wood for fireplaces, rough construction lumber, and edible nuts. The demand for fireplace wood and for clear, high-quality logs has increased. Consequently, an opportunity for improving the composition and quality of stands exists through planting and cultural treatments of existing woodland.

Besides adding to farm income, woodland provides esthetic benefits that cannot be measured in monetary terms. Trees add natural beauty to the landscape, and they provide a more amenable environment. They can be used as buffer and noise abatement strips along highways and railroads.

Woodland is becoming increasingly more important for its recreation value. As the population increases, the need increases for more areas of woodland to provide space for camping, hiking, and hunting.

The total landscape in Miami County can be improved by planting programs adapted to the various kinds of soils. Each soil in the county is suited to certain trees. Steep or eroded soils are particularly dependent on woodland for permanent cover. Many abandoned, open-area sites would benefit from a transitional crop of conifer trees to improve the soil and site. In time these sites would support production of high-value hardwoods similar to the original woodland.

Because most of these soils are valuable for crops and are not being used extensively for woodland, local data about potential productivity of Miami County soils in terms of board feet per acre is limited. However, studies of site index and correlations with potential yield in board feet per acre have been made on identical and on similar soils in nearby counties.

Information on yields and limitations of these soils for woodland management can be obtained from the local Soil Conservation Service office.

Suitable kinds of trees to plant and to favor in existing woodland depend, to a great extent, on drainage of the soils. Some trees grow well only on well drained or moderately well drained soils. Others grow best in moist areas. Following are examples of soils in this county, grouped according to drainage and the trees that grow best on the soils of each group.

Well drained and moderately well drained soils.—Examples of these are Miamian, Celina, and Eldean soils. Trees to favor in existing stands are northern red oak, white oak, yellow-poplar, and black walnut. Species suitable for planting in sunlit openings of wooded areas are black walnut, eastern white pine, yellow-poplar, red pine, and black locust. All of these soils, except the shallow ones, are suited to black walnut.

Somewhat poorly drained soils on uplands.—Examples of these are Crosby, Randolph, and Odell soils. Trees to favor in existing stands are bur oak, white ash, and red maple. Species suitable for planting in woodland openings are eastern white pine, red maple, and white ash.

Somewhat poorly drained soils on bottom lands.—Shoals is the most extensive soil of this kind. Trees to favor in existing stands are sweetgum, pin oak, bur oak, and red maple. Species suitable for planting in woodland openings are eastern white pine, red maple, and white ash.

Very poorly drained soils.—Examples of these wet soils are Brookston, Montgomery, Westland, and Millsdale soils. Trees to favor in existing stands are sweetgum, pin oak, red maple, and white ash. Trees are not generally planted on these soils, nor are they planted on the muck soils.

On several farms in this county, windbreaks were planted to protect the farmstead from winds in winter and early spring. These windbreaks also add beauty to the landscape. A windbreak is effective a distance of 10 to 15 times its height to leeward in reducing snow drifting and conserving moisture.

Evergreens are suitable for windbreaks, and they are more effective in winter than deciduous trees. Norway spruce, Austrian pine, eastern white pine, and arborvitae grow well on most of the soils in this county.

General forest management information is also available in the county from the Cooperative Extension Service, the State Division of Forestry and Preserves, the Agricultural Stabilization and Conservation Service, and the Soil Conservation Service.

Use of the Soils for Wildlife Habitat

Wildlife is an important natural resource in Miami County. Types of wildlife that are common in Miami County include pheasants, rabbits, quail, deer, waterfowl, and squirrels. Also numerous are raccoons, opossums, skunks, muskrats, woodchucks, foxes, and many species of birds. Since the early settlement and clearing of the county, the kind, distribution, and quantity of wildlife has changed. Because of changes in land use and the resulting changes in wildlife distribution, it is difficult to correlate the kinds and numbers of wildlife with specific soils.

The production of a wildlife species depends largely on the amount and distribution of food, shelter, and water. If any of these elements is missing, inadequate, or inaccessible, the species is absent or scarce. The kinds of wildlife that live in a given area and the number of each kind are closely related to land use, to the resulting kinds and patterns of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soils.

For example, pheasants and quail are most numerous on bottom lands and in other areas in the county that are intensively used for corn, soybeans, and small grain. Squirrels and raccoons prefer the wooded areas, interspersed with some grainfields. Waterfowl are abundant in the county during spring and fall migration and prefer the drainageways and areas of the Miami and Stillwater Rivers.

Habitat for wildlife commonly can be created or improved by planting suitable vegetation, by properly managing the existing plant cover, by fostering the natural establishment of desirable plants, or by using a combination of these measures.

This section rates the soils of Miami County according to their suitability for seven elements of wildlife habitat and for three general kinds of wildlife habitat (*1*). Then it explains the elements and the general kinds of wildlife habitat and explains the ratings.

Information in this section can be used to aid in—

1. Broad-scale planning for wildlife land use, such as in parks, wildlife refuges, nature-study areas, and other recreational developments.
2. Selecting the better soil sites for creating, improving, or maintaining specific kinds of wildlife habitat elements.
3. Determining the relative degree of management intensity required for individual habitat elements.
4. Eliminating sites on which management for specific kinds of wildlife is difficult or not feasible.
5. Determining areas suitable for acquisition for wildlife use.

Each soil is rated in table 2 according to its suitability for various kinds of plants and other elements that make up wildlife habitat. Not considered in the ratings are present use of the soil, the location of a soil in relation to other soils, and the mobility of wildlife. All of the soils are rated on the basis of their natural drainage class. Artificial drainage can change the ratings indicated in table 2.

The seven elements considered important are as follows:

Grain and seed crops.—These include such seed-producing annuals as corn, sorghum, wheat, barley, rye, oats, millet, sunflowers, and other plants commonly grown for grain or for seed. The major properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer.

Grasses and legumes.—In this group are domestic perennial grasses and herbaceous legumes that are established by planting and furnish wildlife cover and food. Among the plants are bluegrass, fescue, bromegrass, timothy, orchardgrass, reed canarygrass, clover, and alfalfa. The major properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer.

Wild herbaceous plants.—In this group are native or introduced perennial grasses and weeds that generally are established naturally. They include bluestem, foxtail, ragweed, wild rye, goldenrod, wild carrot, nightshade, dandelion, and native lespedeza. They provide food and cover principally to upland forms of wildlife. The major properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, surface stoniness, hazard of flooding or ponding, and texture of the surface layer.

Hardwood trees.—This element includes nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally but may be planted. Among the native kinds are oak, cherry, maple, hackberry, apple, hawthorn, dogwood, persimmon, sumac, sassafras, hazelnut, black walnut, hickory, sweetgum, huckleberry, blackhaw, vibernum, grape, and briers. The major properties affecting this habitat element are effective rooting depth, available water capacity, and natural drainage.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky cornel dogwood are some of the shrubs that generally are available and can be planted on soils that are rated good. Hardwoods that are not available commercially can commonly be transplanted successfully.

Coniferous plants.—This element consists of cone-bearing evergreen trees and shrubs that are used by wildlife primarily as cover, though they also provide browse and seeds or fruit-like cones. Among them are Norway spruce, Virginia pine, shortleaf pine, Scotch pine, and eastern redcedar. The major properties affecting this habitat element are effective rooting depth, available water capacity, and natural drainage.

Wetland plants.—Making up this group are wild, herbaceous, annual and perennial plants that grow on moist to wet soils exclusive of submerged or floating aquatics. They produce food and cover used mainly by wetland forms of wildlife. They include smartweed, wild millet, bulrush, sedges, barnyardgrass, pondweed, duckweed, wild millet, arrow-arum, pickerelweed, waterwillow, wetland grasses, and cattails. The major properties affecting these plants are natural drainage, surface stoniness, slope, and texture of the surface layer.

Shallow water areas.—These shallow water areas are generally not more than 5 feet deep and are near food and cover for wetland wildlife. They may be naturally wet areas or those created by dams or levees or by water-control devices in marshes or streams. Examples of such developments are wildlife ponds, beaver ponds, muskrat marshes, waterfowl feeding areas, and wildlife watering developments. The major properties affecting this habitat element are depth to bedrock, natural drainage, slope, surface stoniness, and permeability. Naturally wet areas that are acquifer fed are rated on the basis of drainage class without regard to permeability. Permeability applies only to those non-aquifer areas with a potential for development, and water is assumed to be available offsite.

Table 2 also rates the soils according to their suitability for three general kinds of wildlife in the county—openland, woodland, and wetland wildlife.

TABLE 2.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Algiers: Ag	Poor	Fair	Fair	Good
Blount:				
BlA	Fair	Good	Good	Good
BlB, BlB2	Fair	Good	Good	Good
Brookston: Bs	Poor	Poor	Poor	Poor
Celina:				
CeA	Good	Good	Good	Good
CeB, CeB2	Good	Good	Good	Good
Corwin:				
CoA	Good	Good	Good	Good
CoB	Good	Good	Good	Good
Crosby:				
CrA	Fair	Good	Good	Good
CrB	Fair	Good	Good	Good
Edwards: Ed	Very poor	Poor	Poor	Poor
Eel: Ee	Good	Good	Good	Good
Eldean:				
ElA, ElB, ElB2, EmA, EmB	Fair	Good	Good	Fair
EoC2:				
Eldean part	Fair	Good	Good	Fair
Casco part	Poor	Fair	Fair	Poor
EoD2, EpD3:				
Eldean part	Poor	Fair	Good	Fair
Casco part	Poor	Poor	Fair	Poor
ErB:				
Eldean part	Fair	Good	Good	Fair
Miamian part	Fair	Good	Good	Good
ErC:				
Eldean part	Fair	Good	Good	Fair
Miamian part	Fair	Good	Good	Good
Genesee: Gn	Good	Good	Good	Good
Glynwood:				
GwB, GwB2	Fair	Good	Good	Good
GwC2, GyC3	Fair	Good	Good	Good
GwD2, GyD3	Poor	Fair	Good	Good
Linwood: Ln	Very poor	Poor	Poor	Poor
Lorenzo: LrE2	Poor	Fair	Fair	Poor
Martinsville: MaB	Good	Good	Good	Good
Medway: Md	Good	Good	Good	Good
Miamian:				
MhA, MhB, MhB2, MkA, MkB, MkB2	Fair	Good	Good	Good
MhC2, MkC2, MlC3	Fair	Good	Good	Good
MhD2, MlD3	Poor	Fair	Good	Good
Miamian and Hennepin:				
MmE:				
Miamian part	Poor	Fair	Good	Good
Hennepin part	Poor	Poor	Fair	Poor

of wildlife habitat and kinds of wildlife

Elements of wildlife habitat—Continued			Kinds of wildlife		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Poor	Good	Good	Poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Poor	Very poor	Very poor	Fair	Poor	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Fair	Poor	Very poor	Good	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Good	Fair	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Very poor	Very poor	Fair	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.

TABLE 2.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
MmF:				
Miamian part	Very poor	Poor	Good	Good
Hennepin part	Very poor	Very poor	Fair	Poor
Millsdale:				
MnA, MoA	Very poor	Poor	Poor	Poor
MnB, MoB	Very poor	Poor	Poor	Poor
Milton:				
MpA, MpB, MpB2	Fair	Good	Good	Good
MpC2	Fair	Good	Good	Good
MpD2	Poor	Fair	Good	Good
Montgomery: Mt	Very poor	Poor	Poor	Poor
Ockley: OcA, OcB	Good	Good	Good	Good
Odell:				
OdA	Fair	Good	Good	Good
OdB	Fair	Good	Good	Good
Pewamo: Pe	Very poor	Poor	Poor	Poor
Randolph:				
RdA	Fair	Good	Good	Good
RdB	Fair	Good	Good	Good
Ritchey:				
RhB, RhC	Poor	Poor	Fair	Fair
RhE	Very poor	Poor	Fair	Fair
Ross: Rs	Good	Good	Good	Good
Ross variant: Rt	Poor	Poor	Fair	Fair
Shoals: Sh	Fair	Good	Good	Good
Shoals variant: Sk	Fair	Good	Good	Good
Sleeth: SlA	Fair	Good	Good	Good
Stonelick: St	Poor	Fair	Fair	Poor
Wallkill: Wa	Very poor	Poor	Poor	Poor
Warsaw: WdA	Fair	Good	Good	Good
Wea: WeA	Good	Good	Good	Good
Westland: Wt	Poor	Poor	Poor	Poor

Openland wildlife.—Examples of openland wildlife are bobwhite quail, ringneck pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals generally use habitat in areas of crops, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, shrubs, and vines. They are also found along the fence lines and borders associated with openland.

Woodland wildlife.—Birds and mammals that prefer woodland habitat include ruffed grouse, woodcock, thrush, vireo, scarlet tanager, red, gray, and fox squirrels, red and gray foxes, white-tailed deer, and raccoon. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife.—Ducks, Canada geese, rails, herons, and muskrat are familiar examples of birds and mammals that generally use habitat in areas of ponds, marshes, swamps and other wet areas.

Each rating under "Kind of Wildlife" in table 2 is based on the ratings listed for the habitat elements in the first part of the table. For openland wildlife the rating is based on the ratings shown for grain and seed crops, domestic grasses and legumes, wild herbaceous upland plants, and either hardwood woody plants or coniferous woody plants, whichever is most applicable.

of wildlife habitat and kinds of wildlife—Continued

Elements of wildlife habitat—Continued			Kinds of wildlife		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Poor	Poor	Poor	Poor	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Poor	Good	Good	Poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.

The rating for woodland wildlife is based on the ratings listed for domestic grasses and legumes, wild herbaceous upland plants, and either hardwood woody plants or coniferous woody plants, whichever is most applicable. For wetland wildlife the rating is based on the ratings shown for wetland food and cover plants and shallow water areas.

On soils rated *good,* habitat is generally easily created, improved, or maintained. There are few or no soil limitations in habitat management and satisfactory results are well assured.

On soils rated *fair,* habitat generally can be created, improved, or maintained, but the soils have moderate limitations that affect the creation, improvement, or maintenance of the habitat. A moderate intensity of management and fairly frequent attention is required to assure satisfactory results.

On soils rated *poor,* habitat can generally be created, improved, or maintained, but there are rather severe soil limitations. Habitat management may be difficult, expensive, and require intensive effort. Satisfactory results are questionable.

On soils rated *very poor,* it is impractical to create, improve, or maintain habitat because of the very severe soil limitations. Unsatisfactory results are probable on such soils.

Engineering Uses of the Soils [5]

This section is useful to planning commissions, town and city managers, land developers, engineers, contractors, and farmers and others who need information about soils used as structural material or as foundation upon which structures are built.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slopes. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance or structures already built with properties of the kinds of soil on which they are built to help predict per-

[5] KYLE L. MORAN, assistant State conservation engineer, Soil Conservation Service, helped prepare this section.

TABLE 3.—*Engineering*

[Tests performed by the Soil Physical Studies Laboratory, Ohio State University. Dashes

Soil name and location	Parent material	Report number	Depth
			Inches
Brookston silty clay loam:			
MM–17, SW¼SW¼ sec. 31, T. 5 N., R. 6 E., Concord Township.	Glacial till.	19094	0–11
		19095	11–17
		19096	17–31
		19097	31–39
		19098	39–60
Crosby silt loam:			
MM–20, SW¼NE¼ sec. 23, T. 7 N., R. 5 E., Concord Township.	Glacial till.	19805	0–8
		19806	8–11
		19807	11–20
		19808	20–24
		19809	24–28
		19810	28–60
Genesee silt loam:			
MM–22, NW¼SW¼ sec. 36, T. 2 E., R. 9 N., Bethel Township.	Loamy alluvium.	19817	0–11
		19818	11–25
		19819	25–43
		19820	43–60
Miamian silt loam, limestone substratum:			
MM–18, SE¼NE¼ sec. 16, T. 4 N., R. 6 E., Monroe Township.	Glacial till over limestone bedrock.	19099	0–9
		19100	9–12
		19101	12–24
		19102	24–28
		19103	28–35
		19104	35–53
Milton silt loam:			
MM–19, SE¼SW¼ sec. 21, T. 4 N., R. 6 E., Monroe Township.	Glacial till over limestone bedrock.	19105	0–9
		19106	9–13
		19107	13–28
		19108	28–33
Warsaw silt loam:			
MM–32, SE¼SE¼ sec. 35, T. 4 N., R. 6 E., Monroe Township.	Glacial outwash.	20145	0–9
		20146	9–18
		20147	18–23
		20148	23–28
		20149	28–34
		20150	34–37
		20151	37–60

[1] Mechanical analysis according to AASHTO Designation T 88 (*2*), except that all material larger than 2 millimeters in diameter was discarded from the samples. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the procedure used, the fine material was analyzed by the hydrometer method. In the SCS procedure, the fine material is analyzed by the pipette method. The mechanical analyses in this table may not be suitable for use in naming textural classes for soil.

formance of structures on the same or similar kinds of soil in other locations.

6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables. Table 3 shows results of engineering laboratory tests on soil samples. Table 4 shows several estimated soil properties significant in engineering. Table 5 shows interpretations for various engineering uses.

This information, along with the soil map and data in other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to a greater depth than those shown in the tables, generally a depth of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil can include small areas of other kinds of soil that have strongly contrasting properties and different suitability or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists. The Glossary defines many of these terms.

test data

indicate that tests were not made for the properties and the samples were not classified]

Mechanical analysis[1]				Liquid limit	Plasticity index	Classification	
Percentage passing sieve—			Percentage smaller than 0.005 mm			AASHTO[2]	Unified[3]
No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Percent			
100	95	84	41	47	18	A-7-6(12)	CL-ML
100	95	86	45	---	---	---	---
100	93	83	42	43	14	A-7-6(10)	ML
100	94	84	42	44	19	A-7-6(13)	CL-ML
100	88	72	26	31	11	A-6(8)	CL
100	94	84	27	---	---	---	---
100	98	95	46	---	---	---	---
100	98	93	50	53	11	A-7-5(15)	MH
100	96	85	44	42	13	A-7-6(10)	ML
100	90	76	30	---	---	---	---
100	87	69	26	24	6	A-4(8)	CL-ML
100	97	87	33	---	---	---	---
100	96	82	34	41	9	A-5(8)	ML
100	89	63	25	33	8	A-4(8)	CL-ML
100	29	12	6	[4] NP	NP	A-1-b(0)	SW-SM
100	95	83	26	---	---	---	---
100	95	83	37	44	16	A-7-6(12)	CL-ML
100	91	76	46	44	13	A-7-5(10)	ML
100	94	79	47	---	---	---	---
100	92	80	50	---	---	---	---
100	82	69	21	21	5	A-4(8)	CL-ML
100	93	82	27	---	---	---	---
100	93	81	38	33	12	A-6(9)	CL
100	91	76	46	44	18	A-7-6(12)	CL-ML
100	88	70	38	38	14	A-6(10)	CL-ML
100	95	85	40	---	---	---	---
100	93	83	39	---	---	---	---
100	88	79	66	50	17	A-7-5(13)	MH
100	84	75	64	50	23	A-7-6(15)	CL-ML
100	77	66	59	47	22	A-7-6(14)	CL-ML
100	79	65	52	---	---	---	---
100	23	10	7	---	---	---	---

[2] Based on AASHTO Designation M 145-49 (*2*).
[3] Based on the Unified Soil Classification System (*3*).
[4] NP means nonplastic.

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The
the first column of this table. Dashes indicate that the soil property is too variable to be estimated or that no

Soil series and map symbols	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface	USDA texture	Classification: Unified	Classification: AASHTO	Coarse fraction larger than 3 inches
	Feet	*Feet*	*Inches*				*Percent*
Algiers: Ag	[1] 0–1½	>8	0–23	Silt loam	ML, CL–ML	A–4	-------
			23–60	Silty clay loam, clay loam	CL, CL–ML	A–6, A–7	-------
Blount: BlA, BlB, BlB2	0–2	>8	0–9	Silt loam	ML	A–4	-------
			9–33	Silty clay, silty clay loam	CL, CH	A–7	-------
			33–60	Clay loam	CL	A–6	-------
Brookston: Bs	0–1	>8	0–39	Silty clay loam	CL, ML, CH	A–6, A–7	-------
			39–60	Loam	CL, ML	A–4, A–6	-------
Casco. Mapped only in complexes with Eldean soils.	>5	>8	0–8	Gravelly loam	ML	A–4	-------
			8–20	Gravelly clay loam	CL, SC	A–6	-------
			20–60	Stratified sand and gravel	GW, GM, SW, GP, SM	A–1	0–5
Celina: CeA, CeB, CeB2	2–3	>8	0–12	Silt loam	ML	A–4	-------
			12–24	Clay loam, silty clay	CL	A–7, A–6	-------
			24–60	Loam	CL, ML	A–4, A–6	-------
Corwin: CoA, CoB	2–4	>5	0–13	Silt loam, loam	ML	A–4	-------
			13–28	Clay loam	CL	A–6, A–7	-------
			28–60	Loam	ML, CL	A–4, A–6	-------
Crosby: CrA, CrB	0–2	>5	0–8	Silt loam	ML	A–4	-------
			8–28	Silty clay, silty clay loam	CL, MH, CH, ML	A–7, A–6	-------
			28–60	Loam	CL, ML	A–4, A–6	-------
Edwards: Ed	0–1	>8	0–21	Muck	Pt	-------	-------
			21–60	Marl	-------	-------	-------
Eel: Ee	[1] 2–3	>5	0–31	Silt loam, loam	ML, CL-ML	A–4, A–6	-------
			31–42	Loam, gravelly loam	ML, CL-ML	A–4	-------
			42–60	Stratified sand and gravel	GM, SM	A–1	0–5
* Eldean: ElA, ElB, ElB2, EmA, EmB, EoC2, EoD2, EpD3, ErB, ErC. For Casco part of EoC2, EoD2, and EpD3 and the Miamian part of ErB and ErC, see the Casco and Miamian series.	>5	>8	0–12	Loam, silt loam, gravelly loam.	ML	A–4	-------
			12–23	Clay, clay loam	CL	A–7, A–6	-------
			23–30	Gravelly clay loam	CL, SC	A–6	-------
			30–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5
Genesee: Gn	[1] 4	>5	0–25	Silt loam, loam	ML, CL–ML	A–4, A–5, A–6	-------
			25–43	Loam	ML, CL–ML	A–4	-------
			43–60	Stratified sand and gravel	GM, SM	A–1	0–5
Glynwood: GwB, GwB2, GwC2, GwD2, GyC3, GyD3.	1½–3	>8	0–8	Silt loam, clay loam	ML, CL	A–4, A–6	-------
			11–29	Clay, clay loam, silty clay loam.	CL, CH	A–7, A–6	-------
			29–60	Clay loam	CL	A–6	-------
Hennepin. Mapped only in undifferentiated groups with Miamian soils.	>5	>5	0–14	Silt loam	ML, CL–ML	A–4, A–6	-------
			14–60	Loam	ML, CL	A–4, A–6	-------
Linwood: Ln	0–1	>8	0–28	Muck	Pt	-------	-------
			28–60	Silty clay loam	CL	A–6, A–7	-------
* Lorenzo: LrE2. For Rodman part, see Rodman series.	>5	>8	0–7	Gravelly loam	ML	A–4	-------
			7–20	Gravelly clay loam, sandy clay loam.	CL, SC	A–6	-------
			20–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5

See footnotes at end of table.

significant in engineering

soils in such mapping units may have different properties, and for this reason it is necessary to refer to other series as indicated in estimate was made. The symbol > means more than; the symbol < means less than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Liquid limit	Plasticity index	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Inches per hour	*Inches per inch of soil*	*pH*					
100	100	90–100	70–90	0.6–2.0	0.17–0.21	6.1–7.3	25–40	4–10	Low	High	Low.
100	90–100	90–100	75–95	0.6–2.0	0.14–0.18	6.6–8.4	25–45	5–16	Moderate	High	Low.
100	100	90–100	75–95	0.6–2.0	0.16–0.20	5.6–6.0	30–40	6–10	Low	High	Moderate.
100	95–100	90–100	80–95	0.06–0.2	0.10–0.15	5.6–7.8	40–52	18–26	Moderate	High	Moderate.
90–100	85–100	80–100	70–80	0.06–0.2	0.06–0.10	[2] 7.9–8.4	30–38	12–20	Moderate	High	Low.
100	95–100	90–100	80–95	0.6–2.0	0.18–0.22	6.1–7.8	38–52	14–24	Moderate	High	Low.
95–100	85–100	80–95	60–75	0.2–0.6	0.07–0.12	[2] 7.9–8.4	20–35	6–14	Low to moderate.	High	Low.
75–95	70–85	65–80	50–70	0.6–2.0	0.13–0.17	6.6–7.8	25–35	4–10	Low	Low	Low.
75–95	70–85	60–80	45–65	0.6–6.0	0.10–0.14	[2] 6.6–7.8	30–40	11–18	Low	Moderate	Low.
35–60	30–55	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	[3] NP	NP	Low	Low	Low.
100	100	90–100	70–90	0.6–2.0	0.16–0.20	5.6–7.3	30–40	6–10	Low	Moderate	Moderate.
95–100	85–100	90–100	70–90	0.2–0.6	0.12–0.16	5.6–7.8	35–45	16–24	Moderate	High	Moderate.
90–100	80–100	75–95	55–75	0.2–0.6	0.07–0.12	[2] 7.9–8.4	20–35	6–14	Low	Moderate	Low.
100	95–100	90–100	70–85	0.6–2.0	0.18–0.22	6.1–7.3	30–40	6–10	Low	Moderate	Low.
95–100	90–100	85–100	70–80	0.2–0.6	0.14–0.18	6.1–7.8	35–45	14–22	Moderate	High	Low.
90–100	80–95	75–90	55–75	0.2–0.6	0.07–0.12	[2] 7.9–8.4	20–35	6–14	Low	Moderate	Low.
100	95–100	90–100	70–90	0.6–2.0	0.16–0.20	5.6–6.5	30–40	6–10	Low	High	Moderate.
90–100	85–100	90–100	75–95	0.2–0.6	0.12–0.16	5.6–7.8	40–55	13–24	Moderate	High	Moderate.
85–100	75–95	70–90	55–75	0.2–0.6	0.07–0.12	[2] 7.4–8.4	20–35	6–14	Low	High	Low.
--------	--------	--------	--------	2.0–6.0	0.20–0.30	6.6–7.8	--------	--------	Variable	High	Low.
--------	--------	--------	--------	--------	--------	[2] 7.4–8.4	--------	--------	--------	--------	Low.
95–100	90–100	85–100	65–85	0.6–2.0	0.16–0.20	[2] 7.4–7.8	30–40	4–14	Low	Moderate	Low.
80–95	75–90	65–80	50–65	0.6–6.0	0.14–0.18	[2] 7.9–8.4	25–35	4–10	Low	Moderate	Low.
45–60	40–55	30–40	10–30	6.0–20	0.06–0.10	[2] 7.9–8.4	NP	NP	Low	Low	Low.
85–100	75–100	70–90	60–75	0.6–2.0	0.13–0.17	5.6–7.3	20–40	4–10	Low	Low	Moderate.
85–100	80–100	75–90	60–80	0.6–2.0	0.09–0.13	5.6–7.3	35–50	14–25	Moderate	High	Moderate.
55–80	50–70	45–65	40–60	0.6–6.0	0.07–0.11	[2] 6.6–8.4	30–40	11–18	Low	Moderate	Low.
35–60	30–55	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.
95–100	90–100	85–100	70–90	0.6–2.0	0.16–0.20	[2] 7.4–8.4	30–42	4–14	Low	Low	Low.
85–100	80–95	75–90	55–70	0.6–2.0	0.13–0.17	[2] 7.9–8.4	25–35	4–10	Low	Moderate	Low.
45–60	40–55	25–40	10–30	6.0–20	0.06–0.10	[2] 7.9–8.4	NP	NP	Low	Low	Low.
95–100	95–100	90–100	75–90	0.6–2.0	0.16–0.20	5.6–7.3	28–40	4–14	Low	Moderate	Moderate.
95–100	85–100	80–100	75–95	0.06–0.2	0.10–0.15	5.6–7.8	38–52	18–28	Moderate	High	Moderate.
90–100	80–100	75–95	65–80	0.06–0.2	0.06–0.10	[2] 7.4–8.4	30–40	12–17	Low	High	Low.
95–100	90–100	85–95	70–85	0.6–2.0	0.11–0.17	[2] 7.4–8.4	25–38	4–12	Low	Low	Low.
90–100	85–100	80–95	60–75	0.2–0.6	0.06–0.10	[2] 7.9–8.4	25–35	6–14	Low	Low	Low.
--------	--------	--------	--------	6.0–20	0.20–0.30	[2] 7.4–8.4	--------	--------	Low	High	Low.
95–100	90–100	85–100	75–95	0.2–0.6	0.14–0.18	[2] 7.9–8.4	25–35	11–20	Moderate	High	Low.
80–95	75–85	65–75	55–65	2.0–6.0	0.13–0.17	6.6–7.8	30–40	4–10	Low	Low	Low.
80–100	75–95	70–85	35–65	2.0–6.0	0.10–0.14	[2] 6.6–8.4	30–40	11–20	Low	Moderate	Low.
35–60	30–55	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface	USDA texture	Classification: Unified	Classification: AASHTO	Coarse fraction larger than 3 inches
	Feet	*Feet*	*Inches*				*Percent*
* Martinsville: MaB. For Ockley part, see Ockley series.	>5	>8	0–8	Loam	ML	A–4	
			8–30	Clay loam, sandy clay loam	CL, SC	A–6, A–4	
			30–50	Gravelly clay loam, fine sandy loam.	SC, CL	A–6, A–4	
			50–66	Loam	ML, CL	A–4, A–6	
Medway: Md	[1] 2–3	>5	0–20	Silt loam, light silty clay loam.	ML, CL	A–4, A–6	
			20–60	Loam, light clay loam	ML, CL	A–4, A–6	
* Miamian: MhA, MhB, MhB2, MhC2, MhD2, MkA, MkB, MkB2, MkC2, MlC3, MlD3, MmE, MmF. For Hennepin part of MmE and MmF, see Hennepin series.	>4	[4] 3½	0–10	Silt loam, clay loam	ML, CL	A–4, A–6	
			10–38	Clay loam, silty clay loam	CL, ML	A–7, A–6	
			38–80	Loam	ML, CL	A–4, A–6	
Millsdale: MnA, MnB, MoA, MoB.	0–1	1½–3½	0–14	Silty clay loam, silt loam	CL	A–6, A–7	
			14–30	Silty clay	CH, MH, CL	A–7	
			30	Limestone bedrock.			
Milton: MpA, MpB, MpB2, MpC2, MpD2.	>4	1½–3½	0–8	Silt loam	ML, CL–ML	A–4	
			8–19	Silty clay loam, clay loam	CL, CL–ML	A–6, A–7	
			19–29	Clay, clay loam	CH, CL, CL–ML	A–7, A–6	0–5
			29	Limestone bedrock.			
Montgomery: Mt	0–1	>5	0–16	Silty clay loam	CL, CH, MH	A–6, A–7	
			16–33	Silty clay, silty clay loam	CH	A–7	
			33–68	Silty clay loam	CL, CH	A–6, A–7	
Ockley: OcA, OcB	>5	>8	0–12	Silt loam	ML	A–4	
			12–37	Silty clay loam, clay loam, clay.	CL	A–6	
			37–47	Gravelly loam	ML, SC	A–6	
			47–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5
Odell: OdA, OdB	1–2	>5	0–16	Silt loam	ML	A–4	
			16–38	Clay loam	CL	A–6, A–7	
			38–60	Loam	ML, CL	A–4, A–6	
Pewamo: Pe	0–1	>8	0–16	Silty clay loam	CL	A–6, A–7	
			16–30	Silty clay	CH, CL	A–7	
			35–60	Silty clay loam	CL	A–6, A–7	
Randolph: RdA, RdB	1–2	1½–3½	0–11	Silt loam, silty clay loam	ML, CL–ML	A–4, A–6	
			11–29	Silty clay, clay	CH, CL	A–7	
			29–34	Very gravelly clay loam	GC, GM	A–6, A–2	0–15
			34	Limestone bedrock.			
Ritchey: RhB, RhC, RhE	>3	1–2	0–9	Silt loam	ML	A–4	
			9–16	Silty clay loam, silty clay	CL, CH	A–7, A–6	0–15
			16	Limestone bedrock.			
Rodman. Mapped only in a complex with Lorenzo soils.	>5	>8	0–15	Gravelly loam	ML, SM	A–4	
			15–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5
Ross: Rs	>4	>5	0–45	Silt loam	ML, CL	A–4, A–6	
			45–60	Loam	ML, CL	A–4, A–6	
Ross variant: Rt	[1] >3	1–2	0–7	Silt loam	ML, CL	A–4, A–6	
			7–13	Silty clay loam	CL	A–6, A–7	
			13	Limestone bedrock.			
Shoals: Sh	[1] 0–1	>5	0–40	Silt loam, loam	ML, CL–ML	A–4, A–6	
			40–60	Stratified sand and gravel	SM, GM	A–1, A–3	0–5

See footnotes at end of table.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Liquid limit	Plasticity index	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Inches per hour	*Inches per inch of soil*	*pH*					
100	95–100	85–95	60–75	0.6–2.0	0.14–0.18	5.6–7.3	25–38	4–10	Low	Low	Moderate.
100	95–100	80–90	45–75	0.6–2.0	0.12–0.16	5.6–6.5	20–35	8–17	Moderate	Moderate	Moderate.
85–100	80–100	70–85	40–70	0.6–6.0	0.10–0.14	[2] 6.6–8.4	20–35	6–15	Low	Moderate	Low.
85–100	80–95	75–90	55–75	0.2–0.6	0.07–0.12	[2] 7.9–8.4	20–35	6–14	Low	Low	Low.
100	95–100	90–100	70–90	0.6–2.0	0.18–0.22	[2] 7.4–7.8	25–40	4–12	Low	Moderate	Low.
95–100	90–100	80–95	60–80	0.6–2.0	0.13–0.17	[2] 7.4–8.4	25–40	6–14	Low	Moderate	Low.
100	95–100	85–100	70–85	0.6–2.0	0.16–0.20	6.1–6.5	30–40	6–12	Low	Low	Low.
95–100	90–100	90–100	70–90	0.2–0.6	0.12–0.16	5.6–7.8	35–45	12–24	Moderate	Moderate	Moderate.
95–100	90–100	80–95	60–75	0.2–0.6	0.07–0.12	[2] 7.9–8.4	20–35	5–12	Low	Moderate	Low.
100	100	95–100	80–95	0.6–2.0	0.16–0.20	6.1–7.3	32–45	12–22	Moderate	High	Low.
90–100	85–100	80–100	75–85	0.2–0.6	0.11–0.17	6.1–7.8	40–60	20–30	High	High	Low.
100	95–100	90–100	80–90	0.6–2.0	0.16–0.20	6.1–6.5	26–36	6–10	Low	Low	Low.
100	95–100	90–100	70–85	0.2–0.6	0.12–0.16	5.6–7.3	34–48	11–28	Moderate	Moderate	Moderate.
95–100	90–100	85–100	65–85	0.2–0.6	0.10–0.14	6.1–7.8	38–55	14–30	Moderate	High	Low.
100	100	95–100	85–98	0.6–2.0	0.16–0.21	6.6–7.3	35–54	20–32	Moderate	High	Low.
100	100	95–100	90–98	0.06–0.2	0.12–0.16	6.6–7.8	50–69	30–40	Moderate	High	Low.
10	100	95–100	85–95	0.06–0.6	0.10–0.15	7.4–8.4	35–52	20–32	Moderate	High	Low.
100	100	90–100	70–90	0.6–2.0	0.16–0.20	6.1–6.5	30–40	4–10	Low	Low	Low.
95–100	95–100	90–100	70–80	0.6–2.0	0.15–0.17	6.1–7.8	25–35	11–17	Moderate	Moderate	Low.
75–90	70–80	60–75	45–60	2.0–6.0	0.12–0.16	[2] 6.6–7.8	30–40	11–18	Low	Low	Low.
35–60	30–50	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.
100	95–100	90–100	70–95	0.6–2.0	0.18–0.22	6.1–7.3	30–40	6–10	Low	High	Low.
95–100	90–100	90–100	70–85	0.6–2.0	0.14–0.18	6.1–7.8	35–45	14–22	Moderate	High	Low.
90–100	85–100	85–95	60–75	0.2–0.6	0.07–0.12	[2] 7.9–8.4	20–35	6–14	Low	High	Low.
95–100	85–100	85–100	80–95	0.6–2.0	0.17–0.21	6.1–7.3	34–42	12–20	Moderate	High	Low.
90–100	80–100	80–100	75–95	0.2–0.6	0.12–0.16	6.6–7.3	40–52	24–34	Moderate	High	Low.
85–100	80–95	75–95	70–90	0.2–0.6	0.07–0.12	[2] 7.4–8.4	30–42	12–20	Moderate	High	Low.
100	95–100	90–100	70–90	0.6–2.0	0.16–0.20	5.6–6.5	20–40	5–14	Low	High	Moderate.
100	95–100	90–100	75–95	0.2–0.6	0.13–0.17	5.6–7.3	45–60	22–35	High	High	Moderate.
40–55	30–50	20–45	15–40	0.2–2.0	0.10–0.14	[2] 7.4–7.8	20–40	5–12	Moderate	High	Low.
100	90–100	85–100	70–90	0.6–2.0	0.16–0.20	5.6–7.3	30–40	4–10	Low	Low	Moderate.
90–100	85–100	80–95	75–95	0.6–2.0	0.13–0.17	6.6–8.4	35–52	18–26	Moderate	Moderate	Low.
75–90	70–85	69–75	40–60	2.0–6.0	0.10–0.14	[2] 7.4–7.8	22–30	2–6	Low	Low	Low.
35–60	30–50	20–40	4–15	6.0–20	0.02–0.04	[2] 7.9–8.4	NP	NP	Low	Low	Low.
100	95–100	90–100	70–90	0.6–2.0	0.18–0.22	[2] 6.6–8.4	25–40	4–12	Low	Low	Low.
95–100	90–100	80–95	55–75	0.6–2.0	0.13–0.17	[2] 7.4–8.4	25–40	6–14	Low	Low	Low.
100	95–100	90–100	70–90	0.6–2.0	0.18–0.22	7.4–7.8	25–40	4–12	Low	Low	Low.
95–100	90–100	85–100	80–95	0.6–2.0	0.15–0.19	[2] 7.9–8.4	25–35	11–15	Low	Moderate	Low.
100	95–100	90–100	70–90	0.6–2.0	0.16–0.20	[2] 7.4–7.8	30–40	4–14	Low	High	Low.
45–60	40–55	30–40	10–30	6.0–20	0.06–0.10	[2] 7.9–8.4	NP	NP	Low	Low	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface	USDA texture	Classification: Unified	Classification: AASHTO	Coarse fraction larger than 3 inches
	Feet	*Feet*	*Inches*				*Percent*
Shoals variant: Sk	[1] 0–1	1½–3½	0–8	Silt loam	ML, CL–ML	A–4, A–6	
			8–36	Loam, silt loam, clay loam	ML, CL–ML	A–4, A–6	
			36	Limestone bedrock.			
Sleeth: SIA	0–2	>8	0–10	Silt loam	ML	A–4	
			10–42	Clay loam, sandy clay loam	CL, SC	A–6	
			42–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5
Stonelick: St	[1] >4	>8	0–15	Loam	ML	A–4	
			15–38	Sandy loam	SM	A–2	
			38–60	Stratified sand and loamy sand.	SM	A–2	
Wallkill: Wa	0–1	>8	0–27	Silt loam	ML	A–4	
			27–60	Muck	Pt		
Warsaw: WdA	>5	>8	0–18	Silt loam	ML, CL–ML	A–4, A–6	
			18–37	Clay loam, gravelly loam, loam.	CL, MH, ML	A–6, A–7	
			37–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5
Wea: WeA	>5	>8	0–18	Silt loam	ML, CL–ML	A–4, A–6	
			18–44	Clay loam, gravelly clay loam.	CL	A–6	
			44–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5
Westland: Wt	0–1	>5	0–18	Silty clay loam	CL	A–6, A–7	
			18–32	Clay loam, gravelly clay loam.	CL	A–6, A–7	
			32–45	Gravelly loam	ML, CL	A–4, A–6	
			45–60	Stratified sand and gravel	GW, GM, SW, SM	A–1	0–5

[1] Subject to flooding.
[2] Calcareous.

TABLE 5.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The as indicated in the first

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of— Topsoil	Suitability as a source of— Sand and gravel	Suitability as a source of— Road fill	Soil features affecting— Highway location
Algiers: Ag	Poor: seasonal high water table; subject to flooding.	High	Good	Unsuited	Poor: moderately fine texture.	Seasonal high water table; subject to flooding.
Blount: BIA, BIB, BIB2.	Poor: Seasonal high water table.	Moderate	Fair: thin layer.	Unsuited	Poor: clayey subsoil.	Seasonal high water table; slow permeability; clayey subsoil.
Brookston: Bs	Poor: seasonal high water table.	High	Poor: wetness.	Unsuited	Poor: seasonal high water table; moderately fine texture.	Seasonal high water table; surface ponding in low areas.

significant in engineering—Continued

Percentage passing sieve—				Permea-bility	Available water capacity	Reaction	Liquid limit	Plasti-city index	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Inches per hour	*Inches per inch of soil*	*pH*					
95–100	95–100	90–100	70–90	0.6–2.0	0.16–0.20	[2] 7.4–7.8	30–40	4–14	Low	High	Low.
95–100	90–100	80–95	60–80	0.6–2.0	0.13–0.17	[2] 7.4–8.4	25–35	4–14	Low	High	Low.
100	95–100	90–100	70–90	0.6–2.0	0.16–0.20	6.1–7.3	30–40	4–10	Low	High	Low.
85–100	80–100	70–95	45–75	0.6–2.0	0.13–0.17	[2] 6.1–7.8	25–35	11–17	Moderate	High	Low.
35–60	30–50	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.
100	95–100	85–95	60–75	0.6–2.0	0.10–0.15	[2] 7.4–8.4	30–40	4–10	Low	Low	Low.
95–100	90–100	65–85	35–50	2.0–6.0	0.06–0.12	[2] 7.9–8.4	<36	NP–6	Low	Low	Low.
85–100	75–95	50–70	10–20	2.0–6.0	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.
100	95–100	80–100	60–90	0.6–2.0	0.16–0.20	6.6–7.8	20–35	2–8	Low	High	Low.
--------	--------	--------	--------	6.0–20	0.20–0.30	6.6–7.8	--------	--------	Low	High	Low.
100	95–100	90–100	70–90	0.6–2.0	0.14–0.19	6.1–7.8	25–40	4–14	Low	Low	Low.
75–100	70–100	65–95	50–80	0.6–2.0	0.10–0.15	[2] 7.1–8.4	35–54	14–23	Moderate	Moderate	Low.
35–60	30–50	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.
100	95–100	90–100	70–90	0.6–2.0	0.18–0.22	6.1–7.3	30–40	6–12	Low	Low	Low.
80–100	70–95	65–75	55–80	0.6–2.0	0.13–0.17	[2] 6.6–8.4	30–40	11–18	Moderate	Moderate	Low.
35–60	30–50	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.4	NP	NP	Low	Low	Low.
100	95–100	90–100	80–95	0.2–2.0	0.17–0.21	6.1–7.3	35–45	14–22	Moderate	High	Low.
80–100	75–95	70–90	60–80	0.2–0.6	0.13–0.17	6.6–7.3	35–45	15–25	Moderate	High	Low.
75–90	70–85	60–75	50–65	0.6–2.0	0.13–0.17	[2] 7.4–7.8	30–40	8–14	Low	High	Low.
35–60	30–50	20–40	4–15	6.0–20	0.02–0.06	[2] 7.9–8.5	NP	NP	Low	High	Low.

[3] NP means nonplastic.
[4] Mapping units MkA, MkB, MkB2, and MkC2 have bedrock at a depth of 3½ to 6 feet. All other mapping units in the **Miamian** series have bedrock at a depth of more than 6 feet.

properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series column of this table]

Soil features affecting—Continued					
Ponds		Drainage for crops and pasture	Sprinkler irrigation	Terraces and diversions	Grassed waterways
Reservoir area	Embankments				
Seasonal high water table; slow seepage; some lenses of sand.	Fair stability; low permeability in compacted soil.	Poor natural drainage; moderate permeability; poor outlets.	Seasonal high water table; moderate permeability.	Nearly level; high water table.	Nearly level; subject to flooding.
Slow seepage; seasonal high water table.	Fair stability; fair compaction characteristics.	Somewhat poor natural drainage; slow permeability.	Slow permeability; seasonal high water table.	Seasonal high water table.	Seasonal high water table.
Slow seepage; seasonal high water table.	Fair stability; fair compaction characteristics.	Very poor natural drainage; moderate permeability.	Moderate permeability; seasonal high water table.	Depressional to nearly level; seasonal high water table.	Seasonal high water table; depressional to nearly level.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Casco. Mapped only in complex with Eldean soils.	Good	Low	Fair: gravelly texture.	Good below a depth of 2 feet.	Fair within a depth of 2 feet. Good below a depth of 2 feet.	Moderately steep in some areas.
Celina: CeA, CeB, CeB2.	Poor: moderately fine textured material.	Moderate	Fair: thin layer.	Unsuited	Poor: clayey subsoil. Fair below a depth of 2 feet.	Moderately slow permeability; clayey subsoil.
Corwin: CoA, CoB.	Poor: moderately fine textured subsoil.	Moderate	Good	Unsuited	Fair: moderately fine textured subsoil; moderate shrink-swell potential.	Moderately slow permeability; fine-textured subsoil.
Crosby: CrA, CrB	Poor: moderately fine textured subsoil; seasonal high water table.	Moderate	Fair: thin layer.	Unsuited	Poor to fair: clayey subsoil.	Seasonal high water table; moderately slow permeability.
Edwards: Ed	Poor: seasonal high water table; unstable organic soil.	High	Poor: oxidizes rapidly; good if mixed with mineral soil.	Unsuited	Unsuited: unstable material.	Seasonal high water table; soft and unstable material; removal necessary for roadbed.
Eel: Ee	Poor: subject to flooding.	Moderate	Good	Poor: excess fines.	Fair: subject to flooding; poor compaction characteristics.	Subject to flooding.
*Eldean: ElA, ElB, ElB2, EmA, EmB, EoC2, EoD2, EpD3, ErB, ErC. For Casco part of EoC2, EoD2, and EpD3, and Miamian part of ErB and ErC, see the Casco and Miamian series.	Fair within a depth of 2 to 3½ feet; good in substratum.	Low	Fair: low in organic matter; limited suitable material.	Good below a depth of 2 to 3½ feet.	Fair: good in substratum.	Well drained; cut slopes are droughty.
Genesee: Gn	Fair: good drainage; subject to occasional flooding.	Moderate	Good	Poor: excess fines.	Fair: subject to flooding; poor compaction characteristics.	Subject to flooding.
Glynwood: GwB, GwB2, GwC2, GwD2, GyC3, GyD3.	Poor: moderately fine and fine textured material.	Moderate	Fair: thin layer; moderately fine textured material in places.	Unsuited	Poor to fair: clayey subsoil.	Slow permeability; moderately steep slopes in places; clayey material.
Hennepin. Mapped only in undifferentiated groups with Miamian soils.	Poor: steep to very steep slopes.	Moderate	Fair: thin layer.	Unsuited	Fair to poor: fair compaction characteristics; steep to very steep slopes.	Well drained; steep to very steep slopes; cut slopes are droughty.

properties of the soils—Continued

Soil features affecting—Continued					
Ponds		Drainage for crops and pasture	Sprinkler irrigation	Terraces and diversions	Grassed waterways
Reservoir area	Embankments				
Excessive seepage	Good stability; rapid permeability.	Not needed; well drained.	Rapid intake rate; low available water capacity.	Rapid permeability; cuts are gravelly and droughty.	Shallow to sand and gravel; cuts are droughty and difficult to vegatate.
Slow seepage	Fair stability; moderately slow permeability.	Generally not needed; moderately well drained.	Medium intake rate; moderately slow permeability.	Nearly level to gently sloping; moderately erodible.	Moderately erodible.
Slow seepage	Fair stability; moderately slow permeability.	Generally not needed; moderately slow permeability.	Medium intake rate; moderately slow permeability.	Nearly level to gently sloping; moderately erodible.	Moderately erodible.
Slow seepage; seasonal high water table.	Fair stability; moderately slow permeability.	Seasonal high water table; moderately slow permeability.	Medium intake rate; moderately slow permeability.	Seasonal high water table; nearly level to gently sloping.	Seasonal high water table; nearly level to gently sloping.
Seasonal high water table; rapid seepage rate.	Unstable organic material and marl; high seepage rate.	Seasonal high water table; organic material subsides when drained; outlets difficult to obtain in places.	Seasonal high water table; rapid intake rate; high available water capacity.	Nearly level; diversion needed in some places to divert runoff from adjacent higher areas.	Seasonal high water table; usually not needed.
Subject to flooding; subject to seepage in substratum.	Fair stability; moderate permeability.	Subject to flooding; moderate permeability.	Medium intake rate; moderate permeability.	Nearly level; subject to flooding;	Nearly level; subject to flooding; highly erodible.
Excessive seepage	Good stability; rapid seepage.	Not needed; well drained.	Medium to rapid intake rate; moderate to low available water capacity.	Exposed cuts difficult to vegetate; most slopes are short.	Exposed cuts difficult to vegetate.
Subject to flooding; subject to seepage in substratum.	Fair stability; moderate permeability.	Not needed; well drained.	Medium intake rate; moderate permeability.	Nearly level; subpact to flooding.	Nearly level; subject to flooding; highly erodible.
Slow seepage; moderately steep slopes.	Fair stability and compaction characteristics; slow permeability.	Usually not needed; moderately well drained.	Slow permeability; moderately steep slopes in places.	Gently sloping to moderately steep; moderately erodible channels.	Gently sloping to moderately steep; moderately erodible channels.
Slow seepage; steep to very steep slopes.	Fair stability; moderately slow permeability.	Not needed; well drained.	Steep to very steep slopes; rapid runoff; low available water capacity.	Steep to very steep slopes; channel erosion hazard.	Steep to very steep slopes; channel erosion hazard.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of— Topsoil	Suitability as a source of— Sand and gravel	Suitability as a source of— Road fill	Soil features affecting— Highway location
Linwood: Ln	Poor: seasonal high water table; unstable organic soil.	High	Poor: oxidizes rapidly; good if mixed with mineral soil.	Unsuited	Unsuited: unstable material.	Seasonal high water table; soft and unstable material; underlying mineral soil is more stable.
* Lorenzo: LrE2. For Rodman part, see Rodman series.	Good	Low	Fair: gravelly texture.	Good below a depth of 2 feet.	Fair to good below a depth of 2 feet.	Steep to very steep slopes.
* Martinsville: MaB. For Ockley part, see Ockley series.	Fair: good drainage; medium to moderately fine textured.	Moderate	Fair: thin layer.	Unsuited	Fair: medium to moderately fine textured.	Moderate permeability; well drained.
Medway: Md	Poor: subject to flooding.	Moderate	Good	Unsuited	Fair: subject to flooding.	Subject to flooding.
* Miamian: MhA, MhB, MhB2, MhC2, MhD2, MkA, MkB, MkB2, MkC2, MlC3, MlD3, MmE, MmF. For Hennepin part of MmE and MmF, see Hennepin series.	Poor: moderately fine and fine textured material.	Moderate	Fair: thin layer; moderately fine textured in places.	Unsuited	Fair to poor: clayey subsoil; very steep slopes in places.	Good natural drainage; very steep slopes in places; moderately slow permeability.
Millsdale: MnA, MnB, MoA, MoB.	Poor: seasonal high water table.	High	Poor: wetness.	Unsuited: limestone at a depth of 20 to 40 inches.	Poor: clayey subsoil; bedrock at a depth of 20 to 40 inches.	Seasonal high water table; bedrock at a depth of 20 to 40 inches.
Milton: MpA, MpB, MpB2, MpC2, MpD2.	Poor: moderately fine and fine textured material.	Moderate	Fair: thin layer.	Unsuited: limestone at a depth of 20 to 40 inches.	Poor: bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches; moderately steep slopes in places.
Montgomery: Mt	Poor: seasonal high water table; moderately fine and fine txetured material.	Moderate	Poor: wetness.	Unsuited	Poor: clayey material; low strength; wetness.	Seasonal high water table; slow permeability; clayey material.
Ockley: OcA, OcB	Fair above a depth of 3½ to 5 feet; good below that depth.	Moderate	Fair: thin layer.	Good below a depth of 3½ to 5 feet.	Fair: moderately fine textured; good below a depth of 3½ to 5 feet.	Good natural drainage; moderate permeability.
Odell: OdA, OdB	Poor: moderately fine textured material.	High	Good	Unsuited	Poor: clayey subsoil; fair below a depth of 3 feet.	Seasonal high water table.
Pewamo: Pe	Poor: fine and moderately fine textured material.	Moderate	Poor: wetness.	Unsuited	Poor: clayey material; wetness.	Seasonal high water table; moderately slow permeability; clayey material.

properties of the soils—Continued

Soil features affecting—Continued					
Ponds		Drainage for crops and pasture	Sprinkler irrigation	Terraces and diversions	Grassed waterways
Reservoir area	Embankments				
Seasonal high water table; rapid seepage rate.	Unstable organic material; fair stability in underlying mineral soil.	Seasonal high water table; organic material subsides when drained; outlets difficult to obtain in places.	Seasonal high water table; rapid intake rate; high available water capacity.	Nearly level; diversions needed in places to divert runoff from adjacent higher areas.	Seasonal high water table; usually not needed.
Excessive seepage	Good stability; rapid permeability.	Not needed; well drained.	Rapid intake rate; low available water capacity.	Cuts are droughty and difficult to vegetate; slopes are mainly short.	Shallow to sand and gravel; cuts are droughty and difficult to vegetate.
Possibility of permeable layers in places.	Fair stability; moderate permeability.	Not needed; well drained.	Medium intake rate; moderate permeability.	Channel erosion hazard.	Channel erosion hazard.
Subject to flooding; moderate permeability.	Fair stability; moderate permeability.	Subject to flooding; moderate permeability.	Medium intake rate; moderate permeability.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Slow seepage; very steep slopes in places.	Fair stability; moderately slow permeability.	Not needed; well drained.	Medium intake rate on uneroded soils; moderately slow permeability erodible if slopes are steep.	Relief nearly level to very steep; moderately erodible.	Susceptible to erosion on slopes; relief nearly level to very steep; moderately erodible.
Bedrock at a depth of 20 to 40 inches; may be fractured.	Bedrock at a depth of 20 to 40 inches; poor compaction characteristics.	Seasonal high water table; bedrock at a depth of 20 to 40 inches.	Medium intake rate; seasonal high water table.	Moderately slow permeability; seasonal high water table; bedrock at a depth of 20 to 40 inches.	Seasonal high water table; nearly level to gently sloping.
Bedrock at a depth of 20 to 40 inches; nearly level to moderately steep.	Bedrock at a depth of 20 to 40 inches; fair stability.	Not needed; well drained.	Medium intake rate; moderately slow permeability.	Relief nearly level to moderately steep; moderately erodible; bedrock at a depth of 20 to 40 inches.	Moderately erodible; cut channels are droughty; bedrock at a depth of 20 to 40 inches.
Very slow seepage; seasonal high water table.	Poor compaction characteristics; cracks when dry; slow permeability.	Seasonal high water table; slow permeability.	Moderately slow intake rate; slow permeability.	Nearly level to depressional; seasonal high water table.	Nearly level to depressional; seasonal high water table.
Excessive seepage in substratum.	Fair to good stability; permeable material in substratum.	Not needed; well drained.	Medium intake rate; moderate permeability.	All features favorable.	All features favorable.
Slow seepage; seasonal high water table.	Fair stability and compaction characteristics.	Seasonal high water table; all features favorable.	Medium intake rate; seasonal high water table.	Seasonal high water table; nearly level to gently sloping.	Seasonal high water table; nearly level to gently sloping.
Very slow seepage; seasonal high water table.	Fair stability and compaction characteristics.	Seasonal high water table; moderately slow permeability.	Moderately slow intake rate; seasonal high water table.	Seasonal high water table; nearly level.	Seasonal high water table; nearly level.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of— Topsoil	Sand and gravel	Road fill	Soil features affecting— Highway location
Randolph: RdA, RdB.	Poor: clayey material; moderate depth to bedrock.	Moderate	Fair: thin layer; moderately fine textured.	Unsuited: limestone at a depth of 20 to 40 inches.	Poor: bedrock at a depth of 20 to 40 inches; clayey material.	Bedrock at a depth of 20 to 40 inches; seasonal high water table.
Ritchey: RhB, RhC, RhE.	Poor: moderately fine and fine textured material; shallow to bedrock.	Moderate	Fair: thin layer.	Unsuited: limestone at a depth of 10 to 20 inches.	Poor: bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; very steep slopes in places.
Rodman. Mapped only in complex with Lorenzo soils.	Good	Low	Poor: gravelly texture.	Good	Good	Steep and very steep slopes; good drainage; stable material.
Ross: Rs	Fair: good drainage; subject to occasional flooding.	Moderate	Good	Unsuited	Fair: subject to flooding.	Subject to flooding.
Ross variant: Rt	Poor: shallow to bedrock.	Moderate	Fair: limited amount of soil material.	Unsuited	Poor: limited amount of soil material.	Shallow to bedrock.
Shoals: Sh	Poor: seasonal high water table.	High	Good	Poor: excess fines.	Poor: soft; loamy material; seasonal high water table.	Subject to flooding; seasonal high water table.
Shoals variant: Sk.	Poor: seasonal high water table.	High	Good	Unsuited	Poor: bedrock at a depth of 20 to 40 inches.	Subject to flooding; seasonal high water table; bedrock at a depth of 20 to 40 inches.
Sleeth: SlA	Poor: seasonal high water table.	Moderate	Fair: thin layer.	Good below a depth of 3½ to 5 feet.	Fair: good below a depth of 3½ to 5 feet.	Seasonal high water table.
Stonelick: St	Fair: good drainage; subject to flooding.	Low	Fair: sandy texture.	Poor: excess fines.	Fair: gravel below a depth of 15 inches.	Subject to flooding.
Wallkill: Wa	Poor: seasonal high water table; organic material at a depth of 2 to 3½ feet.	High	Poor: wetness.	Unsuited	Poor: organic material below a depth of 2 to 3½ feet; wetness.	Seasonal high water table; organic material below a depth of 2 to 3½ feet.
Warsaw: WdA	Fair in upper 2 to 3½ feet; good below that depth.	Low	Good	Good below a depth of 2 to 3½ feet.	Fair: good below a depth of 2 to 3½ feet.	Good natural drainage; cut slopes are droughty.
Wea: WeA	Fair in upper 3½ to 5 feet; good below that depth.	Moderate	Good	Good below a depth of 3½ to 5 feet.	Fair: good below a depth of 3½ to 5 feet.	Good natural drainage; no limiting features.

properties of the soils—Continued

Soil features affecting—Continued					
Ponds		Drainage for crops and pasture	Sprinkler irrigation	Terraces and diversions	Grassed waterways
Reservoir area	Embankments				
Bedrock at a depth of 20 to 40 inches; seasonal high water table.	Bedrock at a depth of 20 to 40 inches; fair stability.	Seasonal high water table; bedrock at a depth of 20 to 40 inches.	Medium intake rate; moderately slow permeability.	Seasonal high water table; nearly level to gently sloping.	Seasonal high water table; nearly level to gently sloping.
Bedrock at a depth of 10 to 20 inches; very steep slopes in places.	Commonly not used; thin soil material over limestone.	Not needed; well drained.	Medium intake rate; low available water capacity.	Erodible; shallow to bedrock; gently sloping to very steep.	Erodible; shallow to bedrock; droughty.
Rapid seepage	Good stability; rapid permeability.	Not needed; well drained.	Rapid intake rate; low available water capacity.	Steep and very steep slopes; gravelly cuts; droughty.	Shallow to sand and gravel; steep and very steep slopes; droughty.
Subject to flooding; moderate permeability.	Fair stability; moderate permeability.	Not needed; well drained.	Medium intake rate; moderate permeability.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not needed; well drained.	Medium intake rate	Shallow to bedrock	Shallow to bedrock.
Subject to flooding; subject to seepage in substratum.	Fair stability; moderate permeability.	Seasonal high water table; moderate permeability.	Medium intake rate; moderate permeability.	Nearly level; subject to flooding; seasonal high water table.	Nearly level; subject to flooding; seasonal high water table.
Bedrock at a depth of 20 to 40 inches; subject to flooding.	Bedrock at a depth of 20 to 40 inches; fair stability.	Seasonal high water table; bedrock at a depth of 20 to 40 inches.	Medium intake rate; moderate permeability.	Nearly level; subject to flooding; bedrock at a depth of 20 to 40 inches.	Nearly level; subject to flooding; bedrock at a depth of 20 to 40 inches.
Rapid seepage below a depth of 3½ to 5 feet.	Fair stability and compaction characteristics in upper layers; rapid seepage below a depth of 3½ to 5 feet.	Seasonal high water table; moderate permeability.	Medium intake rate; moderate permeability; seasonal high water table.	Nearly level; seasonal high water table.	Nearly level; seasonal high water table.
Subject to flooding; seepage hazard in substratum.	Fair to good stability; moderately rapid permeability.	Not needed; well drained.	Medium to rapid intake rate; low available water capacity.	Nearly level; subject to flooding.	Nearly level; subject to flooding.
Seasonal high water table; organic material at a depth of 2 to 3½ feet.	Unstable organic material at a depth of 2 to 3½ feet.	Seasonal high water table; organic material subsides.	Seasonal high water table; moderate permeability.	Nearly level; seasonal high water table.	Nearly level; seasonal high water table.
Excessive seepage	Good stability; rapid seepage.	Not needed; well drained.	Medium to rapid intake rate; moderate available water capacity.	Nearly level; cuts are droughty.	Nearly level.
Moderate seepage in upper 3½ to 5 feet; rapid seepage below that depth.	Fair stability; rapid seepage below a depth of 3½ to 5 feet.	Not needed; well drained.	Medium intake rate; moderate.	Nearly level	Nearly level.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as a source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Westland: Wt	Poor: seasonal high water table.	High	Poor: wetness.	Good below a depth of 3½ to 5 feet.	Poor: wetness	Seasonal high water table; moderately slow permeability.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*3*) used by SCS engineers, the Department of Defense, and others, and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*2*).

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and content of organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to properties that affect their use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 3; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Engineering test data

Soil samples from six of the principal soil series in the county were tested by standard AASHTO procedures to help evaluate the soils for engineering purposes. All samples are modal for the series with respect to texture. Only selected layers of each soil were sampled. The results of these tests are given in table 3.

The engineering classifications in table 3 are based on data obtained by grain-size analysis and by tests to determine liquid limit and plastic limit. The grain-size analysis was made by using a combination of the sieve and hydrometer methods. The percentage of clay obtained by the hydrometer methods is not used by the U.S. Department of Agriculture to name textural classes of soils.

Tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a soil increases from a very dry state, the material changes from solid to semisolid or plastic. As the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content, expressed as a percentage of the oven dry weight of the soil, at which the soil material passes from semisolid to plastic. The liquid limit is the moisture content at which the material passes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which the soil material is plastic. Some silty and sandy soils are nonplastic; that is, they do not become plastic at any moisture content.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 4. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 4.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Depth to bedrock is distance from the surface of the soil to the rock layer.

Soil texture is described in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that

properties of the soils—Continued

Soil features affecting—Continued					
Ponds		Drainage for crops and pasture	Sprinkler irrigation	Terraces and diversions	Grassed waterways
Reservoir area	Embankments				
Moderate seepage in upper 3½ to 5 feet; rapid seepage below that depth; seasonal high water table.	Fair to good stability; rapid seepage below a depth of 3½ to 5 feet.	Seasonal high water table; moderately slow permeability.	Medium to moderately slow intake rate; moderately slow permeability.	Nearly level; seasonal high water table.	Nearly level; seasonal high water table.

contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loam." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil and is expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material, as has been explained for table 3. Liquid limit and plasticity index are estimated in table 4, but in table 3 the data on liquid limit and plasticity index are based on tests of soil samples.

Shrink-swell potential is the relative change in volume of soil material to be expected as moisture content changes, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of soils

The estimated interpretations in table 5 are based on the engineering properties of soils shown in table 4, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Miami County.

In table 5, summarized limitations or ratings of suitability of the soils are given for all listed purposes other than for highway location, reservoir areas, embankments, drainage of cropland and pasture, irrigation, terraces and diversions, and grassed waterways. For these particular uses, table 5 lists those soil features not to be overlooked in planning, installation, and maintenance.

Winter grading is affected chiefly by soil features that are relevant to moving, mixing, and compacting soil in road building when temperatures are below freezing.

Soils most susceptible to damaging frost action are silt loam and fine sandy loam soils that are wet or saturated most of the winter. Such soils are rated high.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material, or plant response when fertilizer is added to the soil; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, and also considered in the ratings is damage that can result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Soil properties that most affect highway location (fig. 4) are load supporting capacity, stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

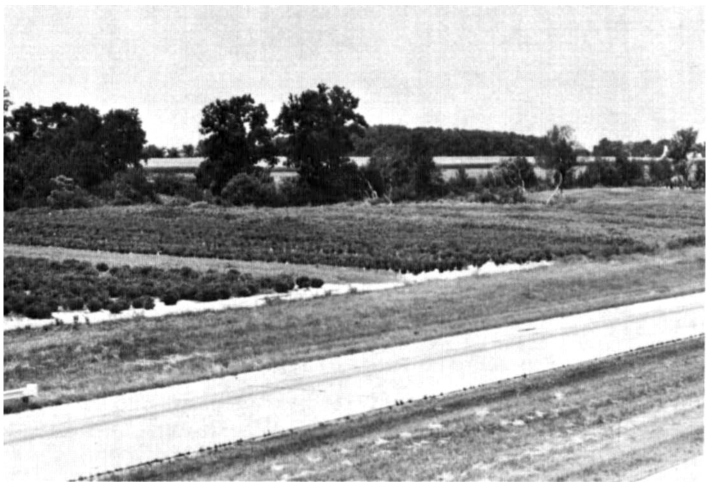

Figure 4.—**This highway is on Crosby and Brookston soils. These soils are also used for nursery stock.**

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic material in a soil are among factors that are unfavorable.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Sprinkler irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff, and establishing a plant cover on such a soil is not difficult.

The layout and construction of grassed waterways are affected by such soil properties as texture, depth, and erodibility of the soil material; stones or rock outcrops; and slope. Other factors affecting waterways are seepage, natural soil drainage, available water capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Soils and Land Use Planning for Town and Country Development

An increasingly large acreage of Miami County soils is being taken out of farming and used as residential, industrial, commercial, and recreational areas. Miami County is close to the rapidly expanding communities of Dayton and Springfield, Ohio. This expansion has already affected land use in the southern part of the county, notably in Bethel, Monroe, and Union Townships. Most of the county is being used for crops, but there is a mixing of farm and nonfarm uses.

The expansion of nonfarm uses can take many areas out of agricultural use in a short period. Shopping centers can easily replace 50 to 100 acres of farmland. Freeways and super highways can displace as much as 50 acres per mile. These uses permanently remove land from farm use.

This section provides information on the properties of the soils that can affect selected nonfarm uses. It can help community planners and industrial users of land who generally look for areas that are the least costly to develop and maintain. Development and maintenance costs are related to soil limitations. Land use planners can find other useful information in the soil maps and in data in other parts of this survey. Table 6 gives the estimated degree and kind of limitation of the soils for some selected land uses. From this information, alternative uses can be considered in long-range planning and zoning. Because extensive disturbance of the soil alters some of its natural properties, the ratings for some uses do not apply to areas that have undergone extensive cutting and filling.

The degree of the limitation of the soils for a specified land use is indicated as slight, moderate, and severe. *Slight* indicates that the soil has no important limitation for the specified use. *Moderate* means that the soil has some limitations for the specified use. These limitations need to be recognized, but they can be overcome or corrected. *Severe* indicates that the soil has serious limitations that are costly and difficult to overcome.

Following are explanations of the uses rated in table 6.

Farming.—The soils have been rated according to their limitations to use for cultivated crops only. The degree of limitation is based on slope and erosion hazard or to the ease or difficulty of artificial drainage of the soil.

Septic tank absorption fields.—Most soils in the county have some limitations for use as absorption areas for septic tanks. The limitations include excessive slope, a seasonal high water table, restricted permeability, poor natural drainage, susceptibility to flooding, and limited depth to bedrock. Flooding and a seasonal high water table prevent proper functioning of septic tank disposal systems for variable periods of time. Soils subject to flooding have been rated severe. Local flooding frequencies, however, are such that some of the soils could be rated moderate or slight if other soil properties are not limitations.

Many of the soils in the county have been rated severe because of moderately slow or slow permeability. The permeability of each soil has been estimated and is shown in table 4. A severe limitation is imposed by a restrictive layer, such as dense glacial till or bedrock, that interferes with adequate filtration and the movement of effluent. Some soils, even though rated severe, are better than other similarly rated soils.

If filter beds for septic tanks are located in areas that have slopes of more than 12 percent, erosion and downslope seepage can be a concern, or the soil might become unstable when saturated.

Some soils in the county have a gravelly and sandy substratum that inadequately filters effluent. Even though the soils dispose of the effluent quickly, there is a distinct hazard of polluting ground water of nearby springs, lakes, or streams.

Sewage lagoons.—Sewage lagoons are shallow ponds built to dispose of sewage through oxidation. They may be needed where septic tanks or a central sewage system is not feasible or practical. It is assumed that the natural soil will be used for the reservoir site and as embankment material. Among the features that control the degree of limitation are the hazard of flooding, degree of slope, depth to bedrock, permeability, coarse fragments, and organic-matter content.

Dwellings.—Major soil features that affect use of soils as homesites are limited depth to bedrock, susceptibility to flooding, poor natural drainage, and excessive slope. Not considered is a method for disposing of sewage as this is rated separately in this table. The ratings in table 6 are for houses of 3 stories or less, with or without a basement, but the ratings also apply to sites for small industrial, commercial, and institutional buildings.

Soils subject to flooding have severe limitations for permanently used structures. Flooding may be infrequent, but it is costly and damaging when it does occur. Houses on naturally wet soils are likely to have wet basements if adequate drainage is not provided. Brookston, Crosby, and Pewamo soils are some of the soils in this county that have a wetness hazard. In many areas tile drains or open ditches or both have been installed in cultivated areas. Excavations in these areas for houses or other buildings can disrupt the established drainage system, and return the soil to its natural condition of wetness.

Some soils, such as Montgomery soils, have a high content of silt and clay and are not so favorable for supporting structural foundations as soils that are coarser textured, such as Eldean and Warsaw soils. Soils that have high shrink-swell potential are likely to heave, and foundations will crack unless precautions are taken. Also, a high shrink-swell potential affects the alignment of sidewalks, patios, floors, and rock walls. To minimize this effect, a subgrade or layers of sandy or gravelly material directly below the structure is desirable.

Excavating basements and installing underground utility lines is difficult and expensive in soils that have limited depth to bedrock. On soils that have slopes of more than 12 percent, there is an erosion hazard and excavation and leveling are difficult.

Roads and streets.—The ratings in table 6 are for soils used for roads and streets in residential areas where traffic is not heavy. Considered in estimating the ratings were the hazard of flooding, slope, depth to and kind of bedrock, depth to the water table, and the degree of stoniness. The estimated soil properties and soil features that are important in designing, constructing, and maintaining highways are given in "Engineering Uses of the Soils."

Shallow excavations.—These excavations require excavating or trenching to a depth of less than 6 feet. Characteristics that make a soil suitable for excavations are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops and big stones, no flooding hazard, and absence of a seasonal high water table.

Sanitary landfill.—Among the properties affecting the use of soils for the trench type of sanitary landfill are depth to rock, seasonal wetness, permeability, slope, texture of the soil material, and hazard of flooding. Deep, nearly level well drained soils that have slow permeability generally have the least limitations for sanitary landfills. This combination of properties, however, exists in very few soils. Excessive wetness in the form of ponding or a high water table increases the difficulty of excavation and proper covering. Clayey textures are less desirable for cover than coarser textures because they are hard to grade properly and are subject to cracking when dry. All soils that have bedrock within a depth of 60 inches are rated severe.

Lawns, landscaping, and golf fairways.—In most areas used for homes and golf courses, the natural surface soil, or topsoil, can be used for lawns, flowers, shrubs, and trees and should be saved. It can be removed from the site, stored until contruction and grading are completed, and then returned. The natural surface layer from areas graded for streets also can be saved and used for lawns and fairways. Among the soil properties that determine whether a good lawn or golf fairway can be established are natural drainage, degree of slope, depth to bedrock, texture of the surface layer, stoniness and rockiness, and hazard of flooding.

Playgrounds.—Properties to consider when selecting sites to be used as athletic fields and other intensive play areas include natural drainage, slope, depth to

TABLE 6.—*Degree and kind of limitation*

Soil series and map symbols	Farming (cultivated crops)	Septic tank absorption fields	Sewage lagoons	Dwellings		Roads and streets
				With basements	Without basements	
Algiers: Ag	Slight: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; susceptible to frost action.
Blount:						
BlA	Slight	Severe: slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: clayey subsoil; low strength.
BlB, BlB2	Moderate	Severe: slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: clayey subsoil; low strength.
Brookston: Bs	Slight	Severe: seasonal high water table.	Slight	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; susceptible to frost action.
Celina:						
CeA	Slight	Severe: moderately slow permeability.	Slight	Moderate: seasonal high water table.	Slight	Moderate: susceptible to frost action.
CeB, CeB2	Slight	Severe: moderately slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight	Moderate: slope; susceptible to frost action.
Corwin:						
CoA	Slight	Severe: moderately slow permeability.	Slight	Moderate: seasonal high water table.	Slight	Moderate: susceptible to frost action.
CoB	Slight	Severe: moderately slow permeability.	Moderate: slope.	Moderate: seasonal high water table.	Slight	Moderate: slope; susceptible to frost action.
Crosby:						
CrA	Slight	Severe: seasonal high water table; moderately slow permeability.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; susceptible to frost action.
CrB	Slight	Severe: seasonal high water table; moderately slow permeability.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; susceptible to frost action.
Edwards: Ed	Severe: wetness.	Severe: seasonal high water table.	Severe: organic material; seasonal high water table.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.
Eel: Ee	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Eldean:						
ElA, EmA	Slight	Slight[1]	Severe[1]: too permeable.	Slight	Slight	Slight

See footnote at end of table.

of the soils for town and country planning

Shallow excavations	Sanitary landfill (trench)	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: seasonal high water table; subject to flooding.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; slow permeability; slope.	Moderate: seasonal high water table.	Moderate: slow permeability; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
Moderate: seasonal high water table.	Slight	Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: seasonal high water table.	Slight	Slight	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: seasonal high water table.	Slight	Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: seasonal high water table.	Slight	Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table.
Severe: seasonal high water table; organic material.	Severe: seasonal high water table; organic material.	Severe: seasonal high water table.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.
Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Moderate: gravelly texture.	Severe[1]: too permeable.	Moderate: droughtiness.	Slight	Slight	Slight	Slight.

TABLE 6.—*Degree and kind of limitation*

Soil series and map symbols	Farming (cultivated crops)	Septic tank absorption fields	Sewage lagoons	Dwellings: With basements	Dwellings: Without basements	Roads and streets
Eldean (con.):						
ElB, ElB2, EmB, ErB. For Miamian part of ErB, see MhB in Miamian series.	Slight	Slight[1]	Severe[1]: too permeable.	Slight	Slight	Slight
EoC2. Interpretations are for both the Eldean and Casco soils in this mapping unit.	Severe: slope; erosion.	Moderate[1]: slope.	Severe[1]: too permeable; slope.	Moderate: slope.	Moderate: slope	Moderate: slope
EoD2, EpD3. Interpretations are for both the Eldean and Casco soils in these mapping units.	Severe: slope; erosion.	Severe[1]: slope	Severe[1]: too permeable; slope.	Severe: slope	Severe: Slope	Severe: slope
ErC. For Miamian part, see MhC2 in the Miamian series.	Moderate: slope; erosion.	Moderate[1]: slope.	Severe[1]: too permeable; slope.	Moderate: slope.	Moderate: slope	Moderate: slope
Genesee: Gn	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Glynwood:						
GwB	Slight	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table; shrink-swell potential.	Moderate: clayey subsoil; shrink-swell potential.	Severe: clayey subsoil; low strength.
GwB2	Moderate: erosion.	Severe: slow permeability.	Moderate: slope.	Moderate: seasonal high water table; shrink-swell potential.	Moderate: clayey subsoil; shrink-swell potential.	Severe: clayey subsoil; low strength.
GwC2	Moderate: slope; erosion.	Severe: slow permeability.	Severe: slope.	Moderate: slope; seasonal high water table; shrink-swell potential.	Moderate: slope; clayey subsoil; shrink-swell potential.	Severe: clayey subsoil; low strength.
GwD2	Severe: slope; erosion.	Severe: slope; slow permeability.	Severe: slope.	Severe: slope	Severe: slope	Severe: slope; low strength.

See footnote at end of table.

of the soils for town and country planning—Continued

Shallow excavations	Sanitary landfill (trench)	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: gravelly texture.	Severe [1]: too permeable.	Moderate: droughtiness.	Moderate: slope.	Slight	Slight	Slight.
Moderate: slope; gravelly texture.	Severe [1]: too permeable.	Moderate: slope; droughtiness.	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: slope.	Severe [1]: too permeable.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: slope; gravelly texture.	Severe [1]: too permeable.	Moderate: slope; droughtiness.	Severe: slope	Moderate: slope	Moderate: slope	Slight.
Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Moderate: seasonal high water table; clayey subsoil.	Moderate: clayey subsoil.	Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight	Moderate: slow permeability.	Slight.
Moderate: seasonal high water table; clayey subsoil.	Moderate: clayey subsoil.	Moderate: slow permeability.	Moderate: slow permeability; slope.	Slight	Moderate: slow permeability.	Slight.
Moderate: seasonal high water table; clayey subsoil.	Moderate: clayey subsoil.	Moderate: slope; slow permeability.	Severe: slope	Moderate: slope	Moderate: slope; slow permeability.	Slight.
Severe: slope.	Moderate: slope; clayey subsoil.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.

TABLE 6.—*Degree and kind of limitation*

Soil series and map symbols	Farming (cultivated crops)	Septic tank absorption fields	Sewage lagoons	Dwellings: With basements	Dwellings: Without basements	Roads and streets
Glynwood (con.):						
GyC3	Severe: slope; erosion.	Severe: slow permeability.	Severe: slope.	Moderate: slope; seasonal high water table; shrink-swell potential.	Moderate: slope; clayey subsoil; shrink-swell potential.	Severe: clayey subsoil; low strength.
GyD3	Severe: slope; erosion.	Severe: slope; slow permeability.	Severe: slope.	Severe: slope	Severe: slope	Severe: slope; low strength.
Linwood: Ln	Slight	Severe: seasonal high water table.	Severe: organic material; seasonal high water table.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.	Severe: seasonal high water table; soft and unstable.
Lorenzo: LrE2. Interpretations are for both the Lorenzo and Rodman soils in this mapping unit.	Severe: slope; erosion.	Severe [1]: slope	Severe [1]: permeable material; slope.	Severe: slope	Severe: slope	Severe: slope
Martinsville: MaB. Interpretations are for both the Martinsville and Ockley soils in this mapping unit.	Slight	Moderate: moderate permeability.	Moderate: slope; moderate permeability.	Slight	Slight	Moderate: moderately fine textured subsoil.
Medway: Md	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Miamian:						
MhA	Slight	Severe: moderately slow permeability.	Slight	Slight	Slight	Moderate: moderately fine textured subsoil.
MhB, MhB2	Slight	Severe: moderately slow permeability.	Moderate: slope.	Slight	Slight	Moderate: moderately fine textured subsoil.
MhC2	Moderate: slope; erosion.	Severe: moderately slow permeability.	Severe: slope.	Moderate: slope.	Moderate: slope.	Moderate: slope; moderately fine textured subsoil.
MhD2, MlD3	Severe: slope; erosion.	Severe; slope; moderately slow permeability.	Severe: slope.	Severe: slope	Severe: slope	Severe: slope
MkA	Slight	Severe: moderately slow permeability; depth to bedrock.	Moderate: depth to bedrock.	Moderate: depth to bedrock.	Slight	Moderate: moderately fine textured subsoil.
MkB, MkB2	Slight	Severe: moderately slow permeability; depth to bedrock.	Moderate: slope; depth to bedrock.	Moderate: depth to bedrock.	Slight	Moderate: moderately fine textured subsoil.

See footnote at end of table.

of the soils for town and country planning—Continued

Shallow excavations	Sanitary landfill (trench)	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: slope; seasonal high water table; clayey subsoil.	Moderate: slope; clayey subsoil.	Moderate: slope; slow permeability.	Severe: slope	Moderate: slope; surface soil too clayey.	Moderate: slope; slow permeability; surface soil too clayey.	Moderate: surface soil too clayey.
Severe: slope.	Moderate: slope; clayey subsoil.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; surface soil too clayey.
Severe: seasonal high water table; organic material.	Severe: seasonal high water table; organic material.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Severe: slope.	Severe[1]: permeable material; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Slight	Slight	Slight	Moderate: slope.	Slight	Slight	Slight.
Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Slight	Slight	Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Slight	Slight	Slight	Moderate: slope; moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: slope.	Slight	Moderate: slope.	Severe: slope	Moderate: slope	Moderate: slope; moderately slow permeability.	Slight.
Severe: slope.	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Moderate: depth to bedrock.	Severe: depth to bedrock.	Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Moderate: depth to bedrock.	Severe: depth to bedrock.	Slight	Moderate: slope; moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.

TABLE 6.—*Degree and kind of limitation*

Soil series and map symbols	Farming (cultivated crops)	Septic tank absorption fields	Sewage lagoons	Dwellings: With basements	Dwellings: Without basements	Roads and streets
Miamian (con.):						
MkC2	Moderate: slope; erosion.	Severe: moderately slow permeability; depth to bedrock.	Severe: slope.	Moderate: slope; depth to bedrock.	Moderate: slope	Moderate: slope; moderately fine textured subsoil.
MlC3	Severe: slope; erosion.	Severe: moderately slow permeability.	Severe: slope.	Moderate: slope.	Moderate: slope	Moderate: slope; moderately fine textured subsoil.
MmE. Interpretations are for both the Miamian and Hennepin soils in this mapping unit.	Severe: slope; erosion.	Severe: slope; moderately slow permeability.	Severe: slope.	Severe: slope	Severe: slope	Severe: slope
MmF. Interpretations are for both the Miamian and Hennepin soils in this mapping unit.	Severe: slope; erosion.	Severe: slope; moderately slow permeability.	Severe: slope.	Severe: slope	Severe: slope	Severe: slope
Millsdale: MnA, MnB, MoA, MoB.	Moderate: wetness.	Severe: seasonal high water table; moderately slow permeability.	Severe: depth to bedrock.	Severe: seasonal high water table; depth to bedrock.	Severe: seasonal high water table.	Severe: seasonal high water table; susceptible to frost action.
Milton:						
MpA, MpB, MpB2.	Slight	Severe: depth to bedrock; moderately slow permeability.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth to bedrock.	Moderate: depth to bedrock.
MpC2	Moderate: slope; erosion.	Severe: depth to bedrock; moderately slow permeability.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth to bedrock; slope.	Moderate: slope; depth to bedrock.
MpD2	Severe: slope; erosion.	Severe: slope; depth to bedrock; moderately slow permeability;	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope	Severe: slope
Montgomery: Mt.	Moderate: wetness.	Severe: slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.	Severe: seasonal high water table; soft and compressible.	Severe: seasonal high water table; soft and compressible.
Ockley:						
OcA	Slight	Slight [1]	Severe [1]: permeable substratum.	Slight	Slight	Moderate: moderately fine textured subsoil; susceptible to frost action.

See footnote at end of table.

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Shallow excavations	Sanitary landfill (trench)	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Moderate: slope; depth to bedrock.	Severe: depth to bedrock.	Moderate: slope.	Severe: slope	Moderate: slope	Moderate: slope; moderately slow permeability.	Slight.
Moderate: slope.	Slight	Moderate: slope; clay loam surface layer.	Severe: slope	Moderate: slope; clay loam surface layer.	Moderate: slope; clay loam surface layer.	Moderate: clay loam surface layer.
Severe: slope.	Moderate: slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: slope.	Severe: slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: seasonal high water table; depth to bedrock.	Severe: seasonal high water table; depth to bedrock.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth to bedrock.	Moderate: depth to bedrock; moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth bedrock; slope.	Severe: slope	Moderate: slope	Moderate: slope; moderately slow permeability.	Slight.
Severe: slope; depth to bedrock.	Severe: depth to bedrock.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Slight	Severe[1]: permeable substratum.	Slight	Slight	Slight	Slight	Slight.

TABLE 6.—*Degree and kind of limitation*

Soil series and map symbols	Farming (cultivated crops)	Septic tank absorption fields	Sewage lagoons	Dwellings: With basements	Dwellings: Without basements	Roads and streets
Ockley (con.): OcB	Slight	Slight [1]	Severe [1]: permeable substratum.	Slight	Slight	Moderate: slope; moderately fine textured subsoil.
Odell: OdA	Slight	Severe: seasonal high water table.	Slight	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: susceptible to frost action.
OdB	Slight	Severe: seasonal high water table.	Moderate: slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: susceptible to frost action.
Pewamo: Pe	Slight	Severe: seasonal high water table; moderately slow permeability.	Slight	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Randolph: RdA, RdB.	Moderate: wetness.	Severe: seasonal high water table; moderately slow permeability; depth to bedrock.	Severe: depth to bedrock.	Severe: depth to bedrock; seasonal high water table.	Severe: high shrink-swell potential.	Severe: clayey subsoil; high shrink-swell potential.
Ritchey: RhB	Moderate: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.
RhC, RhE	Severe: slope.	Severe: slope; shallow to bedrock.	Severe: slope; shallow to bedrock.	Severe: shallow to bedrock; slope.	Severe: slope; shallow to bedrock.	Severe: slope; shallow to bedrock.
Ross: Rs	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Ross variant: Rt	Moderate: shallow to bedrock.	Severe: shallow to bedrock; subject to flooding.	Severe: shallow to bedrock; subject to flooding.	Severe: shallow to bedrock; subject to flooding.	Severe: shallow to bedrock; subject to flooding.	Severe: shallow to bedrock; subject to flooding.
Shoals: Sh	Slight	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding; susceptible to frost action.
Shoals variant: Sk.	Severe: wetness.	Severe: subject to flooding; seasonal high table; depth to bedrock.	Severe: subject to flooding; depth to bedrock.	Severe: subject to flooding; seasonal high water table; depth to bedrock.	Severe: subject to flooding.	Severe: subject to flooding; susceptible to frost action.
Sleeth: SlA	Slight	Severe: seasonal high water table.	Severe: permeable substratum.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Stonelick: St	Slight	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

See footnote at end of table.

of the soils for town and country planning—Continued

Shallow excavations	Sanitary landfill (trench)	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Slight	Severe[1]: permeable substratum.	Slight	Moderate: slope.	Slight	Slight	Slight.
Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high table.	Moderate: seasonal high table.	Moderate: seasonal high table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Moderate: seasonal high table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Severe: seasonal high water table; depth to bedrock; clayey material.	Severe: clayey material.	Moderate: seasonal high water table; depth to bedrock.	Moderate: seasonal high water table; depth to bedrock; moderately slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table.
Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Slight	Slight	Slight.
Severe: shallow to bedrock; slope.	Severe: shallow to bedrock.	Severe: slope; shallow to bedrock.	Severe: slope; shallow to bedrock.	Severe: slope	Severe: slope	Slight.
Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: shallow to bedrock; subject to flooding.	Severe: shallow to bedrock; subject to flooding.	Severe: shallow to bedrock.	Severe: shallow to bedrock.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.
Severe: subject to flooding; seansonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: subject to flooding; seasonal high water table; depth to bedrock.	Severe: subject to flooding; depth to bedrock.	Severe: subject to flooding.	Severe: subject to flooding; seasonal high water table.	Moderate: subject to flooding; seasonal high water table.	Severe: subject to flooding; seasonal high water table.	Moderate: seasonal high water table.
Severe: seasonal high water table.	Severe: permeable substratum.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.
Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Slight.

TABLE 6.—*Degree and kind of limitation*

Soil series and map symbols	Farming (cultivated crops)	Septic tank absorption fields	Sewage lagoons	Dwellings		Roads and streets
				With basements	Without basements	
Wallkill: Wa	Slight	Severe: seasonal high water table.	Severe: organic material below a depth of 2 feet.	Severe: seasonal high water table; organic material below a depth of 2 feet.	Severe: seasonal high water table; organic material below a depth of 2 feet.	Severe: seasonal high water table; organic material below a depth of 2 feet.
Warsaw: WdA	Slight	Slight [1]	Severe [1]: permeable substratum.	Slight	Slight	Moderate: moderately fine textured subsoil.
Wea: WeA	Slight	Slight [1]	Severe [1]: permeable substratum.	Slight	Slight	Moderate: moderately fine textured subsoil.
Westland: Wt	Slight	Severe: seasonal high water table.	Severe: permeable substratum; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; susceptible to frost action.

[1] Pollution is a hazard in places because of permeable substratum.

the water table, depth to and kind of bedrock, permeability, degree of stoniness, the hazard of flooding, and the texture of the surface layer. In table 6 the use of fill material from other areas was not considered in the ratings. Soils on flood plains can be used as ball diamonds and other intensive play areas that are not subject to costly damage by floodwater and that are not used during normal periods of flooding. The ratings given in table 6 for streets and parking lots are also important when considering the use of soils for tennis courts.

Picnic areas.—Picnic areas and other extensive use areas can be located on many soils that have severe limitations for most other uses. Flood plains, for example, can be safely developed as extensive play areas. Many areas along streams are scenic and, because of their linear shape, can be used by a relatively large number of people. Considered in rating the soils for picnic and other extensive play areas were the hazard of flooding, degree of stoniness and rockiness, degree of slope, texture of the surface layer, and depth to the water table.

Camp areas.—Sites suitable for tents and trailers should be located in areas suitable as unsurfaced parking lots for cars and camping trailers. Properties to consider when selecting camp areas are a hazard of flooding, a seasonal high water table, permeability, the degree of slope, and soil texture. Soils that have slopes of less than 12 percent are the most desirable for use as tent campsites, but trailers require less sloping soils than tents. Soils having a medium-textured surface layer have fewer limitations to use as campsites than the very clayey or very sandy soils.

Paths and trails.—This rating applies to soils to be used for local and cross-country footpaths and trails and for bridle paths. It is assumed that these areas will be used as they occur in nature and little or no soil will be moved. Soil properties considered in rating the soils for this use were the presence of a seasonal high water table, flooding hazard, slope, surface layer texture, and rockiness or stoniness.

Descriptions of the Soils

This section describes the soil series and mapping units in Miami County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise

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Shallow excavations	Sanitary landfill (trench)	Lawns, landscaping, and golf fairways	Playgrounds	Picnic areas	Camp areas	Paths and trails
Severe: seasonal high water table; organic material below a depth of 2 feet.	Severe: seasonal high water table; organic material below a depth of 2 feet.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Slight	Severe [1]: permeable substratum.	Slight	Slight	Slight	Slight	Slight.
Slight	Severe [1]: permeable substratum.	Slight	Slight	Slight	Slight	Slight.
Severe: seasonal high water table.	Severe: seasonal high water table; permeable substratum.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.

studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit in which the mapping unit has been placed. The page for the description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 7. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*14*).

Algiers Series

The Algiers series consists of somewhat poorly drained, level or nearly level soils. The upper part of Algiers soils formed in recent alluvium. The lower part is a buried dark-colored soil that formed in older alluvium or in glacial till. Algiers soils formed under mixed hardwoods. They are on flood plains and in depressions on uplands. Areas are small and widely scattered throughout the county.

In a representative profile the surface layer is dark grayish-brown silt loam about 16 inches thick. The subsoil is dark-brown silt loam about 7 inches thick. A buried soil is at a depth of 23 inches. It is very dark gray silty clay loam in the upper 12 inches, very dark grayish-brown clay loam in the next 6 inches, and grayish-brown silty clay loam in the lower 5 inches. Olive-gray clay loam is between depths of 46 and 60 inches.

Algiers soils have a deep root zone when the water table is low. The capacity to store and release plant nutrients is high, and the avaliable water capacity is also high. The surface layer is medium in organic-matter content and is slightly acid or neutral if it has not been limed. Permeability is moderate. The wetness hazard is moderate and the soils are subject to occasional flooding.

Artificially drained Algiers soils are used for cultivated crops, pasture, and meadow. Undrained areas are too wet for crops, but in places are suited to pasture or wildlife habitat. Tile and open ditches are used to provide drainage. Levees are used to control flooding in some areas.

Representative profile of Algiers silt loam in a pasture field in Bethel Township, SE¼NW¼ sec. 8, T. 2 E., R. 9 N.

A—0 to 16 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and fine, granular structure; friable; slightly acid; clear, smooth boundary.

TABLE 7.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Algiers silt loam	842	0.3
Blount silt loam, 0 to 2 percent slopes	2,218	.9
Blount silt loam, 2 to 6 percent slopes	5,236	2.0
Blount silt loam, 2 to 6 percent slopes, moderately eroded	291	.1
Brookston silty clay loam	35,993	13.8
Celina silt loam, 0 to 2 percent slopes	2,293	.9
Celina silt loam, 2 to 6 percent slopes	13,717	5.3
Celina silt loam, 2 to 6 percent slopes, moderately eroded	1,278	.5
Corwin silt loam, 0 to 2 percent slopes	136	[1]
Corwin silt loam, 2 to 6 percent slopes	108	[1]
Crosby silt loam, 0 to 2 percent slopes	65,326	25.1
Crosby silt loam, 2 to 6 percent slopes	20,170	7.7
Edwards muck	107	[1]
Eel silt loam	1,163	.5
Eldean loam, 0 to 2 percent slopes	4,575	1.8
Eldean loam, 2 to 6 percent slopes	4,714	1.8
Eldean loam, 2 to 6 percent slopes, moderately eroded	1,113	.4
Eldean silt loam, 0 to 2 percent slopes	1,117	.4
Eldean silt loam, 2 to 6 percent slopes	1,283	.5
Eldean-Casco gravelly loams, 6 to 12 percent slopes, moderately eroded	1,632	.6
Eldean-Casco gravelly loams, 12 to 18 percent slopes, moderately eroded	535	.2
Eldean-Casco complex, 6 to 18 percent slopes, severely eroded	158	.1
Eldean-Miamian complex, 2 to 6 percent slopes	1,179	.5
Eldean-Miamian complex, 6 to 12 percent slopes	525	.2
Genesee silt loam	4,511	1.7
Glynwood silt loam, 2 to 6 percent slopes	1,503	.6
Glynwood silt loam, 2 to 6 percent slopes, moderately eroded	1,870	.7
Glynwood silt loam, 6 to 12 percent slopes, moderately eroded	1,119	.4
Glynwood silt loam, 12 to 18 percent slopes, moderately eroded	240	.1
Glynwood clay loam, 6 to 12 percent slopes, severely eroded	289	.1
Glynwood clay loam, 12 to 18 percent slopes, severely eroded	102	[1]
Linwood muck	317	.1
Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded	409	.2
Martinsville and Ockley loams, till substratum, 2 to 6 percent slopes	262	.1
Medway silt loam	1,807	.7
Miamian silt loam, 0 to 2 percent slopes	2,117	.8
Miamian silt loam, 2 to 6 percent slopes	16,373	6.3
Miamian silt loam, 2 to 6 percent slopes, moderately eroded	7,208	2.8
Miamian silt loam, 6 to 12 percent slopes, moderately eroded	7,522	2.9
Miamian silt loam, 12 to 18 percent slopes, moderately eroded	1,592	.6
Miamian silt loam, limestone substratum, 0 to 2 percent slopes	3,206	1.2
Miamian silt loam, limestone substratum, 2 to 6 percent slopes	2,539	1.0
Miamian silt loam, limestone substratum, 2 to 6 percent slopes, moderately eroded	492	.2
Miamian silt loam, limestone substratum, 6 to 12 percent slopes, moderately eroded	216	.1
Miamian clay loam, 6 to 12 percent slopes, severely eroded	633	.2
Miamian clay loam, 12 to 18 percent slopes, severely eroded	334	.1
Miamian and Hennepin silt loams, 18 to 25 percent slopes	596	.2
Miamian and Hennepin silt loams, 25 to 50 percent slopes	1,250	.5
Millsdale silt loam, 0 to 2 percent slopes	541	.2
Millsdale silt loam, 2 to 6 percent slopes	90	[1]
Millsdale silty clay loam, 0 to 2 percent slopes	2,982	1.1
Millsdale silty clay loam, 2 to 6 percent slopes	192	.1
Milton silt loam, 0 to 2 percent slopes	3,557	1.4
Milton silt loam, 2 to 6 percent slopes	4,917	1.9
Milton silt loam, 2 to 6 percent slopes, moderately eroded	214	.1
Milton silt loam, 6 to 12 percent slopes, moderately eroded	689	.3
Milton silt loam, 12 to 18 percent slopes, moderately eroded	122	[1]
Montgomery silty clay loam	1,664	.6
Ockley silt loam, 0 to 2 percent slopes	829	.3
Ockley silt loam, 2 to 6 percent slopes	220	.1
Odell silt loam, 0 to 2 percent slopes	2,838	1.1
Odell silt loam, 2 to 6 percent slopes	725	.3
Pewamo silty clay loam	1,350	.5
Randolph silt loam, 0 to 2 percent slopes	4,156	1.6
Randolph silt loam, 2 to 6 percent slopes	179	.1
Ritchey silt loam, 2 to 6 percent slopes	170	.1
Ritchey silt loam, 6 to 18 percent slopes	134	[1]
Ritchey silt loam, 18 to 50 percent slopes	269	.1
Ross silt loam	2,876	1.1
Ross silt loam, shallow variant	131	[1]
Shoals silt loam	2,147	.8
Shoals silt loam, moderately shallow variant	210	.1
Sleeth silt loam, 0 to 2 percent slopes	227	.1
Stonelick loam	611	.2
Wallkill silt loam	71	[1]
Warsaw silt loam, 0 to 2 percent slopes	850	.4
Wea silt loam, 0 to 2 percent slopes	789	.3
Westland silty clay loam	1,185	.5
Cut and fill land	686	.3
Gravel pits	554	.2
Made land	237	.1
Quarries	346	.1
Water area	1,378	.5
Total extent of soils that each make up less than 0.05 percent of the county	------	.3
Total	260,352	100.0

[1] Less than 0.05 percent.

B2—16 to 23 inches, dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; neutral; clear, wavy boundary.

IIAb—23 to 35 inches, very dark gray (10YR 3/1) light silty clay loam; moderate, medium, angular blocky structure; friable; few reddish-brown (5YR 4/4) streaks; mildly alkaline; clear, wavy boundary.

IIB2bg—35 to 41 inches, very dark grayish-brown (10YR 3/2) clay loam; common, medium, distinct, grayish-brown (2.5Y 5/2) mottles; moderate, medium, subangular blocky structure; firm; few reddish-brown (5YR 4/4) streaks; 2 percent pebbles; mildly alkaline; clear, smooth boundary.

IIB3bg—41 to 46 inches, grayish-brown (2.5Y 5/2) silty clay loam; medium, distinct, brown (10YR 4/3) and dark-gray (N 4/0) mottles; weak, medium, subangular blocky structure; firm; 5 to 10 percent pebbles; moderately alkaline; clear, wavy boundary.

IIIC—46 to 60 inches, olive-gray (5Y 5/2) light clay loam; many, medium, distinct, olive-brown (2.5Y 4/4) mottles and few, medium, distinct, brown (10YR 4/3) mottles; massive; firm; 10 percent pebbles; moderately alkaline.

The medium-textured recent alluvium is 14 to 36 inches thick over the IIAb horizon of the buried soil. The recent alluvium ranges from slightly acid to neutral, and the buried soil ranges from neutral to moderately alkaline and in places is calcareous.

The A horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). In some places there is an 8- to 10-inch Ap horizon.

The B2 horizon is dark-brown (10YR 4/3) or dark grayish-brown (10YR 4/2) silt loam or loam. It is 6 to 20 inches thick. The IIAb horizon is very dark gray (10YR 3/1) or black (10YR 2/1) clay loam or silty clay loam and contains up to 5 percent pebbles in places. The IIAb horizon is 10 to 18 inches thick. The IIB2 horizon is very dark grayish-brown (10YR 3/2), dark-gray (10YR 4/1), or dark grayish-brown (10YR 4/2) silty clay loam, clay loam, or heavy loam. It has few to many gray and brown mottles. The content of pebbles is 0 to 10 percent. The IIB3 horizon is similar to the IIB2 horizon.

The IIC horizon or IIIC horizon is olive-gray (5Y 5/2) or grayish-brown (10YR 5/2 or 2.5Y 5/2) silty clay loam or clay loam. The content of pebbles is 2 to 10 percent.

The B2 horizon in these Algiers soils has more structural development than is defined as the range for the series, but this difference does not alter the use or behavior of the soils.

Algiers soils are near Shoals, Medway, and Montgomery soils. A few areas of Algiers soils are near Brookston and Wallkill soils. Algiers soils have dark-colored buried soils, which are lacking in the Shoals, Medway, Montgomery, and Brookston soils. They have a lighter colored A horizon than Medway, Montgomery, and Brookston soils. They are underlain by mineral soil material, but Wallkill soils are underlain by muck.

Ag—Algiers silt loam. This soil is on strips, generally 80 to 150 feet wide, on flood plains of streams and waterways. Areas cover about 4 to 29 acres.

Included with this soil in mapping are small areas of Shoals soils and dark-colored Medway and Montgomery soils. A few spots of dark-colored Brookston soils are also included in depressional areas on uplands.

A seasonal high water table and the hazard of occasional flooding are limitations for most farm and nonfarm uses. Capability unit IIw-1.

Blount Series

The Blount series consists of somewhat poorly drained, level to gently sloping soils. These soils formed in moderately fine-textured glacial till in the northwestern part of the county. The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is grayish-brown silty clay loam in the upper 3 inches, olive-brown silty clay in the next 9 inches, and light olive-brown silty clay in the lower 12 inches. It is firm and has some grayish-brown and olive-brown mottles. The underlying material is olive-brown clay loam to a depth of 60 inches. It is mottled with olive gray.

Blount soils have a moderately deep root zone over the glacial till. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is slow. The soils have a seasonal high water table.

These soils are used mainly for crops. A few areas are in pasture or woods. Most cultivated areas have been artificially drained. These soils dry and warm later in the spring than nearby Glynwood soils. Because water moves slowly through these soils after rain, more days of drying are needed before they are suited to tillage or planting. The soils generally drain well with tile.

Representative profile of Blount silt loam, 0 to 2 percent slopes, in Washington Township, NW¼SW¼ sec. 36, T. 8 N., R. 5 E.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.

B&A—9 to 12 inches, grayish-brown (2.5Y 5/2) silty clay loam; common, medium, faint, olive-brown (2.5Y 4/4) mottles; moderate, medium, angular blocky structure; firm; many roots; thin, very patchy, dark grayish-brown (10YR 4/2) clay coatings; medium, patchy, grayish-brown (10YR 5/2) silt coatings; medium acid; clear, smooth boundary.

B21t—12 to 21 inches, olive-brown (2.5Y 4.4) silty clay; many, coarse, distinct, grayish-brown (10YR 5/2) mottles; weak, medium, prismatic structure parting to moderate, fine and medium, angular blocky; firm; many roots; medium, continuous, grayish-brown (2.5Y 5/2) clay films on ped faces; few dark concretions; few pebbles; medium acid; clear, smooth boundary.

B22t—21 to 29 inches, light olive-brown (2.5Y 5/4) silty clay; common, medium, faint, grayish-brown (2.5Y 5/2) and light olive-brown (2.5Y 5/6) mottles; moderate, medium, angular blocky structure; firm; few roots; grayish-brown (2.5Y 5/2) coatings on peds; thin, patchy, grayish-brown (2.5Y 5/2) clay films on ped faces; few dark concretions; few pebbles; mildly alkaline; clear, wavy boundary.

B3t—29 to 33 inches, light olive-brown (2.5Y 5/4) light silty clay; common, medium, distinct, olive-gray (5Y 5/2) mottles and few, medium, faint, olive-brown (2.5Y 4/4) mottles; weak, coarse, subanglar blocky structure; firm; thin, very patchy, grayish-brown (2.5Y 5/2) clay films on ped faces; few pebbles; mildly alkaline, weakly calcareous; clear, wavy boundary.

C—33 to 60 inches, olive-brown (2.5Y 4/4) clay loam; many, coarse, distinct, olive-gray (5Y 5/2) mottles; massive; firm; 10 percent pebbles; moderately alkaline, calcareous.

The solum is 20 to 40 inches thick.

In some places there is a 2- to 3-inch A2 horizon. The Ap horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2). In wooded areas there is a 3- to 4-inch A1 horizon that is very dark gray (10YR 3/1) or very dark brown (10YR 2/2).

The B horizon is silty clay or heavy silty clay loam. It has matrix colors with hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 4. It is medium acid or slightly acid in the upper part and slightly acid to mildly alkaline in the lower part. In some places the B3 horizon is weakly calcareous.

The C horizon is silty clay loam or clay loam and commonly contains glacial pebbles.

Blount soils are near Pewamo and Glynwood soils. They are somewhat poorly drained members of a drainage sequence that includes the moderately well drained Glynwood soils and the very poorly drained Pewamo soils. Blount soils are similar to Crosby soils but have heavier texture in the B horizon and C horizon. Blount soils commonly have poorer tilth than Crosby soils. They are underlain by glacial till, but Randolph soils are underlain by limestone bedrock.

BlA—Blount silt loam, 0 to 2 percent slopes. This level to nearly level soil is on broad areas adjacent to the Pewamo soils, which are in depressions. Areas cover about 10 to 30 acres. Nearly all the original surface layer remains, and there is little or no evidence of erosion. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of dark-colored Pewamo soils in drainageways, small areas of gently sloping Blount soils at the head of drainageways, and a few spots of better drained Glynwood soils.

This soil is used mainly for crops. Because it is nearly level, runoff is slow. The relief is mainly convex, but there are a few concave areas where water collects and ponds. Seasonal wetness is the main limitation for farm use, but if the soil is artificially drained, it is suited to most crops commonly grown in the county. Seasonal wetness and slow permeability are limitations for many nonfarm uses. Capability unit IIw-2.

BlB—Blount silt loam, 2 to 6 percent slopes. This gently sloping soil is on low knolls and along drainageways. Areas cover about 5 to 25 acres. Slopes are generally 60 to 80 feet long. Most of the original surface layer remains, and there is only slight evidence of erosion.

Included with this soil in mapping are small areas of nearly level Blount soils on ridgetops, spots of moderately eroded Blount and Glynwood soils, and small areas of Pewamo soils in drainageways.

This soil is used mainly for woodland or pasture, but some drained areas are used for crops. Water runoff is more rapid on this soil than on nearly level Blount soils. An artificial drainage system is more difficult to design on this soil than on nearly level Blount soils, because this soil is more sloping. This soil has a seasonal high water table and is moderately subject to erosion. Because the surface layer contains more organic matter than that of eroded Blount soils, it is easier to till and plants can be more easily established. The surface layer is less likely to seal over after rain and become puddled than that of eroded Blount soils. A seasonal high water table is the main limitation for both farm and nonfarm uses. Capability unit IIw-2.

BlB2—Blount silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on knolls and along drainageways. Most areas cover 3 to 10 acres. The slopes are generally about 60 to 80 feet long. The plow layer is a mixture of the original surface layer and the more sticky subsoil. There are a few severely eroded spots where the plow layer is mainly subsoil material.

Included with this soil in mapping are small areas of uneroded Blount soils that have mainly 2 to 4 percent slopes and dark-colored Pewamo soils in drainageways. Also included are small areas of moderately well drained Glynwood soils that have mainly 4 to 6 percent slopes.

This soil is suited to many crops commonly grown in the county, but it is highly susceptible to erosion. The plow layer is lower in organic-matter content than that of uneroded Blount soils, and it has a lower capacity to absorb and retain moisture. Establishing plants is more difficult on this soil than on uneroded Blount soils. The surface tends to puddle or seal over after rain, which increases the amount of runoff. A seasonal high water table and the hazard of erosion are limitations for farming. An artificial drainage system is more difficult to design on this soil than on nearly level Blount soils. A seasonal high water table and the clayey subsoil are the main limitations for nonfarm uses. Capability unit IIIe-4.

Brookston Series

The Brookston series consists of very poorly drained, nearly level, deep soils. These soils formed in loam glacial till. They are in depressions and drainageways on uplands throughout the county. The native vegetation was a mixed stand of hardwoods and wetland grasses, but most areas have been cleared and are used for crops.

In a representative profile the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is firm silty clay loam 28 inches thick. It is dark gray mottled with light olive brown in the upper 6 inches and olive gray mottled with yellowish brown in the lower 22 inches. Light olive-brown loam glacial till is between depths of 39 and 60 inches.

Brookston soils have a deep root zone if they are drained. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is neutral or slightly acid. Permeability is moderate in the upper part of the soil and moderately slow in the underlying material. The soils have a seasonal high water table for long periods in winter and spring if they are not artificially drained.

Brookston soils are used extensively for crops. A few areas are wooded and in pasture. Most cultivated areas are artificially drained. Tiling and open ditches provide drainage, and the soils generally drain well with tile. Crops respond well to fertilizers. Undrained areas are commonly used for wildlife habitat or woods.

Representative profile of Brookston silty clay loam in Concord Township, SW¼SW¼ sec. 31, T. 5 N., R. 6 E. (sample MM-17 in laboratory data table):

Ap—0 to 11 inches, very dark gray (10YR 3/1) silty clay loam; weak, medium, subangular blocky structure; firm; many roots; neutral; abrupt, smooth boundary.

B1g—11 to 17 inches, dark-gray (5Y 4/1) silty clay loam; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; moderate, medium, angular blocky structure; firm; many roots; organic coatings on some vertical ped faces; neutral; clear, smooth boundary.

B2tg—17 to 31 inches, olive-gray (5Y 5/2) silty clay loam; many, medium, distinct, light olive-brown (2.5Y 5/4) and yellowish-brown (10YR 5/4) mottles; weak, medium, prismatic structure parting to moderate, medium, angular blocky; firm; thin continuous clay films on ped faces; 5 percent pebbles; few fine roots; neutral; gradual, smooth boundary.

B3tg—31 to 39 inches, olive-gray (5Y 5/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; thin patchy clay films on vertical ped surfaces; 5 percent pebbles; neutral grading to mildly alkaline in lower part; clear, wavy boundary.

C—39 to 60 inches, light olive-brown (2.5Y 5/4) loam; many, coarse, distinct, gray (10YR 6/1) mottles; massive; friable; 10 percent pebbles; moderately alkaline, calcareous.

The solum is 30 to 50 inches thick. It ranges from slightly acid to mildly alkaline, and the B3 horizon is weakly calcareous in places.

The A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or black (10YR 2/1). It has weak or medium, subangular blocky or granular structure.

There is a B1g horizon in most places. The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It is mainly silty clay loam or clay loam, but individual subhorizons are silty clay or loam. In the lower part of the B2 horizon, the content of glacial pebbles is 5 to 15 percent in places. Clay films in the Bt horizon range from thin and very patchy to medium and continuous. The B3 horizon is similar in color to the B2 horizon, but it has chroma of 2 to 6. It is silty clay loam or clay loam and is 5 to 15 percent glacial pebbles.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. It is generally loam, but is light clay loam in places.

Brookston soils are very poorly drained members of a drainage sequence that includes the somewhat poorly drained Crosby soils, the moderately well drained Celina soils, and the well-drained Miamian soils. In some places, Brookston soils are near Odell, Montgomery, Millsdale, and Algiers soils. Brookston soils have a grayer B horizon and are more highly mottled than Odell soils. They are underlain by glacial till, unlike Montgomery soils, which are underlain by silty clay and clay loam lacustrine sediment, and Millsdale soils, which are underlain by limestone bedrock. Brookston soils have a darker colored A horizon than Algiers soils. They are similar to Pewamo soils but have a coarser textured B horizon and C horizon.

Bs—Brookston silty clay loam. This level to nearly level soil is mainly in irregularly shaped depressions that cover about 20 to 100 acres. It is commonly surrounded by Crosby soils. In some areas, the soil is in narrow bands along drainageways, generally less than 10 acres in size, and is surrounded by more sloping Celina and Miamian soils.

Included with this soil in mapping are small areas near adjoining more sloping soils where the surface layer is silt loam. In some areas the dark-colored surface layer is only 7 to 9 inches thick and is likely to become cloddy if tilled when too wet. Also included are small areas of Odell soils in slightly higher positions and spots of Crosby and Celina soils.

This soil is suited to crops. Where artificially drained, it is suited to many crops commonly grown in the county. Surface runoff is slow, and there is little if any hazard of erosion. Seasonal wetness is the main limitation for farm uses and is a severe limitation for many nonfarm uses. Capability unit IIw-3.

Casco Series

The Casco series consist of well-drained, sloping to moderately steep soils. These soils are shallow over sand and gravel. They formed in loamy glacial outwash. They are mainly on gravelly outwash terraces along the Miami and Stillwater Rivers and their larger tributaries. A few areas of Casco soils are on kames and eskers on uplands, mainly in Bethel Township. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 8 inches thick. The subsoil is gravelly clay loam 12 inches thick. It is dark yellowish brown in the upper 5 inches and dark reddish brown in the lower 7 inches. Brown, calcareous stratified sand and gravel are between depths of 20 and 60 inches.

Casco soils have a shallow root zone. The capacity to store and release plant nutrients is low, and the available water capacity is low. The surface layer is low in organic-matter content. Permeability is moderate in the upper part of the soil and rapid in the coarse underlying material.

The hazard of drought is severe, and crops are damaged by a lack of moisture during the growing season of most years. These soils dry and warm early in spring.

Representative profile of Casco gravelly loam, in an area of Eldean-Casco gravelly loams, 6 to 12 percent slopes, moderately eroded, in a cultivated field in Staunton Township, NE¼SE¼ sec. 2, T. 1 E., R. 10 N.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam; weak, fine and medium, subangular blocky structure; friable; many roots; mildly alkaline; clear, smooth boundary.

B2t—8 to 13 inches, dark yellowish-brown (10YR 4/4) gravelly clay loam; moderate, medium, subangular blocky structure; firm; common roots; thin, continuous, dark-brown (7.5YR 3/2) clay films on ped and pebble faces; mildly alkaline; clear, smooth boundary.

B3t—13 to 20 inches, dark reddish-brown (5YR 3/3) gravelly clay loam; weak, coarse, subangular blocky structure; firm; common roots; thin, patchy, dark-brown (7.5YR 3/2) clay films on ped faces; mildly alkaline; abrupt, irregular boundary.

C—20 to 60 inches, brown (10YR 5/3) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 12 to 24 inches thick. Depth to calcareous material ranges from 10 to 20 inches. The solum is neutral or mildly alkaline and in places is calcareous in the lower part.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown.

The Bt horizon is clay loam or sandy clay loam and has 2- to 3-inch layers of clay in places. It is mainly gravelly. The B2t horizon ranges from reddish brown (5YR 4/4) to dark yellowish brown (10YR 4/4). In some places the B3 horizon lacks clay films. Tongues of the B3 horizon extend as much as 1 foot to 2 feet into the C horizon in many places.

The C horizon ranges from poorly sorted to well sorted, calcareous sand and gravel.

Casco soils are near Eldean, Rodman, Lorenzo, Sleeth, Wea, and Warsaw soils. Casco soils have a thinner B horizon and are shallower to calcareous sand and gravel than Eldean, Sleeth, Wea, and Warsaw soils. They have a lighter colored A horizon than Rodman, Lorenzo, Wea, and Warsaw soils. They also lack the gray B horizon that Sleeth soils have.

Casco soils are mapped only with Eldean soils.

Celina Series

The Celina series consists of moderately well drained, level to gently sloping soils on uplands. These soils formed in medium-textured glacial till. In some areas the till is mantled with 6 to 12 inches of loess. The soils occur in scattered areas on uplands throughout the county, except in the northern third of Newberry Township. The native vegetation was a mixed stand of hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is dark grayish-brown silt loam about 12 inches thick. The subsoil is firm clay loam 12 inches thick. It is dark brown mottled with grayish brown in the upper 7 inches and yellowish brown mottled with grayish brown in the lower 5 inches. Mottled yellowish-brown calcareous loam glacial till is between depths of 24 and 60 inches.

Celina soils have a moderately deep root zone over the glacial till. The capacity to store and release plant nutrients is moderate. The available water capacity is moderate. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is moderately slow.

Celina soils are used mainly for crops. A few areas are wooded. These soils dry and warm earlier in spring than nearby Crosby, Odell, and Brookston soils.

Representative profile of Celina silt loam, 2 to 6 percent slopes, in an orchard field in Springcreek Township, NE¼SE¼ sec. 7, R. 12 N., T. 1 E.

Ap1—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; few roots; slightly acid; clear, smooth boundary.

Ap2—9 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, subangular blocky structure; friable; few roots; neutral; abrupt, smooth boundary.

IIB21t—12 to 19 inches, dark-brown (10YR 4/3) clay loam; few, fine, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; thin, patchy, dark grayish-brown (10YR 4/2) clay films on ped faces; few glacial pebbles; neutral; gradual, smooth boundary.

IIB22t—19 to 24 inches, yellowish-brown (10YR 5/6) heavy clay loam; common, fine, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/8) mottles; moderate, medium and coarse, subangular blocky structure; firm; thin, patchy, dark-brown (10YR 4/3) clay films on ped faces; few glacial pebbles; mildly alkaline; clear, wavy boundary.

IIC—24 to 60 inches, yellowish-brown (10YR 5/4) loam; few, fine, distinct, dark grayish-brown (10YR 4/2) mottles; massive; friable; 10 percent glacial pebbles; moderately alkaline, calcareous.

The solum is 20 to 40 inches thick. The depth to calcareous material ranges from 18 to 36 inches. The silty loess capping ranges from 0 to 12 inches in thickness. The solum ranges from medium acid to neutral in the upper part and is mildly alkaline and in places weakly calcareous in the B3 horizon. Coarse fragment content below the silty loess cap ranges from 5 to 15 percent.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). In uncultivated areas there is a very dark brown (10YR 2/2) or black (10YR 2/1) A1 horizon that is 3 to 4 inches thick and a brown (10YR 5/3) A2 horizon that is 4 to 8 inches thick. In some cultivated areas there is a 1- to 2-inch A2 horizon below the Ap horizon. The Ap horizon has weak or moderate, granular or subangular blocky structure.

In some places there is a yellowish-brown (10YR 5/4) or brown (10YR 5/3) B1 horizon that is 1 inch to 3 inches thick. It is heavy silt loam or silty clay loam and has weak or moderate, medium, subangular blocky structure. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, silty clay, or clay. It has moderate or strong, medium or coarse, subangular blocky structure. In some places there is a 4- to 6-inch B3 horizon that is yellowish-brown (10YR 5/4) clay loam or heavy loam.

The C horizon is brown (10YR 5/3) or yellowish-brown (10YR 5/4) silt loam or loam.

Celina soils are moderately well drained members of a drainage sequence that includes the well-drained Miamian soils, the somewhat poorly drained Crosby soils, and the very poorly drained Brookston soils. Celina soils are near these soils and also near Odell, Corwin, and Martinsville soils and Ockley, till substratum soils. Celina soils have more mottles than Miamian soils, but they have less mottles and are better drained than Crosby and Odell soils. They have a lighter colored A horizon than Corwin soils. Celina soils contain more clay and less sand in the B horizon than Martinsville and Ockley, till substratum soils, and they are shallower to calcareous till. They contain less clay in the B horizon and C horizon than Glynwood soils.

CeA—Celina silt loam, 0 to 2 percent slopes. This level to nearly level soil is in small patches scattered throughout larger areas of Crosby soils and gently sloping Celina soils. It is on low, smooth ridgetops and in areas bordering streams. Most areas cover about 5 to 30 acres. The soil has a profile similar to the one described as representative of the series, but the depth to calcareous till is about 32 to 36 inches.

Included with this soil in mapping are spots of nearly level Crosby soils and small areas of gently sloping Celina soils.

This soil is suited to all crops commonly grown in the county. Surface runoff is slow. There is little or no evidence of erosion. This soil has few limitations for farm uses. The moderately slow permeability is a limitation for some nonfarm uses. Capability unit I-1.

CeB—Celina silt loam, 2 to 6 percent slopes. This gently sloping soil is on low knolls and ridges of the till plains. It is surrounded by Crosby and Brookston soils in drainageways and larger areas. The soil generally has a convex surface, and slopes are about 60 to 80 feet long. Most areas cover about 2 to 25 acres. The soil has the profile described as representative of the series. Nearly all of the original surface layer remains, and there is only slight evidence of erosion. The surface layer is silt loam, but in a few spots it is loam and has some scattered pebbles on the surface.

Included with this soil in mapping are some spots of moderately eroded Celina soils, small areas of wetter Crosby soils, and spots of soils that are less than 18 inches deep to calcareous loam till.

This soil is used for all crops commonly grown in the county. It is easy to till. Surface runoff is greater than on nearly level Celina soils, and the hazard of erosion is moderate. Erosion is the main limitation for farm uses. The moderately slow permeability is a limitation for many nonfarm uses. Capability unit IIe-1.

CeB2—Celina silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on low knolls and ridges of variable sizes on uplands and on side slopes at the head of drainageways. Most areas cover about 2 to 15 acres in size. Slopes are generally 60 to 75 feet long. The plow layer is a mixture of the original surface layer and the upper part of the subsoil. There are a few severely eroded spots where the plow layer is mainly subsoil material.

Included with this soil in mapping are small areas of uneroded Celina and Miamian soils and small areas of somewhat poorly drained Crosby soils that are near the bottom of side slopes. Also included are spots of soils that are less than 18 inches deep to calcareous loam till.

This soil is suited to most crops commonly grown in the county, but it is subject to erosion. The plow layer is lower in content of organic matter than that of uneroded Celina soils, and it has a lower capacity to absorb and retain moisture. Establishing plants, especially grasses, is more difficult on this soil than on uneroded Celina soils. The surface of this soil tends to seal over after rain and becomes more puddled than that of uneroded Celina soils. The results of past erosion and the hazard of further erosion are the main limitations for farm uses. The moderately slow permeability is a limitation for many nonfarm uses. Capability unit IIe-3.

Corwin Series

The Corwin series consists of moderately well drained, level to gently sloping soils. These soils formed in medium-textured glacial till. They are in scattered small areas on uplands, mainly in the northeastern part of the county. The native vegetation was tall prairies grasses and some scattered mixed hardwoods, but most areas have been cultivated.

In a representative profile the surface layer is very dark grayish-brown silt loam in the upper 10 inches, and very dark grayish-brown heavy loam in the lower 3 inches. The subsoil is firm clay loam 15 inches thick. It is dark brown in the upper 8 inches and olive brown mottled with dark grayish brown in the lower 7 inches. Calcareous, olive-brown loam till mottled with light yellowish brown is between depths of 28 and 60 inches.

Corwin soils have a moderately deep root zone over glacial till, and their capacity to store and release plant nutrients is high. The available water capacity is high. The surface layer is high in organic-matter content and is commonly acid if it has not been limed. Permeability is moderately slow.

Corwin soils are used mainly for crops. These soils dry and warm earlier in spring than nearby Brookston, Odell, and Crosby soils.

Representative profile of Corwin silt loam, 0 to 2 percent slopes, in a cultivated field in Lost Creek Township, SW¼NW¼ sec. 26, T. 2 E., R. 11 N.

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; neutral; abrupt, smooth boundary.

A12—10 to 13 inches, very dark grayish-brown (10YR 3/2) heavy loam; moderate, medium, subangular blocky structure; slightly firm; common roots; neutral; clear, wavy boundary.

B21t—13 to 21 inches, dark-brown (10YR 4/3) clay loam; moderate, fine and medium, angular blocky structure; firm; few roots; thin patchy clay films on ped faces; few, medium, very dark grayish-brown (10YR 3/2) organic fillings; 10 percent pebbles; neutral; clear, wavy boundary.

B22t—21 to 28 inches, olive-brown (2.5Y 4/4) clay loam; few, fine, distinct, dark grayish-brown (2.5Y 4/2) mottles; moderate, medium, subangular blocky structure; firm; thin very patchy clay films on ped faces; 10 percent pebbles; mildly alkaline; clear, wavy boundary.

C—28 to 60 inches, olive-brown (2.5Y 4/4) loam till; few, fine, distinct, light yellowish-brown (2.5Y 6/4) mottles; massive; firm; 15 percent pebbles, moderately alkaline, calcareous.

The solum is 24 to 36 inches thick. The depth to calcareous material ranges from 20 to 36 inches. The thickness of the dark-colored surface layer ranges from 11 to 16 inches and corresponds to the thickness of the A horizon. The solum is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. In some places it is weakly calcareous in the lower part. The solum generally is 2 to 5 percent coarse fragments in the upper part and 5 to 15 percent in the lower part.

The A horizon is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). Its structure is weak or moderate, fine or medium, granular, or it is weak, fine or medium, subangular blocky.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 5. Mottles of chroma of 2 or less are at a depth of 6 inches or more below the A horizon. The B2t horizon is clay loam or silty clay loam.

The C horizon is brown (10YR 5/3), yellowish-brown (10YR 5/4), or olive-brown (2.5Y 4/4) loam or light clay loam.

Corwin soils are moderately well drained members of a drainage sequence that includes the somewhat poorly drained Odell soils. Corwin soils are near Odell, Crosby, Celina, Brookston, and Miamian soils. Corwin soils contain fewer mottles in the B horizon and are naturally better drained than Odell, Crosby, and Brookston soils. They have a darker colored A horizon than Crosby, Celina, and Miamian soils.

CoA—Corwin silt loam, 0 to 2 percent slopes. This level to nearly level soil is in irregularly shaped areas that cover about 2 to 10 acres. It is at a slightly higher elevation than nearby Brookston, Crosby, and Odell soils, and it is at a slightly lower elevation than nearby Miamian soils. In some areas this soil is underlain by sand and gravel at a depth of 5 feet or more. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Odell and Crosby soils in the more depressional drainageways and small areas of gently sloping Corwin and Celina soils.

This soil is suited to all crops commonly grown in the county. It has few, if any, limitations that affect its use for crops. Surface runoff is slow, and there is little or no hazard of erosion. Crops can be seeded earlier on this soil than on wetter nearby Odell, Crosby, and Brookston soils. The moderately slow permeability is a limitation for some nonfarm uses. Capability unit I-1.

CoB—Corwin silt loam, 2 to 6 percent slopes. This gently sloping soil is in positions between Brookston and Montgomery soils in depressions and drainageways and Celina and Miamian soils in slightly higher lying areas. Most areas cover about 4 to 10 acres and are irregularly shaped.

Included with this soil in mapping are small areas of nearly level Corwin soils and Odell soils and a few spots of Celina soils.

This soil is suited to all crops commonly grown in the county. It is easy to till and seed to crops. Water runoff is greater on this soil than on nearly level Corwin soils. The hazard of erosion is moderate in cultivated areas. The moderately slow permeability and the gentle slopes are limitations for some nonfarm uses. Capability unit IIe-1.

Crosby Series

The Crosby series consists of somewhat poorly drained, nearly level to gently sloping soils. These soils formed in loam till. They are on uplands in every township in the county. The native vegetation was mixed hardwoods, but most wooded areas have been cleared and are used for crops.

In a representative profile the surface layer is dark grayish-brown silt loam 8 inches thick. The subsoil is 20 inches thick and is mottled with yellowish brown and grayish brown. It is light brownish-gray silty clay loam in the upper 3 inches, grayish-brown silty clay in the next 9 inches, and yellowish-brown silty clay loam and heavy loam in the lower 8 inches. Yellowish-brown, calcareous loam till is between depths of 28 and 60 inches.

Crosby soils have a moderately deep root zone over the compact glacial till, and the capacity to store and release plant nutrients is moderate. The available water capacity is moderate. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is moderately slow. The soils have a seasonal high water table in winter and spring if they are not artificially drained.

These soils are used mainly for crops. Most cultivated areas have been artificially drained. These soils dry and warm later in spring than adjacent Miamian and Celina soils. They commonly drain well with tile.

Representative profile of Crosby silt loam, 0 to 2 percent slopes, in a cultivated field in Concord Township, SW¼NE¼ sec. 23, T. 7 N., R. 5 E. (sample MM-20 in laboratory data table):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; few wormholes; slightly acid; abrupt, smooth boundary.

B&A—8 to 11 inches, light brownish-gray (10YR 6/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, fine and medium, angular blocky structure; slightly firm; gray (10YR 6/1) and grayish-brown (10YR 5/2) silt coatings; few very dark gray (10YR 3/1) concretions; few wormholes with fillings of dark grayish-brown (10YR 4/2); slightly acid; clear, smooth boundary.

B21t—11 to 20 inches, grayish-brown (10YR 5/2) silty clay; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; silt coatings of grayish-brown (10YR 5/2) in upper 1 inch; thin continuous clay films on ped faces; few very dark gray (10YR 3/1) concretions; few pebbles; neutral; gradual, smooth boundary.

B22t—20 to 24 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, medium, prismatic structure parting to moderate, medium, angular blocky; firm; thin continuous clay films on ped faces; few pebbles; mildly alkaline; clear, wavy boundary.

B3t—24 to 28 inches, yellowish-brown (10YR 5/4) heavy loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, fine and medium, subangular blocky structure; friable; thin patchy clay films on vertical ped faces; 10 percent pebbles; moderately alkaline; gradual, wavy boundary.

C—28 to 60 inches, yellowish-brown (10YR 5/4) loam; common, medium, faint, light brownish-gray (10YR 6/2) and brownish-yellow (10YR 6/6) mottles; massive; friable; 10 percent pebbles; moderately alkaline, calcareous.

The solum is 20 to 38 inches thick. Depth to calcareous material ranges from 18 to 36 inches.

The Ap horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). In undisturbed areas, there is a 2- to 3-inch, very dark gray (10YR 3/1) A1 horizon and a 4- to 7-inch A2 horizon.

The B horizon is mottled. In some places there is a thin B&A horizon. The B2t horizon is grayish-brown (10YR 5/2), brown (10YR 5/3) or yellowish-brown (10YR 5/4) silty clay loam, clay loam, silty clay, or clay and is 2 to 15 percent pebbles. It ranges from medium acid to mildly alkaline. In most places there is a B3 horizon that is as much as 6 inches thick.

The C horizon is loam or silt loam and is 5 to 20 percent coarse fragments.

Crosby soils are somewhat poorly drained members of a drainage sequence that includes the very poorly drained Brookston soils, the moderately well drained Celina soils, and the well-drained Miamian soils. In some areas, Crosby soils are near Randolph, Odell, and Corwin soils. Crosby soils are similar to Blount soils but have a coarser textured B horizon and C horizon. They are underlain by calcareous loam till, and Randolph soils are underlain by limestone bedrock. Crosby soils have a lighter colored A horizon than Odell and Corwin soils.

CrA—Crosby silt loam, 0 to 2 percent slopes. This level to nearly level soil is in broad areas surrounding Brookston and Odell soils. It is extensive in the county. Most areas cover about 7 to 20 acres. Nearly all of the original surface layer remains and there is little or no evidence of erosion. This soil has the profile described as representative of the series.

Included with this soil in mapping are some narrow areas of Brookston soils in drainageways and gently sloping Crosby soils at the head of drainageways. Also included are a few small areas of gently sloping Miamian and Celina soils and some areas of this Crosby soil that have carbonates at a depth of less than 18 inches.

This soil is used mainly for crops. Where artificially drained, it is suited to most crops commonly grown in the county. Water runoff is slow because the relief is nearly level. Seasonal wetness is the main limitation for farming. A seasonal high water table and the moderately slow permeability are limitations for many nonfarm uses. Capability unit IIw-2.

CrB—Crosby silt loam, 2 to 6 percent slopes. This gently sloping soil is on low knolls and in areas along drainageways. Most areas cover about 4 to 20 acres. Slopes are mainly convex and are generally 75 to 100 feet long. This soil is adjacent to Brookston, Odell, Celina, and Miamian soils. Most areas show evidence of a slight amount of erosion, but some are moderately eroded. The surface layer in the eroded areas is a mixture of the original surface layer and some of the grayish-brown upper part of the subsoil.

Included with this soil in mapping are small areas of Brookston soils in drainageways, nearly level Crosby soils on ridgetops, and spots of moderately eroded Miamian soils and gently sloping Celina soils.

This soil is used mainly for crops. Where it is artificially drained, it is suited to most crops commonly grown in the county. A drainage system is more difficult to design on this soil than on nearly level Crosby soils because this soil is more sloping. Runoff is also more rapid, and erosion is a hazard. The seasonal high water table and the moderately slow permeability are limitations for many nonfarm uses. Capability unit IIw-2.

Cut and Fill Land

Cut and fill land consists of areas where the original soil material has been greatly modified by cutting and filling operations. In some places the soil material to a depth of 2 to 4 feet has been removed. In other places 2 to 4 feet of soil material has been added. In most areas there is a combination of cuts and fills.

Cut and fill land in Miami County occurs mostly in and around cities and villages, industrial and housing developments, and along the right-of-way of the interstate highway. Capability unit not assigned.

Edwards Series

The Edwards series consists of very poorly drained, level organic soils underlain by marl at a depth of 16 to 48 inches. These soils are in bogs and swamps. They consist of partly decomposed plant remains, mainly trees, fibrous grasses, sedges, and reeds.

In a representative profile the organic layer is black muck about 21 inches thick. Below this to a depth of 60 inches is gray, calcareous marl.

Edwards soils have a moderately deep root zone that is restricted by the underlying marl. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is neutral or mildly alkaline and seldom needs to be limed. Permeability is moderately rapid in the muck and is variable in the underlying marl. The muck material of these soils is highly compressible and physically unstable. The water table is high for long periods.

The wetness hazard is very severe, and most areas have not been drained. The soils are difficult to drain because drainage outlets are inadequate and the permeability of the marl underlying material is variable. When the surface is dry these soils are subject to soil blowing.

Representative profile of Edwards muck in Bethel Township, SW¼SW¼ sec. 6, T. 2 E., R. 9 N.

Oa1—0 to 16 inches, black (N 2/0), on broken face and when rubbed, sapric material; 5 percent fiber when broken, none when rubbed; moderate, fine, crumb structure; friable; sodium pyrophosphate brown (10YR 5/3); neutral; gradual, smooth boundary.

Oa2—16 to 21 inches, black (N 2/0), on broken face, and very dark gray (10YR 3/1), when rubbed, sapric material; 15 percent fiber when broken, 2 percent when rubbed; weak, medium and coarse, subangular blocky structure; slightly firm; sodium pyrophosphate pale brown (10YR 6/3); mildly alkaline; abrupt, smooth boundary.

IILca—21 to 60 inches, gray (10YR 5/1) marl; massive; friable; 10 percent fine shell fragments; moderately alkaline, calcareous.

The depth to the IILca horizon ranges from 16 to 48 inches. Reaction of the organic horizons ranges from neutral to mildly alkaline. In some places the soil is calcareous and has shell fragments on the surface.

The organic material is black (N 2/0 or 10YR 2/1) or very dark brown (10YR 2/2). The surface tier of the organic material has structure that is weak or moderate, fine or medium, crumb or granular. The structure of the subsurface or bottom tier of the organic material is weak or moderate, medium or coarse, subangular blocky.

The IILca horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. It is mildly alkaline or moderately alkaline and is calcareous. It is 20 to 40 inches or more thick, and in some areas the marl has 2- to 4-inch layers of sandy and loamy materials.

Edwards soils are near Linwood and Montgomery soils. They are underlain by marl, and Linwood soils are underlain by loamy mineral materials. They have an organic surface layer, and Montgomery soils do not.

Ed—Edwards muck. This is a level soil in bogs and on swales, mainly around Silver Lake in Bethel Township. Areas are round or long; most are 5 to 40 acres in size.

Included with this soil in mapping are small areas of Linwood and Montgomery soils.

This soil is seldom used for crops because of prolonged wetness. It is suited to wildlife habitat. Although it is in low positions, it is rarely artificially drained because suitable outlets are not available. The high water table and the lack of drainage outlets are the main limitations for farm and nonfarm uses. Capability unit VIw-1.

Eel Series

The Eel series consists of moderately well drained, level to nearly level soils. These soils formed in medium-textured alluvial deposits. They are on flood plains next to rivers and the larger tributaries throughout the county. The native vegetation was mixed hardwoods, but many of the wooded areas have been cleared.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is friable, dark-brown and brown silt loam and loam 24 inches thick. It is mottled with grayish brown in the lower 18 inches. The underlying material is mottled, dark-gray loam and grayish-brown gravelly loam between depths of 31 and 42 inches and is stratified, calcareous sand and gravel between depths of 42 and 60 inches.

Eel soils have a deep root zone. The capacity to store and release plant nutrients is moderate to high, and the available water capacity is high. The surface layer is medium in organic-matter content, mildly alkaline, and in places calcareous. Permeability is moderate. The soils are subject to occasional flooding that restricts their use at times.

Eel soils are used for mainly row crops and small grain and for meadow. A few areas in narrow stream valleys are subject to frequent flooding. These areas are used mainly for pasture or trees. The soils are highly suited to row crops if they are protected from flooding. A seasonal water table causes wetness in winter and spring at times. Artificial drainage is needed for some crops.

Representative profile of Eel silt loam, in a pasture field in Lost Creek Township, NE¼SE¼ sec. 34, T. 2 E., R. 11 N.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; many roots; mildly alkaline, weakly calcareous; clear, smooth boundary.

B1—7 to 13 inches, dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; many roots; mildly alkaline, weakly calcareous; clear, wavy boundary.

B21—13 to 19 inches, brown (10YR 4/3) silt loam; few, fine, faint, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; few roots; few pebbles; mildly alkaline, weakly calcareous; clear, wavy boundary.

B22—19 to 31 inches, dark-brown (10YR 4/3) loam; common, coarse, distinct, grayish-brown (2.5Y 5/2) mottles; weak, coarse, subangular blocky structure; friable; 5 percent gravel; mildly alkaline, weakly calcareous; abrupt, wavy boundary.

C1—31 to 37 inches, dark-gray (5Y 4/1) loam; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; friable; 10 percent pebbles; moderately alkaline, calcareous; clear, wavy boundary.

C2—37 to 42 inches, grayish-brown (2.5Y 5/2) gravelly loam; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; massive; friable; moderately alkaline, calcareous; clear, wavy boundary.

C3—42 to 60 inches, light brownish-gray (2.5Y 6/2) stratified sand and gravel; common light yellowish-brown (2.5Y 6/4) mottles; single grained; loose; moderately alkaline, calcareous.

The solum is 24 to 40 inches thick. The solum is mildly alkaline or moderately alkaline, and in most places it is weakly calcareous in the upper part and moderately calcareous or strongly calcareous in the lower part. In some areas shell fragments cover 2 to 5 percent of the surface.

The Ap horizon is brown (10YR 4/3 or 10YR 5/3) or dark grayish brown (10YR 4/2). In undisturbed areas there is a 2- to 3-inch A1 horizon that is very dark brown (10YR 2/2) or very dark gray (10YR 3/1).

The B horizon is dark brown or brown (10YR 4/3) or yellowish brown (10YR 5/4). Depth to gray mottling ranges from 10 to 24 inches. The B horizon is silt loam or loam, and in some places there are 1- to 4-inch subhorizons of clay loam or sandy loam.

The C horizon has hue of 2.5Y, 10YR, or 5Y; value of 4 to 6; and chroma of 1 to 3. Stratified layers of sand and gravel are common at a depth of 40 inches or more.

The A horizon and B horizon in these Eel soils have a higher carbonate content than is defined as the range for the series, but this difference does not alter their use or behavior.

Eel soils are moderately well drained members of a drainage sequence that includes the well-drained Genesee and the somewhat poorly drained Shoals soils. Eel soils are near these soils and also near Medway, Ross, Stonelick, and Shoals variant soils. Eel soils are less brownish and contain more mottles in the B horizon and C horizon than Genesee soils. They lack the limestone bedrock underlying the Shoals variant soils, and they are less mottled and not so gray as those soils. Eel soils have a lighter colored A horizon than Medway and Ross soils. They lack the moderately coarse textures of Stonelick soils and are more mottled than Stonelick soils.

Ee—Eel silt loam. This level to nearly level soil is on flood plains scattered throughout the county. Areas are generally long and narrow and cover about 5 to 50 acres.

Included with this soil in mapping are small areas of wetter Shoals soils next to uplands and spots of well-drained Genesee soils on the slightly higher rises. Also included are spots of Medway soils that occur at the base of the more sloping adjacent soils and a few small areas where the surface layer is loam.

This soil is subject to flooding mostly during winter and spring, but it is not commonly flooded during the growing season. It commonly has good tilth and is easy to work. In some areas, it is highly dissected by braided flood channels. The hazard of flooding is a severe limitation for most nonfarm uses. Capability unit IIw-4.

Eldean Series

The Eldean series consist of well-drained nearly level to moderately steep soils. These soils are moderately deep to stratified, calcareous sand and gravel (fig. 5). They formed in loamy glacial outwash material. They are on outwash terraces along the rivers and larger streams in the county. A few areas of Eldean soils are on kames and eskers, mainly in Bethel Township.

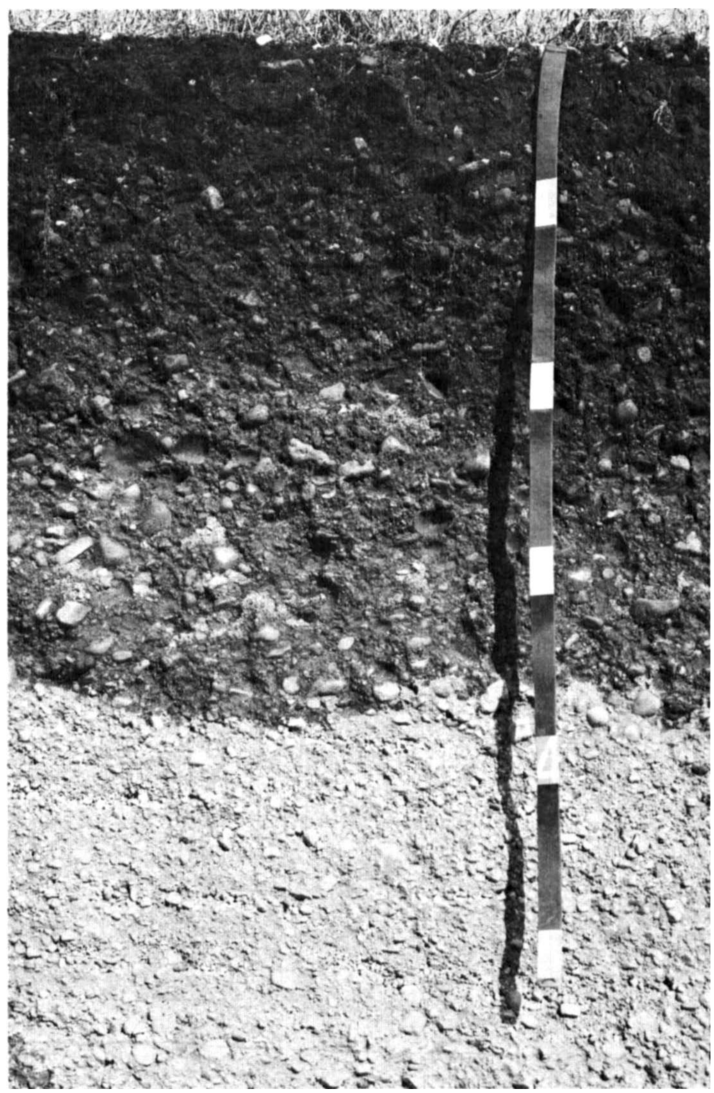

Figure 5.—**Profile of Eldean loam. The lighter colored underlying material is sand and gravel.**

The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is dark-brown loam about 9 inches thick. The subsoil extends to a depth of 30 inches. It is brown loam in the upper 3 inches, dark reddish-brown and reddish-brown clay in the next 11 inches, and dark-brown gravelly clay loam in the lower 7 inches. Yellowish-brown stratified sand and gravel are between depths of 30 and 60 inches.

Eldean soils have a moderately deep root zone. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate to low. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is moderate in the upper part of the soil and rapid in the coarse underlying material.

Eldean soils are used mainly for field crops. Some truck crops (fig. 6) and nursery crops are also grown. Because the soils are droughty, crops are often damaged by a lack of moisture during the growing season. The less sloping areas are well suited to irrigation. Crops can be planted early because the soils dry quickly and warm early in spring.

Representative profile of Eldean loam, 0 to 2 percent slopes, in Elizabeth Township, NE¼SW¼ sec. 31, T. 2 E., R. 10 N.

Ap—0 to 9 inches, dark-brown (7.5YR 4/2) loam; weak, fine, subangular blocky structure; friable; few roots; 5 percent gravel; neutral; abrupt, smooth boundary.

B1—9 to 12 inches, brown (7.5YR 4/4) heavy loam; moderate, medium, subangular blocky structure; friable; few roots; 5 percent gravel; slightly acid; clear, wavy boundary.

B21t—12 to 18 inches, dark reddish-brown (5YR 3/4) clay; moderate, medium, subangular and angular blocky structure; firm, sticky; few roots; thin patchy clay films on ped faces; 5 percent gravel; slightly acid; clear, wavy boundary.

B22t—18 to 23 inches, reddish-brown (5YR 4/4) clay; moderate, fine and medium, subangular blocky structure; firm, sticky; few roots; thin patchy clay films on ped faces; 10 percent gravel; neutral grading to mildly alkaline in the lower part; abrupt, smooth boundary.

B3t—23 to 30 inches, dark-brown (7.5YR 3/2) gravelly clay loam; weak, coarse, subangular blocky structure; friable; thin, very patchy clay films on ped faces; 40 percent gravel; common weathered limestone fragments; light-gray (10YR 7/2) streaks of lime; moderately alkaline, calcareous; clear, irregular boundary.

C—30 to 60 inches, yellowish-brown (10YR 5/4) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 24 to 40 inches thick. The depth to calcareous material ranges from 18 to 36 inches. The solum is medium acid to neutral in the upper part and neutral to moderately alkaline and calcareous in the lower part.

The Ap horizon is loam, silt loam, or gravelly loam, and the content of gravel ranges from 0 to 20 percent. The Ap horizon is brown (10YR 4/3), dark grayish brown (10YR 4/2), or dark brown (7.5YR 4/2). In wooded areas there is a 3- to 4-inch A1 horizon that is very dark grayish brown (10YR 3/2) to black (10YR 2/1). In some places there is a brown (10YR 5/3) or dark grayish-brown (10YR 4/2) A2 horizon.

The B1 horizon is brown (7.5YR 4/4) or dark brown (10YR 4/3). The B2t horizon is heavy clay loam or clay. It has a hue of 7.5YR or 5YR and a value and chroma of 3 to 5. The B3t horizon is gravelly sandy loam, gravelly loam, or gravelly clay loam. It has a hue of 10YR or 7.5YR, a value of 3 to 5, and a chroma of 2 or 3. In places tongues of the B3 horizon extend into the C horizon for 2 to 3 feet.

The proportion of sand and gravel in the C horizon varies greatly within short horizontal distances. The C horizon is yellowish brown (10YR 5/4) or brown (10YR 5/3).

Eldean soils are near Wea, Warsaw, Ockley, and Westland soils and in places are near Casco, Rodman, Sleeth, Lorenzo, and Miamian soils. Eldean soils have a lighter colored A horizon than Wea, Warsaw, and Westland soils. They are shallower to sand and gravel than Wea, Ockley, and Sleeth soils, and their B horizon is not so gray as that of Sleeth soils. Eldean soils are deeper to sand and gravel and have a thicker, more clayey B horizon than Casco, Rodman, and Lorenzo soils. They are underlain by sand and gravel, but Miamian soils are underlain by glacial till.

Figure 6.—**Tomatoes being harvested on Eldean soils. These soils are well suited to specialized crops common to the area.**

ElA—Eldean loam, 0 to 2 percent slopes. This level to nearly level soil is in broad areas on stream terraces near the Miami and Stillwater Rivers and their larger tributaries. Most areas cover 5 to 40 acres. This soil is on slightly lower positions and is closer to the rivers and large streams than Eldean silt loam. There is little or no evidence of past erosion. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Eldean silt loam and spots of deeper Ockley soils in swales and slightly depressed drainageways. Also included are a few areas of gently sloping Eldean soils at the head of drainageways.

This soil is suited to crops. It is used for nursery plants and irrigated truck crops. It has good tilth within a wide range of moisture content, and the surface layer is not so likely to crust as that of Eldean silt loam. This soil is moderately droughty, but it is well suited to irrigation. Surface runoff is slow. Droughtiness is the main limitation for most farm crops, but there are few limitations for most nonfarm uses. Capability unit IIs-1.

ElB—Eldean loam, 2 to 6 percent slopes. This gently sloping soil is along drainageways on stream terraces and on gravelly knolls and ridges on uplands. Most areas cover 2 to 30 acres. Slopes are about 50 to 75 feet long. There is some evidence of erosion, but most of the original surface layer remains. The surface layer is mainly loam and is 5 to 10 percent gravel in some places.

Included with this soil in mapping are small areas of moderately eroded Eldean and Lorenzo soils, small areas of Casco soils, and spots of soils that have slopes of more than 6 percent. A few small areas of soils that have no gravel within a depth of 40 inches and that have a slightly coarser textured subsoil than this Eldean soil are also included.

This soil is used for crops, pasture, and woodland. It has good tilth within a wide range of moisture content. It is easy to till, and seedbeds are easy to prepare. The surface layer is less likely to crust or seal over than that of Eldean silt loam. The hazard of erosion is moderate. The soil is droughty during summer in most years, but it is less droughty than eroded Eldean soils. It has few limitations for most nonfarm uses. Capability unit IIe-2.

ElB2—Eldean loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is at the head of drainageways on stream terraces and on gravelly knolls and ridges on uplands. Most areas cover 2 to 25 acres. Slopes are generally 60 to 100 feet long. About 80 percent of the acreage is moderately eroded. The plow layer is a mixture of the original surface layer and some of the subsoil. In some places the surface layer is 5 to 15 percent gravel.

Included with this soil in mapping are small areas of Eldean soils that are slightly eroded and small areas of Lorenzo soils. Also included are small areas of soils that have slopes of more than 6 percent, spots of Casco soils, and some areas of soils that have a surface layer of gravelly loam or silt loam.

This soil is used mainly for crops, pasture, and woodland. It is highly susceptible to erosion. Because it is eroded, this soil has a surface layer that is lower in content of organic matter than that of uneroded Eldean soils, and it has a lower capacity to absorb and retain moisture. Establishing grass and other plants is more difficult on this soil than on uneroded Eldean soils. Erosion and droughtiness are the main limitations for farm uses; there are few limitations for most nonfarm uses. Capability unit IIe-2.

EmA—Eldean silt loam, 0 to 2 percent slopes. This level to nearly level soil is on high stream terraces and on kames and eskers. It is mainly in areas of 5 to 35 acres, and most areas are farther away from the rivers and major streams than Eldean loam. Nearly all of the original surface layer remains, and there is little or no evidence of erosion.

Included with this soil in mapping are small areas of deeper Ockley soils and spots of gently sloping Eldean soils.

This soil is suited to crops. The surface layer generally has good tilth, but it is subject to more crusting and sealing after rain than that of Eldean loam. Crusting reduces seedling emergence, and it retards infiltration. It affects the choice of irrigation systems, the use of herbicides and other chemicals, and the management of crop residue. This soil has few limitations for farming. Surface runoff is slow. The soil is moderately droughty, but it is suited to irrigation. It has few limitations for nonfarm uses. Capability unit IIs-1.

EmB—Eldean silt loam, 2 to 6 percent slopes. This gently sloping soil is generally at the head of drainageways on high stream terraces. In a few places it is on kames and eskers. Most areas cover 3 to 20 acres. Slopes are generally 60 to 120 feet long.

Included with this soil in mapping are small areas of moderately eroded Eldean soils and a few spots of deeper Ockley soils.

This soil is suited to crops. It generally has good tilth, but the surface layer is subject to more crusting and sealing after rain than that of Eldean loam. Crusting affects the choice of irrigation systems, the use of herbicides and other chemicals, and the management of crop residue. This soil has a moderate erosion hazard and is droughty during summer in most years. It has few limitations for nonfarm uses. Capability unit IIe-2.

EoC2—Eldean-Casco gravelly loams, 6 to 12 percent slopes, moderately eroded. This complex is on long and narrow breaks at the head of drainageways on outwash terraces and on gravelly knolls and ridges on uplands. Most areas cover about 2 to 30 acres. Slopes are generally 60 to 100 feet long.

This complex is about 50 percent Eldean soils, 35 percent Casco soils, and 15 percent other soils. The Eldean soils are generally on the lower two-thirds of side slopes, and the Casco soils are on the upper one-third.

The Casco soils have the profile described as representative of the Casco series. The Eldean soils have a profile similar to the one described as representative of the Eldean series, but the plow layer is a mixture of the original surface layer and some of the upper part of the subsoil. It is 15 to 25 percent gravel.

Included with this complex in mapping are small spots of severely eroded Eldean and Casco soils and small areas of Lorenzo soils. Also included are small areas of soils that have slopes of more than 12 percent, a few areas of soils that have a surface layer of silt loam or loam, and some areas of only slightly eroded soils.

This complex is used for crops and pasture. A few areas are wooded. The surface layer is mainly low in content of organic matter. The severe hazards of erosion and drought are limitations for farm use. Slope is the main limitation for nonfarm uses. Capability unit IVe-2.

EoD2—Eldean-Casco gravelly loams, 12 to 18 percent slopes, moderately eroded. This moderately steep complex is mainly on long, narrow breaks between the flood plains and the higher lying, less sloping soils on stream terraces. It is also on gravelly knolls and ridges on uplands. Most areas cover about 2 to 15 acres. Slopes are generally 60 to 150 feet long.

This complex is about 50 percent Eldean soils, 35 percent Casco soils, and 15 percent other soils. The Eldean soils are mainly on the lower two-thirds of the side slopes, and the Casco soils are on the upper one-third.

These Eldean and Casco soils have profiles similar to those described as representative of their series, but their surface layer is thinner. The surface layer is mainly 20 to 30 percent gravel but is as much as 35 to 40 percent gravel in places.

Included with this complex in mapping are small spots of severely eroded Eldean and Casco soils and small areas of darker colored Lorenzo and Rodman soils. Also included are a few areas of soils that have slopes of more than 18 percent and small areas of soils that have a loam surface layer.

This complex is used mainly for pasture and woodland. A few areas are used for crops. The surface layer is mainly low in content of organic matter. Establishing plants on these soils is more difficult than on the uneroded, less sloping Eldean and Casco soils. Surface runoff is rapid, the hazard of erosion is very severe, and the hazard of drought is severe for most crops. Slope is the main limitation for most nonfarm uses. Capability unit VIe-1.

EpD3—Eldean-Casco complex, 6 to 18 percent slopes, severely eroded. This sloping to moderately steep complex is mainly on long, narrow breaks at the head of drainageways on outwash terraces. It is also on nearly rounded knolls or kames and irregularly shaped eskers on uplands. Most areas cover 4 to 15 acres. Slopes are generally 60 to 120 feet long.

This complex is 40 percent Eldean soils, 40 percent Casco soils, and 20 percent other soils. The Eldean soils are mainly on the lower half of the side slopes, and most of the Casco soils are on the upper half.

The surface layer of the soils in this complex is sandy clay loam or sandy clay. It has poor tilth and is low or very low in organic-matter content. The surface is sticky when wet and hard and cloddy when dry.

Included with this complex in mapping are small spots of soils that have loose sand and gravel at the surface and small areas of moderately eroded Eldean and Casco soils near the base of slopes. Also included are small areas of Lorenzo soils and soils that have slopes of more than 18 percent.

This complex is suited to pasture and woodland. It is not suited to cultivated crops because the erosion hazard is very severe and the drought hazard is severe. Establishing plants on these soils is more difficult than on the uneroded and moderately eroded Eldean and Casco soils. Slope and erosion are the main limitations for nonfarm uses. Capability unit VIe-1.

ErB—Eldean-Miamian complex, 2 to 6 percent slopes. This complex is mainly on low knolls and ridges on moraines. It is also on kames and eskers, mainly in Bethel Township. The soils are so intermingled that it was not practical to map them separately. Most areas cover 4 to 30 acres. Slopes are about 80 to 120 feet long.

This complex is 50 percent Eldean soils, 35 percent Miamian soils, and 15 percent other soils. The Eldean soils have slopes mainly of 4 to 6 percent, and the Miamian soils have slopes mainly of 2 to 4 percent. The Eldean soils are underlain by sand and gravel, and the Miamian soils are underlain by glacial till.

These soils have profiles similar to those described as representative of their series, but the Miamian soils have more sand in the surface layer. About 40 percent of the acreage of these soils is moderately eroded, and the plow layer is a mixture of the original surface layer and some of the subsoil.

Included with this complex in mapping are small areas of Martinsville and Ockley loams, till substratum, and small areas of soils that have slopes of more than 6 percent.

This complex is used mainly for crops. It is suited to all crops commonly grown in the county. Surface runoff is moderate, and the hazard of erosion is moderate. The Eldean soils are droughty during summer in most years. The moderatey slow permeability of the Miamian soils and the gentle slopes are limitations for some nonfarm uses. Capability unit IIe-2.

ErC—Eldean-Miamian complex, 6 to 12 percent slopes. This complex is on long, narrow ridges and knolls on moraines, where kames and eskers are common. It is mainly in Bethel Township. The soils are so intermingled that it was not practical to map them separately. Most areas cover about 4 to 15 acres. Slopes are about 75 to 120 feet long.

This complex is 50 percent Eldean soils, 35 percent Miamian soils, and 15 percent other soils. The Eldean soils are underlain by sand and gravel, and the Miamian soils are underlain by glacial till.

About 40 percent of the acreage is moderately eroded. In these areas the plow layer is a mixture of the original surface layer and some of the subsoil. The surface layer is mainly loam, but in a few places it is silt loam. In some places the surface layer is 5 to 10 percent gravel, especially in areas of the Eldean soils.

Included with this complex in mapping are spots of severely eroded Eldean and Miamian soils and small areas of soils that have slopes of more than 12 percent. Also included are small areas of uneroded Miamian and Eldean soils.

This complex is used mainly for crops and pasture. A few areas are wooded. The hazard of erosion is severe. The Eldean soils are droughty during summer in most years. Slope is a limitation for many nonfarm uses. Capability unit IIIe-1.

Genesee Series

The Genesee series consists of well-drained, level to nearly level soils. These soils formed in medium-textured alluvial deposits. They are on flood plains next to the Miami and Stillwater Rivers and their larger tributaries. The native vegetation was mixed hardwoods, but most wooded areas have been cleared and are used for crops.

In a representative profile the surface layer is dark grayish-brown silt loam about 11 inches thick. The subsoil is friable, dark-brown silt loam 14 inches thick. The underlying material is brown loam between depths of 25 and 43 inches and is stratified brown loose sand and gravel between depths of 43 and 60 inches.

Genesee soils have a deep root zone. The capacity to store and release plant nutrients is moderate to high, and the available water capacity is high. The plow layer is medium in organic-matter content, is mildly alkaline, and in places is calcareous. Permeability is moderate. The soils are subject to occasional flooding.

Genesee soils are used for mainly row crops and some small grain and for meadow. A few areas are wooded or pasture. A large area is protected from flooding by levees along the Miami River. The soils are well suited to row crops, if they are protected from floods.

Representative profile of Genesee silt loam in Bethel Township, NW¼SW¼ sec. 36, T. 2 E., R. 9 N. (sample MM-22 in laboratory data table):

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; 5 percent worm casts; few shell fragments; patchy dark-brown (10YR 3/3) coatings on ped faces; moderately alkaline, calcareous; clear, smooth boundary.

B—11 to 25 inches, dark-brown (10YR 4/3) silt loam; moderate, fine and medium, subangular blocky structure; friable; few shell fragments; moderately alkaline, calcareous; clear, wavy boundary.

C1—25 to 43 inches, brown (10YR 5/3) loam; massive; friable; 10 percent gravel; 2 to 4 percent shell fragments; moderately alkaline, calcareous; abrupt, wavy boundary.

C2—43 to 60 inches, brown (10YR 5/3) stratified sand and gravel; single grained; loose; 5 percent shell fragments; moderately alkaline, calcareous.

The solum is 24 to 36 inches thick. Reaction of the solum is mildly to moderately alkaline and in most places the solum is weakly calcareous. Some areas have 5 to 10 percent shell fragments in the A horizon.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 5/3). In undisturbed areas there is a 2- or 3-inch A1 horizon that is very dark brown (10YR 2/2) or very dark gray (10YR 3/1).

The B horizon is brown (10YR 4/3), yellowish-brown (10YR 5/4), or dark yellowish brown (10YR 4/4). It is mainly silt loam or loam, but in some places there are 1- to 4-inch subhorizons of sandy loam or clay loam. The content of gravel is mainly 5 to 10 percent.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4), stratified silt loam, loam, and sandy loam. In many places sand and gravel are at a depth of 40 or more inches.

The A horizon and upper part of the B horizon of these Genesee soils have a higher carbonate content than is defined as the range for the series, but this difference does not alter the use or behavior of the soils.

Genesee soils are well-drained members of a drainage sequence that includes the moderately well drained Eel soils and the somewhat poorly drained Shoals soils. Genesee soils are near these soils and also are near Ross, Ross variant, Wea, and Stonelick soils. Genesee soils lack the mottled B horizon which Eel and Shoals soils have. They have a lighter colored A horizon than Ross, Ross variant, and Wea soils. They are not underlain by bedrock as Ross variant soils are. Genesee soils contain less sand in the horizons below the A horizon than Stonelick soils.

Gn—Genesee silt loam. This level to nearly level soil is on broad flood plains. It is at a slightly lower elevation than nearby Ross soils. Most areas cover 10 to 60 acres or more.

Included with this soil in mapping are small areas of slightly wetter Eel soils and Ross and Medway soils. Also included are spots of coarser textured Stonelick soils that are next to the river channel and small areas where the surface layer is loam.

This soil has few, if any, limitations for crops. It has good tilth and is easy to work. In a few areas, braided flood channels dissect this soil and restrict its use. The soil is subject to occasional flooding. Row crops can be planted and harvested during the nonflooding period in most years. Occasional flooding is the main limitation for nonfarm uses. Capability unit IIw-4.

Glynwood Series

The Glynwood series consists of moderately well drained, gently sloping to moderately steep soils. These soils formed in clay loam or silty clay loam till and are generally mantled with 8 to 14 inches of silty loess material. They are on till plains and moraines in the northwestern part of the county, mainly in the northern half of Newberry and northwest corner of Washington Township. The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is 21 inches thick. It is yellowish-brown silty clay loam in the upper 3 inches, olive-brown heavy clay loam in the next 7 inches, dark yellowish-brown clay in the next 4 inches, and brown clay loam in the lower 7 inches. It is mottled with grayish brown. Mottled olive-brown clay loam till is between depths of 29 and 60 inches. The till is massive and calcareous, and it restricts root growth and movement of water.

Glynwood soils have a moderately deep root zone. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is slow.

Glynwood soils are used mainly for crops, but some steeper areas are in pasture and a few areas remain wooded. These soils have better natural drainage than most nearby soils.

Representative profile of Glynwood silt loam, 2 to 6 percent slopes, in a cultivated field in Newberry Township, NE¼NW¼ sec. 33, T. 8 N., R. 5 E.

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; common roots; neutral; abrupt, smooth boundary.

B1t—8 to 11 inches, yellowish-brown (10YR 5/4) silty clay loam; few, medium, distinct, grayish-brown (10YR 5/2) mottles; weak, fine and medium, subangular blocky structure; firm; few roots; thin patchy clay films on ped faces; neutral; clear, smooth boundary.

IIB21t—11 to 18 inches, olive-brown (2.5Y 4/4) heavy clay loam; few, medium, distinct, dark grayish-brown (2.5Y 4/2) mottles; strong, fine and medium, angular blocky structure; firm; few roots; medium continuous clay films on ped faces; few dark concretions; 5 percent pebbles; medium acid; clear, wavy boundary.

IIB22t—18 to 22 inches, dark yellowish-brown (10YR 4/4) clay; few, medium, distinct, grayish-brown (2.5Y 5/2) mottles; strong, medium, angular blocky structure; firm; medium continuous clay films on ped faces; 5 percent pebbles; neutral; clear, wavy boundary.

IIB3t—22 to 29 inches, brown (10YR 5/3) clay loam; few, fine, faint, grayish-brown (10YR 5/2) mottles; weak, very thick, platy structure parting to moderate, fine and medium, subangular blocky; firm; thin patchy clay films on ped faces; 5 percent pebbles; mildly alkaline, weakly calcareous; clear, wavy boundary.

IIC—29 to 60 inches, olive-brown (2.5Y 4/4) clay loam; many, coarse, distinct, dark grayish-brown (2.5Y 4/2) mottles; massive; firm; 5 to 10 percent pebbles; moderately alkaline, calcareous.

The solum is 20 to 36 inches thick. The depth to calcareous material ranges mainly from 16 to 32 inches and in severely eroded areas is less than 10 inches. The loess capping is 0 to 14 inches thick. The part of the solum below the loess and the C horizon are 2 to 15 percent coarse fragments.

The Ap horizon is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3). In undisturbed areas there is a 3- to 5-inch A1 horizon that is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2) and a 4- to 6-inch A2 horizon that is grayish brown (10YR 5/2, 2.5Y 5/2) or dark grayish-brown (10YR 4/2). The A horizon is mainly silt loam, but in severely eroded areas it is clay loam. The Ap horizon has weak, medium, granular structure or weak, fine or medium, subangular blocky.

The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 to 6. It is silty clay loam, clay loam, silty clay, or clay. Its structure is weak to strong, fine to coarse, angular or subangular blocky, or prismatic. The B horizon is strongly acid to medium acid in the upper part and neutral to mildly alkaline in the lower part. In some places the B3 horizon is weakly calcareous.

The C horizon is clay loam or silty clay loam.

Glynwood soils are moderately well drained members of a drainage sequence that includes the somewhat poorly drained Blount soils and the very poorly drained Pewamo soils. They are similar to Celina and Miamian soils but contain more clay in the B horizon and C horizon.

GwB—Glynwood silt loam, 2 to 6 percent slopes. This gently sloping soil is on low knolls and ridges on uplands. Areas are irregularly shaped and cover about 2 to 8 acres. Slopes are generally 50 to 100 feet long. This soil has the profile described as representative of the series. Nearly all of the original surface layer remains, and there is only slight evidence of erosion.

Included with this soil in mapping are spots of moderately eroded Glynwood soils and small areas of somewhat poorly drained Blount soils. Also included are a few small areas of very poorly drained Pewamo soils.

This soil is used for crops, pasture, and woodland. The hazard of erosion is moderate, and the hazard of wetness is slight. Surface runoff is medium. Areas on the lower part of side slopes are wetter in spring than areas on the upper part of side slopes. The slow permeability is a limitation for many nonfarm uses. Capability unit IIe-1.

GwB2—Glynwood silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on knolls, ridges, and side slopes at the head of drainageways on uplands. Most areas are variable in shape and cover about 5 to 20 acres. Slopes are generally 50 to 100 feet long. The surface layer is a mixture of the original surface layer and some of the subsoil. There are a few spots where the surface layer is severely eroded and is mainly material from the upper part of the subsoil.

Included with this soil in mapping are spots of uneroded Glynwood soils and small areas of somewhat poorly drained Blount soils. Also included are small areas of wetter Pewamo soils in narrow drainageways.

The surface layer of this soil contains slightly more clay, is more sticky when wet, and becomes harder when dry than that of uneroded Glynwood soils. Thus, it is more crusty when dry and seals over faster after rain. Erosion has reduced the content of organic matter and reduced the capacity to absorb and retain moisture. Establishing plants is more difficult on this soil than on uneroded Glynwood soils. The severe hazard of erosion is the main limitation for farming. The slow permeability is a limitation for many nonfarm uses. Capability unit IIIe-2.

GwC2—Glynwood silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on knolls and side slopes at the head of drainageways. Most areas cover about 5 to 25 acres. Slopes are mainly 40 to 80 feet long. Erosion has removed part of the original surface layer. The plow layer is a mixture of the original surface layer and some of the subsoil. Some areas contain spots that are severely eroded and occasional short gullies that are 1 foot to 2 feet deep.

Included with this soil in mapping are small areas of gently sloping Glynwood and Blount soils, spots of soils that have slopes of more than 12 percent, and small areas of uneroded Glynwood soils.

Past erosion has lowered the content of organic matter and reduced the tilth. As a result, establishing plants is more difficult than on uneroded Glynwood soils. The hazard of erosion is severe if this soil is used for crops. The slope and the slow permeability are limitations for most nonfarm uses. Capability unit IIIe-2.

GwD2—Glynwood silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is on side slopes at the head of drainageways. Areas are long and narrow and cover about 2 to 4 acres. Slopes are generally 50 to 100 feet long. Depth to calcareous till is less than in the less sloping and uneroded Glynwood soil. Erosion has removed most of the original surface layer of this soil in most wooded areas. In cultivated areas, the plow layer is a mixture of the original surface layer and some of the subsoil. Some areas contain spots that are severely eroded and occasional short gullies that are 1 foot to 2 feet deep.

Included with this soil in mapping are spots of uneroded Glynwood soils that are mainly in woods or pasture and small areas of soils that have slopes of more than 18 percent.

Past erosion has reduced the content of organic matter and lowered the capacity to absorb and retain moisture. This soil tends to seal over after rain and is subject to surface crusting. The hazard of erosion is very severe where the soil is used for crops. The moderately steep slopes and the slow permeability are limitations for most nonfarm uses. Capability unit IVe-1.

GyC3—Glynwood clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is in scattered small areas at the head of drainageways and on knolls. Areas cover about 2 to 5 acres. Slopes are about 50 to 80 feet long. This soil has a profile similar to the one described as representative of the series, but the depth to calcareous till is less. In some areas there are spots where the calcareous till is exposed at the surface. Erosion has removed most of the original surface layer. Shallow, short gullies, 1 foot to 2 feet deep, are common in some areas. The surface layer is mostly clay loam, but in a few small areas it is silty clay loam.

Included with this soil in mapping are small areas of moderately eroded Glynwood soils and spots of soils that have slopes of more than 12 percent.

This soil has limited use for crops. The surface layer is low in organic-matter content, and its capacity to absorb and retain moisture is low. It has poor tilth and can be worked only within a narrow range of moisture content. Erosion is a very severe hazard if cultivated crops are grown. The slope and the slow permeability are limitations for most nonfarm uses. Capability unit IVe-1.

GyD3—Glynwood clay loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is on narrow breaks at the head of drainageways. Most areas cover 6 to 10 acres. Slopes are generally 50 to 75 feet long. This soil has a profile that is similar to the one described as representative of the series, but erosion has removed most of the original surface layer, so calcareous till is at a lesser depth. In some areas, spots of calcareous till are exposed at the surface. Shallow, short gullies, 1 foot to 2 feet deep, are common. The surface layer is mostly clay loam, but in a few small areas it is silty clay loam.

Included with this soil in mapping are small areas of moderately eroded Glynwood soils and spots of soils that have slopes of more than 18 percent.

This soil is suited to pasture and woods. It is too steep and eroded for cultivated crops. The surface layer is low in organic-matter content, and its capacity to absorb and retain moisture is low. The moderately steep slopes and the slow permeability are limitations for most nonfarm uses. Capability unit VIe-1.

Gravel Pits

Gravel pits are open excavations where the soil material has been removed and the underlying sand and gravel has been mined. These pits occur in outwash terraces and in kames and eskers on the uplands. They are commonly in areas of Eldean, Warsaw, Casco, Rodman, and Wea soils. These soils have underlying gravelly and sandy material that is suitable for road construction, in making concrete, and for other uses.

Gravel pits vary considerably in size and depth. Smaller pits are 6 to 15 feet deep, and larger pits are 30 feet deep or more. Most of the larger pits contain water, and some are used as fish ponds or for other recreation purposes. Capability unit not assigned.

Hennepin Series

The Hennepin series consists of well-drained, steep to very steep soils. These soils are shallow to calcareous, medium-textured glacial till. They are on uplands along the Miami and Stillwater Rivers and their larger tributaries. The native vegetation was mixed stands of deciduous hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 4 inches thick. The subsoil is brown silt loam in the upper 10 inches and is yellowish-brown loam in the lower 4 inches. Brown, calcareous loam glacial till is between depths of 18 and 60 inches.

Hennepin soils have a shallow root zone over firm glacial till. The capacity to store and release plant nutrients is low, and the available water capacity is low. The surface layer is medium in organic-matter content and is mildly alkaline. Most areas are calcareous at the surface. Permeability is moderately slow.

Hennepin soils are used for pasture and woodland. They are too steep to be cultivated. Surface runoff is rapid, and the erosion hazard is very severe.

Representative profile of Hennepin silt loam, in an area of Miamian and Hennepin silt loams, 25 to 50 percent slopes, in a wooded area, in Newton Township, SE¼SE¼ sec. 13, T 8 N., R. 4 E.

O1—¼ inch to 0, ash and oak leaves.

A1—0 to 4 inches, dark-brown (10YR 3/3) silt loam; moderate, fine and medium, granular structure; friable; mildly alkaline, weakly calcareous; abrupt, smooth boundary.

B1—4 to 14 inches, brown (10YR 4/3) silt loam; moderate, medium and coarse, subangular blocky structure; friable; many fine roots; 5 to 10 percent pebbles; common pores and root channels, 1 to 2 millimeters in diameter; moderately alkaline, calcareous; clear, smooth boundary.

B2—14 to 18 inches, yellowish-brown (10YR 5/4) loam; moderate, medium, subangular blocky structure; friable; few fine roots; 10 percent pebbles; moderately alkaline, calcareous; clear, smooth boundary.

C—18 to 60 inches, brown (10YR 5/3) loam till; massive; firm; 10 percent pebbles; moderately alkaline, calcareous.

The solum is 10 to 18 inches thick. Reaction of the solum is mildly alkaline or moderately alkaline, and most of the solum is weakly calcareous or moderately calcareous.

The A1 horizon is dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), or dark grayish brown (10YR 4/2). In a few areas the A horizon is as much as 5 to 10 percent pebbles.

The B horizon is brown (10YR 4/3), yellowish-brown (10YR 5/4), or dark yellowish-brown (10YR 3/4 or 10YR 4/4) silt loam, loam, or light clay loam. It generally is 5 to 10 percent pebbles. Its structure is weak or moderate, medium or coarse, subangular blocky, or granular.

The C horizon is dark brown (10YR 4/3), brown (10YR 5/3), or yellowish brown (10YR 5/4). It is mainly loam, but is clay loam in a few places. The C horizon is 5 to 15 percent pebbles.

Hennepin soils are near Miamian, Rodman, and Ritchey soils. Hennepin soils are shallower to calcareous till than the Miamian soils. They are underlain by loam till, Rodman soils are underlain by sand and gravel, and Ritchey soils are underlain by limestone bedrock.

In Miami County, Hennepin soils are mapped only with Miamian soils.

Linwood Series

The Linwood series consists of very poorly drained, level, organic soils. These soils are in bogs and swamps, generally on terraces, and in swales on moraines. They consist of layers of muck that are underlain by loamy material at a depth of 16 to 50 inches. The muck is the partly decomposed remains of plants, mostly trees, fibrous grasses, sedges, and reeds.

In a representative profile the surface layer is black or very dark gray muck 28 inches thick. Calcareous, greenish-gray silty clay loam mineral soil is between depths of 28 and 60 inches.

Linwood soils have a deep root zone if they are drained. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is mildly alkaline or moderately alkaline and seldom needs to be limed. Permeability is rapid in the muck material and moderately slow in the underlying material. The organic layers are highly compressible and unstable.

The wetness hazard is moderate. In drained areas, the water table is high throughout most of the year. Drained areas are suited to cultivated crops. Some areas are difficult to drain because drainage outlets are inadequate. If the surface is dry, these soils are subject to soil blowing.

Representative profile of Linwood muck in woodland in Staunton Township, SE¼SW¼ sec. 5, T. 1 E., R. 10 N.

Oa1—0 to 3 inches, black (10YR 2/1 on broken face) and black (N 2/0 when rubbed and pressed) sapric material; 5 percent fiber when broken, none when rubbed; moderate, medium, granular structure; friable; many shell fragments; mildly alkaline, calcareous; clear, smooth boundary.

Oa2—3 to 11 inches, black (10YR 2/1 on broken face and when rubbed and pressed) sapric material; 15 percent fiber when broken, 2 percent when rubbed; weak, medium, subangular blocky structure; friable; common shell fragments; mildly alkaline, calcareous; clear, wavy boundary.

Oa3—11 to 16 inches, black (10YR 2/1 on broken face and when rubbed and pressed) sapric material; 30 percent fiber when broken, 2 percent when rubbed; weak, coarse, subangular blocky structure; friable; few shell fragments; moderately alkaline, calcareous; clear, wavy boundary.

Oa4—16 to 28 inches, very dark gray (10YR 3/1 or broken face and when rubbed and pressed) sapric material; 35 percent fiber when broken, 5 percent when rubbed; weak, medium, subangular blocky structure; friable, nonsticky when wet; few shell fragments; moderately alkaline, calcareous; clear, wavy boundary.

IICg—28 to 60 inches, greenish-gray (5GY 5/1) silty clay loam; massive; sticky when wet; few pebbles, 1/8 to 1/4 inch in diameter; moderately alkaline, calcareous.

The thickness of the organic material or depth to the IIC horizon ranges from 16 to 50 inches. Reaction of the organic material is mildly alkaline or moderately alkaline, and in most places the organic material is calcareous.

The surface tier of the organic material is black (N 2/0 or 10YR 2/1) or very dark brown (10YR 2/2). The subsurface and bottom tiers of the organic material are similar in color to the surface tier but are also very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). In a few places the chroma of broken faces differs from that of rubbed and pressed material by one or two units. Structure of the surface tier is moderate, granular or crumb, and that of the subsurface and bottom tiers is weak or moderate, medium or coarse, subangular blocky.

The IICg horizon has hue of 10YR to 5GY, value of 4 to 6, and chroma of 1 or 2. It ranges from fine sandy loam to silty clay loam and averages less than 35 percent clay. In some places there are 2- to 4-inch layers of silty clay or fine sand.

Linwood soils are near Shoals, Montgomery, Edwards. and Wallkill soils. Linwood soils differ from Shoals and Montgomery soils by having an organic surface layer instead of a mineral surface layer. They are underlain by loamy mineral materials, and Edwards soils are underlain by marl. Linwood soils lack the mineral soil overburden which Wallkill soils have.

Ln—Linwood muck. This soil is in bogs and on swales, mainly along Honey Creek in Bethel Township. Most areas cover about 5 to 15 acres.

Included with this soil in mapping are small areas of muck that are either less than 16 inches or more than 50 inches thick. Also included are small areas of Montgomery soils that are at a slightly higher elevation, mainly along the edge of mapped areas.

This soil is lower lying than nearby soils, and many areas are difficult to drain because drainage outlets are poor. The soil is subject to subsidence if drained. It is subject to soil blowing, especially in open areas where the surface is dry and is not protected by plant cover. This soil is suited to cultivated crops, pasture, and meadow where drained. Undrained areas are often used for and are suited to wildlife habitat. The high water table and the low strength are severe limitations for most nonfarm uses. Capability unit IIw-5.

Lorenzo Series

The Lorenzo series consists of well-drained, steep to very steep soils. These soils are shallow to sand and gravel. They formed in loamy glacial outwash. They are on gravelly stream terraces along the Miami River and its larger tributaries and on kames and eskers on uplands, mainly in Bethel Township. The native vegetation was tall prairie grasses.

In a representative profile the surface layer is very dark grayish-brown gravelly loam about 7 inches thick. The subsoil is dark-brown gravelly clay loam in the upper 9 inches and is dark-brown loamy sand in the lower 4 inches. Calcareous, yellowish-brown sand and gravel is between depths of 20 and 60 inches.

Lorenzo soils have a shallow root zone. The capacity to store and release plant nutrients is low, and the available water capacity is low. Permeability is moderately rapid in the upper part and rapid in the coarse underlying material.

Lorenzo soils are subject to drought and are warm and dry early in spring.

Representative profile of Lorenzo gravelly loam, in an area of Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded, in Bethel Township, SW¼NE¼ sec. 11, T. 2 N., R. 2 E.

A1—0 to 7 inches, very dark grayish-brown (10YR 3/2) gravelly loam; weak, medium, granular structure; friable; 20 percent gravel; mildly alkaline; clear, smooth boundary.

B2t—7 to 16 inches, dark-brown (7.5YR 4/4) gravelly clay loam; moderate, medium, subangular blocky structure; firm; thin patchy clay films on ped faces; 20 percent gravel; mildly alkaline; clear, smooth boundary.

B3t—16 to 20 inches, dark-brown (7.5YR 4/4) loamy sand; weak, medium subangular blocky structure; friable; thin very patchy clay films along channels and bridging sand grains; 10 percent gravel; mildly alkaline, calcareous; abrupt, smooth boundary.

C—20 to 60 inches, yellowish-brown (10YR 5/4) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 12 to 24 inches thick, and the depth to calcareous material ranges from 10 to 20 inches. Reaction of the solum is neutral or mildly alkaline.

The A horizon is 6 to 9 inches thick. It is dark brown (10YR 3/3) or very dark grayish brown (10YR 3/2).

The B2t horizon is 6 to 9 inches thick. It is dark yellowish-brown (10YR 3/4, 10YR 4/4) or dark-brown to brown (10YR 4/3, 7.5YR 4/2, 7.5YR 4/4) clay loam, gravelly clay loam, or gravelly sandy clay loam. It is less than 35 percent gravel. The B3 horizon is gravelly loam, loamy sand, or sandy loam. It is 2 to 5 inches thick. In some places it contains clay films on ped faces and sand bridging. The B3 horizon is mildly alkaline or moderately alkaline and in most places is weakly calcareous.

The proportion of sand and gravel in the C horizon varies greatly within short distances. The C horizon is yellowish brown (10YR 5/4) or brown (10YR 5/3).

Lorenzo soils are near Eldean, Casco, Rodman, Wea, and Warsaw soils. Lorenzo soils are shallower to sand and gravel than Eldean, Wea, and Warsaw soils. They have a darker colored A horizon than Casco soils. Lorenzo soils have a better developed B horizon and contain more clay than Rodman soils.

LrE2—Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded. This steep to very steep complex is in narrow bands on the sides of kames and eskers, mainly in the Honey Creek areas in Bethel Township. It is near areas of less sloping Eldean and Miamian soils and above level Shoals, Algiers, and Montgomery soils. Most areas are about 5 to 20 acres in size. Slopes are about 80 to 150 feet long.

This complex is about 50 percent Lorenzo soils, 35 percent Rodman soils, and 15 percent other soils. The Rodman soils are mainly on the upper one-third of the side slopes, and the Lorenzo soils are mainly on the lower two-thirds.

Included with this complex in mapping are scattered small areas of Warsaw and Eldean soils at the foot of slopes. Also included are a few areas where calcareous sand and gravel is exposed.

In cultivated areas the hazards of drought and erosion are severe. The slope is the main limitation for nonfarm uses. Capability unit VIIs–1.

Made Land

Made land consists mostly of former pits and depressions that have been filled or covered with trash, bricks and stones, cinders, industrial waste, and other nonsoil material. Most areas are dumps or sanitary landfills near villages and cities.

Most areas have a top layer of soil material 1 to 2 feet thick. A few areas have been graded and are vegetated. Capability unit not assigned.

Martinsville Series

The Martinsville series consists of well-drained, gently sloping soils. These soils formed in thin deposits of loamy outwash. Medium-textured glacial till is at a depth of 42 to 66 inches. The soils are on till plains and moraines scattered throughout the county. The native vegetation was mixed hardwoods, but most areas have been cleared and used for crops.

In a representative profile the surface layer is dark-brown loam about 8 inches thick. The subsoil is firm, dark yellowish-brown and brown clay loam, sandy clay loam, and gravelly clay loam 26 inches thick. The underlying material is calcareous, stratified dark yellowish-brown fine sandy loam and brown silt loam between depths of 34 and 54 inches and is calcareous, yellowish-brown loam till between depths of 54 to 60 inches.

Martinsville soils have a moderately deep to deep root zone. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate to high. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is moderate.

These soils are used mainly for crops and are suited to most crops commonly grown in the county. They are in small areas and their use is often determined by the larger areas of adjacent soils. The soils dry and warm earlier in spring than nearby Celina, Crosby, and Brookston soils. Erosion is the main hazard if the soils are used for crops.

Representative profile of Martinsville loam, in an area of Martinsville and Ockley loams, till substratum, 2 to 6 percent slopes, in a cultivated field in Monroe Township, NE¼NW¼ sec. 12, T. 6 N., R. 5 E.

Ap—0 to 8 inches, dark-brown (10YR 4/3) loam; weak, fine, subangular blocky structure; friable; many roots; neutral; abrupt, smooth boundary.

B21t—8 to 19 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; many roots; thin very patchy brown (7.5YR 4/4) clay films on ped faces; slightly acid; clear, wavy boundary.

B22t—19 to 24 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; firm; few roots; thin very patchy brown (7.5YR 4/4) clay films on ped faces; medium acid; clear, wavy boundary.

B23t—24 to 30 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; few roots; thin, continuous, brown (7.5YR 4/4) clay films on ped faces; medium acid; clear, wavy boundary.

IIB3—30 to 34 inches, brown (7.5YR 4/4) gravelly clay loam; weak, fine, subangular blocky structure; firm; neutral; clear, irregular boundary.

IIC1—34 to 50 inches, dark yellowish-brown (10YR 4/4) fine sandy loam and thin strata of sand and fine gravel; weak, coarse, subangular blocky structure; friable; moderately alkaline, calcareous; abrupt, irregular boundary.

IIIC2—50 to 54 inches, brown (10YR 5/3) silt loam; few, fine and medium, faint, gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; massive; friable; moderately alkaline, calcareous; clear, wavy boundary.

IVC3—54 to 60 inches, yellowish-brown (10YR 5/4) loam till; massive; friable; 10 percent pebbles; moderately alkaline, calcareous.

The solum is 24 to 40 inches thick. Depth to calcareous glacial till is 40 to 66 inches. Reaction of the solum is medium acid to neutral in the upper part and is neutral to mildly alkaline in the lower part.

The Ap horizon is dark brown or brown (10YR 4/3) or dark grayish brown (10YR 4/2). In some places there is a 2- to 4-inch A2 horizon that is dark brown (10YR 4/3) or brown (10YR 5/3).

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam or sandy clay loam, and in places there are thin strata of sandy loam or loam. The IIB3 horizon is generally 3 to 6 inches thick; some profiles do not have a IIB3 horizon. This horizon is similar in color to the B2t horizon, but its color includes hue of 5YR. It is clay loam or gravelly clay loam.

The C1 horizon and C2 horizon are 16 to 26 inches thick combined. They are yellowish-brown (10YR 5/4), dark yellowish-brown (10YR 4/4), or brown (10YR 5/3) stratified silt loam, loam, fine sandy loam, sandy loam, or fine sand. The calcareous glacial till is yellowish-brown (10YR 5/4) or brown (10YR 5/3) silt loam or loam. Some areas show evidence of water sorting. The till is weakly calcareous to strongly calcareous and is 5 to 15 percent coarse fragments.

The A horizon and B horizon of these Martinsville soils are slightly thinner than is defined as the range for the series, but this difference does not alter the use or behavior of the soils.

Martinsville soils are near Celina and Miamian soils, and they are mapped with Ockley till substratum soils. Martinsville soils contain less clay and more sand in the subsoil and are deeper to calcareous till than Celina and Miamian soils. They contain less sand and gravel in the lower part of the B horizon and in the C horizon than Ockley soils.

MaB—Martinsville and Ockley loams, till substratum, 2 to 6 percent slopes. This mapping unit is on low knolls and ridges on the till plain and moraines. In some places it is entirely Martinsville soils, or it is entirely Ockley soils, or it is both soils in various proportions and patterns. Most areas cover 2 to 10 acres. Slopes are about 60 to 80 feet long.

These soils have a profile similar to the one described as representative of their series, but Ockley soils have more sand in their surface layer and the underlying material is calcareous loam till. About 40 percent of the acreage is moderately eroded, and the plow layer is a mixture of the original surface layer and some of the subsoil. The surface layer is silt loam in small areas. Some areas have cobbles scattered on the surface. A few areas are in the boulder belt, which is shown on the general soil map.

Included in mapping are small areas of moderately eroded Celina and Miamian soils and small areas of gravelly Eldean soils. Also included are small, narrow areas of soils at the head of drainageways that have slopes of more than 6 percent.

This mapping unit is used for and is suited to most crops grown in the county. Surface runoff is moderate, and the hazard of erosion is moderate if the unit is used for cultivated crops. Slope is a limitation for a few nonfarm uses. Capability unit IIe–1.

Medway Series

The Medway series consists of moderately well drained, level to nearly level soils. These soils formed in medium-textured alluvial deposits. They are on bottom lands in stream valleys throughout the county. The native vegetation was scattered, mixed hardwoods and prairie grasses.

In a representative profile the surface layer is very dark grayish-brown silt loam in the upper 14 inches and is very dark gray light silty clay loam in the lower 6 inches. The subsoil is brown loam mottled with grayish brown and is 11 inches thick. The underlying material is grayish-brown light clay loam and light-olive brown loam mottled with gray and olive to a depth of 60 inches.

Medway soils have a deep root zone. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is mildly alkaline. Permeability is moderate.

These soils are used mainly for pasture and meadow. A limited acreage is used for row crops, and a few areas are used for woods and wildlife habitat. These soils are subject to occasional flooding that restricts their use at times. The water table is often high in winter and early in spring. The soils are suited to intensive cropping if they are protected from floods.

Representative profile of Medway silt loam, in a pasture field in Union Township, NE¼SE¼ sec. 23, T. 6 N., R. 5 E.

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, granular structure; friable; many roots; mildly alkaline, weakly calcareous; clear, smooth boundary.

A1—9 to 14 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, subangular blocky structure; friable; common roots; mildly alkaline, weakly calcareous; clear, smooth boundary.

A3—14 to 20 inches, very dark gray (10YR 3/1) light silty clay loam; few, medium, distinct, dark grayish-brown (2.5Y 4/2) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; mildly alkaline, weakly calcareous; clear, wavy boundary.

B2—20 to 31 inches, brown (10YR 4/3) loam; many, medium, distinct, grayish-brown (2.5Y 5/2) mottles; moderate, medium, subangular blocky structure; slightly firm to friable; few roots; some very dark grayish-brown (10YR 3/2) organic coatings on vertical ped faces; mildly alkaline, weakly calcareous; clear, wavy boundary.

C1—31 to 40 inches, grayish-brown (2.5Y 5/2) light clay loam; many, medium, faint, olive-brown (2.5Y 4/4) mottles; massive; friable; moderately alkaline, calcereous; clear, wavy boundary.

C2—40 to 60 inches, light olive-brown (2.5Y 5/4) loam; common, medium, distinct, light-gray (2.5Y 7/2) mottles and few, medium, faint, olive-yellow (2.5Y 6/6) mottles; massive; friable; 3 to 5 percent pebbles, 1/16 to 1/4 inch in diameter; moderately alkaline, calcareous.

The solum is 28 to 36 inches thick. The solum is mildly alkaline or moderately alkaline and in places is calcareous.

The A horizon is 16 to 24 inches thick. It is very dark gray (10YR 3/1) to dark brown (10YR 3/3).

The B horizon is 4 to 20 inches thick. It has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is mainly silt loam or loam, but in some places there are thin strata of clay loam or sandy clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 6. It is loam, silt loam, sandy loam, light silty clay loam, and light clay loam. In some areas, stratified sand and gravel are common at a depth of 40 inches or more.

Medway soils are near Eel, Shoals, Ross, Algiers, and Shoals variant soils. Medway soils are moderately well drained members of a drainage sequence which includes the well-drained Ross soils. They have a darker colored A horizon than Eel, Shoals, and Algiers soils. They have a mottled B horizon, which is lacking in Ross soils. They lack the dark-colored, buried soil that is characteristic of Algiers soils. Medway soils lack the moderately deep limestone bedrock of Shoals variant soils.

Md—Medway silt loam. This level to nearly level soil is on narrow flood plains along streams that are scattered throughout the county. Most areas cover 5 to 25 acres.

Included with this soil in mapping are areas of soils in a slightly higher position near drainage channels that have a loam surface layer and a few spots where the surface layer is sandy loam. Also included are spots of Shoals, Eel, and Ross soils.

This soil is subject to flooding. Most flooding occurs in winter and spring, and row crops can normally be planted and harvested during the nonflooding period. The soil has good tilth. In some areas it is highly dissected by braided flood channels that restrict its use at times. The hazard of flooding is the main limitation for both farm and nonfarm uses. Capability unit IIw–4.

Miamian Series

The Miamian series consists of well-drained, level to very steep soils. These soils formed in medium-textured glacial till. In some areas, the till is mantled with as much as 12 inches of loess. The soils are on uplands, are extensive, and are in every township in the county. The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile (fig. 7) the surface layer is dark grayish-brown silt loam 10 inches thick. The

Figure 7.—**Profile of Miamian silt loam. The lighter colored underlying material is calcareous loam till.**

subsoil is firm, dark yellowish-brown clay loam in the upper 16 inches and is brown heavy loam in the lower 12 inches. Calcareous, yellowish-brown loam till is between depths of 38 and 80 inches.

Miamian soils have a moderately deep root zone. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. In uneroded areas, the surface layer is medium in organic-matter content and is medium acid if it has not been limed. Permeability is moderately slow.

Miamian soils are used mainly for field crops. In some areas they are used for truck and nursery crops. The soils dry and warm earlier in spring than nearby Crosby, Celina, and Brookston soils. Urban development is currently taking place in some areas of Miamian soils.

Representative profile of Miamian silt loam, 2 to 6 percent slopes, in Union Township, SE¼NE¼ sec. 23, T. 6 N., R. 5 E.

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, subangular blocky structure parting to weak, very fine, subangular blocky; friable; many roots; slightly acid; abrupt, smooth boundary.

B21t—10 to 16 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, angular blocky structure parting to weak, very fine, subangular blocky; firm; common roots; thin, very patchy, dark-brown (7.5YR 4/4) clay films on vertical ped faces; medium acid; gradual, wavy boundary.

B22t—16 to 26 inches, dark yellowish-brown (10YR 4/4) heavy clay loam; weak, medium, prismatic structure parting to moderate, medium, angular blocky; firm; common roots; thin, patchy, dark-brown (7.5YR 4/4) clay films on ped faces; medium acid; clear, wavy boundary.

B3t—26 to 38 inches, brown (10YR 5/3) heavy loam; weak, coarse, subangular blocky structure; firm; few fine roots; dark yellowish-brown (10YR 3/4) clay films on some ped faces; mildly alkaline, calcareous; gradual, wavy boundary.

C1—38 to 50 inches, yellowish-brown (10YR 5/4) loam; massive; firm; moderately alkaline, calcareous; gradual, wavy boundary.

C2—50 to 80 inches, yellowish-brown (10YR 5/4) loam; gray (10YR 6/1) lime streaks; massive; firm; moderately alkaline, calcareous.

The solum is 20 to 40 inches thick. Depth to calcareous material is mainly 18 to 38 inches, but in severely eroded areas it is as shallow as 10 inches. The loess capping is 0 to 12 inches thick. The solum is mainly medium acid to slightly acid, but the B3t horizon is mildly alkaline and is mainly weakly calcareous.

The Ap horizon is dark grayish brown (10YR 4/2), dark brown to brown (10YR 4/3), or brown (10YR 5/3). In undisturbed areas there is a 3- to 4-inch A1 horizon that is very dark gray (10YR 3/1) or black (10YR 2/1) and a 4- to 8-inch A2 horizon that is brown (10YR 5/3) or yellowish brown (10YR 5/4). The A horizon is mainly silt loam, but in severely eroded areas it is clay loam.

In some areas there is a 1- to 5-inch B1 horizon that is yellowish-brown (10YR 5/4) silty clay loam or heavy silt loam. The B2t horizon is dark yellowish-brown (10YR 4/4), yellowish-brown (10YR 5/4), or brown (7.5YR 4/4 or 7.5YR 5/4) silty clay loam, clay loam, silty clay, or clay. Structure is mainly moderate or strong, medium or coarse, subangular blocky or angular blocky, but in some places it is weak, prismatic. The B3t horizon is heavy loam to clay loam.

The C horizon is brown (10YR 5/3) or yellowish-brown (10YR 5/4) loam or silt loam. It commonly is 5 to 15 percent coarse fragments.

Miamian soils are the well-drained member of a drainage sequence that includes the very poorly drained Brookston soils, the somewhat poorly drained Crosby soils, and the moderately well drained Celina soils. Miamian soils are near these soils and also are near Milton, Eldean, Corwin, Hennepin, Glynwood, Martinsville, and Ritchey soils. Miamian soils are less mottled and are generally at a higher elevation than Crosby and Celina soils. They are deeper to limestone bedrock than Milton and Ritchey soils. They are underlain by glacial till, and Eldean soils are underlain by sand and gravel. They have a lighter colored A horizon than Corwin soils. They are deeper to calcareous till than Hennepin soils. Miamian soils are similar to Glynwood soils but have less clay in the B horizon and C horizon. They have less sand in the B horizon than Martinsville soils.

MhA—Miamian silt loam, 0 to 2 percent slopes. This level to nearly level soil is in broad areas on uplands. Most areas cover about 5 to 35 acres. In many places gravel and sand are beneath the calcareous glacial till at a depth of 8 to 10 feet or more. A few areas are underlain by limestone bedrock at a depth of 7 to 10 feet, but bedrock in most areas is at a greater depth. The relief is rather uniform, but there are some slightly depressed areas. These areas generally have a thicker surface layer than that of Miamian silt loam, 2 to 6 percent slopes.

Included with this soil in mapping are small areas of gently sloping Miamian and Celina soils and small areas of a Miamian soil that has a limestone substratum.

This soil is suited to all crops commonly grown in the county and is the most productive of the Miamian soils. Surface runoff is slow, and little or no erosion has occurred. The soil has only slight limitations for farm uses. The moderately slow permeability is a limitation for some nonfarm uses. Capability unit I–1.

MhB—Miamian silt loam, 2 to 6 percent slopes. This gently sloping soil is on low knolls and ridges on uplands. Most areas cover about 5 to 25 acres. Slopes are generally 60 to 100 feet long. The soil has the profile described as representative of the series. Nearly all of the original surface layer remains, and there is little or no evidence of erosion. In a few spots, however, the surface layer is loam and some scattered pebbles are on the surface. The depth to limestone bedrock is commonly more than 7 feet.

Included with this soil in mapping are small areas of Celina soils and spots of moderately eroded Miamian soils.

This soil is used for crops, pasture, and woodland. It is easy to till the soil and prepare a seedbed. Surface runoff is medium, and the hazard of erosion is moderate. Moderately slow permeability and slope are limitations for some nonfarm uses. Capability unit IIe–1.

MhB2—Miamian silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on low knolls and ridges on uplands and on side slopes at the head of drainageways. Most areas cover about 3 to 20 acres. Slopes are generally 60 to 100 feet long. The plow layer is a mixture of the original surface layer and some of the subsoil. There are a few spots where the plow layer is severely eroded and is mainly material from the upper part of the subsoil. The depth to limestone bedrock is commonly more than 7 feet.

Included with this soil in mapping are small areas of Celina soils, Crosby soils, and uneroded Miamian soils. Also included are small areas of soils that have slopes of more than 6 percent.

This soil is suited to most crops commonly grown in the county, but it is highly susceptible to erosion. The present plow layer is lower in content of organic matter than that of uneroded Miamian soils, and it has a lower capacity to absorb moisture. Tilth is poorer, and establishing plants is more difficult. Surface runoff and crusting after rain is greater on this soil than on uneroded Miamian soils. The gentle slopes and the moderately slow permeability are limitations for some nonfarm uses. Capability unit IIe–3.

MhC2—Miamian silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on knolls and side slopes at the head of drainageways and is scattered throughout the county. Most areas cover about 3 to 10 acres. Slopes are 40 to 100 feet long. Erosion has removed part of the original surface layer, and the plow layer is a mixture of the original surface layer and some of the subsoil. In some severely eroded spots the surface layer is mostly subsoil material. There are a few scattered short gullies, 1 to 2 feet deep, near the base of the slopes in some areas. The depth to limestone bedrock is commonly more than 7 feet.

Included with this soil in mapping are spots of uneroded Miamian soils, small areas of soils that have slopes of more than 12 percent, and small areas of Celina soils.

This soil is suited to limited cropping. It is highly susceptible to erosion. The surface layer is more sticky when wet and becomes harder when dry than that of uneroded Miamian soils. Because of past erosion the surface layer is lower in content of organic matter than that of uneroded Miamian soils, and it has a lower capacity to absorb and retain moisture. Also, tilth is poorer. Slope is a limitation for most nonfarm uses. Capability unit IIIe–1.

MhD2—Miamian silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is on side slopes that parallel drainageways, and in a few areas it is on knolls. Most areas are long and narrow and cover about 2 to 15 acres. Slopes are generally 60 to 100 feet long. The soil has a profile similar to the one described as representative of the series, but the depth to compact till is less. Erosion has removed part of the original surface layer, and the plow layer now is a mixture of the original surface layer and some of the subsoil. Scattered short gullies, 1 to 2 feet deep, are in some areas. In some severely eroded spots the surface layer is mostly subsoil material. The depth to limestone bedrock is commonly more than 7 feet.

Included with this soil in mapping are small areas of uneroded Miamian soils and small areas of soils that have slopes of more than 18 percent.

This soil is highly susceptible to erosion if used for crops. Because of past erosion the surface layer is lower in content of organic matter than that of uneroded Miamian soils, and it has a lower capacity to absorb and retain moisture. Tilth is poorer in this soil. Surface runoff is rapid. Erosion is the main limitation to farming, and the moderately steep slopes are a limitation for most nonfarm uses. Capability unit IVe–1.

MkA—Miamian silt loam, limestone substratum, 0 to 2 percent slopes. This level to nearly level soil is in broad areas on uplands. Most areas cover about 5 to 50 acres. The soil has a profile similar to the one described as representative of the series, but it is underlain by limestone bedrock at a depth of 40 to 80 inches. The relief is rather uniform, but some slightly depressed areas have a thicker surface layer and are slightly deeper to calcareous loam till. The surface layer is mainly silt loam, but it is loam in some small spots. In some areas, a few scattered stones are on the surface.

Included with this soil in mapping are small areas of Miamian, Celina, and Milton soils.

This soil is suited to all crops commonly grown in the county. It has few, if any, limitations for crops. Surface runoff is slow, and there is little or no hazard of erosion. The soil dries quickly, and crops can be seeded earlier on this soil than on nearby Celina, Crosby, and Brookston soils. This soil has slight limitations for farm uses. The moderately slow permeability and the underlying limestone bedrock are limitations for some nonfarm uses. Capability unit I–1.

MkB—Miamian silt loam, limestone substratum, 2 to 6 percent slopes. This gently sloping soil is on low knolls and ridges and on side slopes at the head of drainageways. Areas are variable in shape and cover about 5 to

40 acres. Slopes range from 60 to 200 feet in length. The soil has a profile similar to the one described as representative of the series, but it is underlain by limestone bedrock at a depth of 40 to 80 inches. The surface layer is mainly silt loam, but it is loam in spots and scattered pebbles are on the surface.

Included with this soil in mapping are small areas of Miamian, Celina, and Milton soils.

This soil is used for crops, pasture, and woodland. It dries early in the spring and has good tilth. Surface runoff is moderate. Erosion is the main limitation for farming. The moderately slow permeability and the underlying limestone bedrock are limitations for many nonfarm uses. Capability unit IIe-1.

MkB2—Miamian silt loam, limestone substratum, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on low knolls and ridges and on side slopes at the head of drainageways. Most areas cover about 5 to 20 acres. The soil has a profile similar to the one described as representative of the series, but it is underlain by limestone bedrock at a depth of 40 to 80 inches. The plow layer is a mixture of the original surface layer and some of the subsoil. In some severely eroded spots the surface layer is mostly subsoil material. Slopes are generally 60 to 80 feet long, but are as long as 200 to 300 feet in a few areas. Scattered short gullies, 1 to 2 feet deep, are at the base of the slopes in many of these areas.

Included with this soil in mapping are a few small areas of uneroded soils and spots of soils that are deeper than 80 inches to limestone bedrock.

This soil is suited to most crops grown in the county, but it is highly susceptible to erosion. The surface layer is lower in organic-matter content, has poorer tilth, and has a lower capacity to absorb and retain moisture than that of uneroded Miamian soils. Erosion is a moderate hazard for farm uses. The moderately slow permeability and the underlying bedrock are limitations for many nonfarm uses. Capability unit IIe-3.

MkC2—Miamian silt loam, limestone substratum, 6 to 12 percent slopes, moderately eroded. This sloping soil is on knolls and side slopes at the head of drainageways. Areas are variable in shape and most cover 5 to 20 acres. Slopes are generally 40 to 80 feet long. This soil has a profile similar to the one described as representative of the series, but it is underlain by limestone bedrock at a depth of 40 to 80 inches. Erosion has removed part of the original surface layer, and the plow layer is a mixture of original surface layer and some of the subsoil. In a few severely eroded spots the subsoil is exposed.

Included with this soil in mapping are small areas of uneroded soils and a few areas of soils that have slopes of more than 12 percent.

This soil is suited to limited use for crops. The surface layer is lower in content of organic matter and has poorer tilth than that of uneroded Miamian soils. The erosion hazard is severe in cultivated areas. The moderately slow permeability and the underlying limestone bedrock are limitations for many nonfarm uses. Capability unit IIIe-1.

MlC3—Miamian clay loam, 6 to 12 percent slopes, severely eroded. This sloping soil is in scattered small areas at the head of drainageways and on knolls. Areas cover about 2 to 12 acres. Slopes are about 50 to 80 feet long. Erosion has removed most of the original surface layer, and the present surface layer is mainly subsoil material. The soil has a profile that is similar to the one described as representative of the series, but the depth to calcareous loam till is less. In some areas, there are spots where the calcareous till is exposed. Short gullies, 1 foot to 2 feet deep, are common in some areas. The depth to limestone bedrock is commonly more than 7 feet.

Included with this soil in mapping are small areas of moderately eroded Miamian soils and areas where slopes are more than 12 percent.

This soil is highly susceptible to further erosion. Because the surface layer is low in content of organic matter, it has a lower capacity to absorb and retain moisture. Surface runoff is rapid. Erosion is a very severe limitation for farming. The slope and the moderately slow permeability are limitations for nonfarm uses. Capability unit IVe-1.

MlD3—Miamian clay loam, 12 to 18 percent slopes, severely eroded. This moderately steep soil is on narrow breaks at the head of drainageways. Most areas cover about 2 to 12 acres. Slopes are about 50 to 75 feet long. Erosion has removed much of the original surface layer, and the present surface layer is mostly subsoil material. The soil has a profile that is similar to the one described as representative of the series, but the depth to calcareous till is less. In some areas, spots of calcareous till are exposed. Short gullies, 1 foot to 2 feet deep, are common. The depth to limestone bedrock is commonly more than 7 feet.

Included with this soil in mapping are small areas of moderately eroded Miamian soils and small areas of soils that have slopes of more than 18 percent.

This soil is suited to pasture or woodland. It is not suited to cultivated crops because of the moderately steep slopes and the severe erosion. The surface layer is low in content of organic matter and has poor tilth. Surface runoff is rapid. Erosion is a very severe limitation for farming. The moderately steep slopes are a severe limitation for most nonfarm uses. Capability unit VIe-1.

MmE—Miamian and Hennepin silt loams, 18 to 25 percent slopes. This mapping unit is on side slopes on uplands near rivers and their tributaries. It is made up of Miamian and Hennepin soils in most areas, but in some areas it consists of only one or the other of the soils. Slopes are 100 to 160 feet long and are mainly smooth and uniform. Some areas in higher positions are slightly convex, and those on toe slopes are slightly concave. The depth to limestone bedrock is commonly more than 7 feet.

Included in mapping are small areas of soils that have slopes of more than 25 percent. In these areas, meandering streams have undercut the side slopes. Also included are small areas of Ritchey soils that are shallow to limestone bedrock, small areas of Rodman soils that are underlain by sand and gravel, and small spots of severely eroded soils that are mainly in the steeper areas.

The soils are used for pasture, woodland, or wildlife plantings. They are too steep to be cultivated. Surface runoff is rapid, and the hazard of erosion is very severe. The steep slopes are a limitation for most nonfarm uses. Capability unit VIe-1.

MmF—Miamian and Hennepin silt loams, 25 to 50 percent slopes. This mapping unit is on side slopes on uplands near rivers and their tributaries. It is made up of Miamian and Hennepin soils in most areas, but in some areas it is made up of only one or the other of the soils. Slopes are 70 to 110 feet long. Most areas are smooth and uniform in shape. Some areas in upper locations are convex, and some of the lower areas are concave. The depth to limestone bedrock is commonly more than 7 feet. The Hennepin soil has the profile described as representative of its series.

Included in mapping are small areas of Ritchey soils that are shallow to limestone bedrock, Rodman soils that are underlain with sand and gravel, small areas of moderately or severely eroded Miamian and Hennepin soils, and areas of soils that have slopes of more than 50 percent. Some areas of severely eroded soils that have slopes of about 18 percent are included and are indicated on the soil map by the appropriate conventional symbol.

The soils are used mainly for woodland and wildlife habitat. A few areas are used for pasture. The soils are too steep to be used for crops. Surface runoff is rapid. and the hazard of erosion is very severe unless permanent vegetation is maintained. The very steep slopes are a severe limitation for farm and nonfarm uses. Capability unit VIIe-1.

Millsdale Series

The Millsdale series consists of moderately deep, very poorly drained and poorly drained, level to gently sloping soils. These soils formed in a thin mantle of glacial till that is 20 to 40 inches thick over limestone bedrock. They are in depressions on uplands in the west-central and southwestern parts of the county. The native vegetation was mixed hardwoods and marsh grasses.

In a representative profile the surface layer is very dark gray silty clay loam about 14 inches thick. The subsoil is 16 inches thick. It is very dark gray and grayish-brown silty clay mottled with yellowish brown. Very pale brown and light yellowish-brown limestone bedrock is at a depth of 30 inches.

Millsdale soils have a moderately deep root zone over the limestone bedrock. The capacity to store and release plant nutrients is high. The available water capacity is moderate, but the soils often receive seepage from adjacent soils at higher elevations. The surface layer is high in organic-matter content. Permeability is moderately slow. The soils have a seasonal high water table in winter and spring.

Millsdale soils are used mainly for pasture and crops. Most cultivated areas are artificially drained. In some areas, drainage is difficult because the depth to limestone bedrock is variable and adequate drainage outlets are not available. Millsdale soils warm and dry later in spring than the nearby Randolph and Milton soils.

Representative profile of Millsdale silty clay loam, 0 to 2 percent slopes, in a cultivated field in Union Township, SE¼NE¼ sec. 16, T. 6 N., R. 5 E.

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam; weak, medium, subangular blocky structure; firm; many roots; neutral; abrupt, smooth boundary.

A1—9 to 14 inches, very dark gray (N 3/0) heavy silty clay loam; weak, fine, subangular blocky structure; firm; many roots; neutral; clear, wavy boundary.

B1g—14 to 18 inches, very dark gray (10YR 3/1) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; firm; few roots; neutral; clear, smooth boundary.

B21tg—18 to 26 inches, grayish-brown (2.5Y 5/2) silty clay; many, coarse, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm; few roots; organic fillings in old root channels; thin patchy clay films on vertical ped faces; 5 percent glacial pebbles; mildly alkaline; abrupt, smooth boundary.

IIB22tg—26 to 30 inches, grayish-brown (10YR 5/2) silty clay; many, coarse, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; 10 percent igneous and limestone fragments; medium patchy clay films on vertical ped faces; mildly alkaline; abrupt, smooth boundary.

IIR—30 inches, very pale brown (10YR 7/4) and light yellowish-brown (10YR 6/4) limestone bedrock.

The solum is 20 to 40 inches thick. The depth to bedrock ranges from 20 to 40 inches and varies within short distances. Reaction ranges from slightly acid to neutral in the A horizon and the upper part of the B horizon and from neutral to mildly alkaline, and in places weakly calcareous, in the lower part of the B horizon.

The Ap horizon is silt loam or silty clay loam. It is very dark gray (10YR 3/1), black (10YR 2/1), or very dark brown (10YR 2/2).

The B horizon has hue of 10YR or 5Y or is neutral; has value of 3 to 5; and has chroma of 4 or less. It is clay loam, silty clay loam, silty clay, or clay. Its structure is mainly weak or moderate, subangular or angular blocky, but in some places it is weak, prismatic. There is no IIB2t horizon in some places. Calcareous loam till 3 to 6 inches thick is above bedrock in some places. The lower part of the B horizon and the C horizon are 10 to 15 percent limestone fragments.

In some places the limestone bedrock is very dense and hard, but in other places it is thinly bedded and fractured and has soil material mixed in the upper part.

Millsdale soils are the poorly drained and very poorly drained member of a drainage sequence that includes the somewhat poorly drained Randolph soils and the well-drained Milton soils. Millsdale soils are near these soils and near Odell and Ritchey soils. In a few areas the Millsdale soils are near Brookston and Pewamo soils. Millsdale soils are underlain by limestone bedrock, and Odell, Brookston, and Pewamo soils are underlain by glacial till. They are deeper to limestone bedrock and more poorly drained than Ritchey soils.

MnA—Millsdale silt loam, 0 to 2 percent slopes. This level to nearly level soil is at a slightly higher elevation than Millsdale silty clay loams in depressions. It is at a slightly lower elevation than the surrounding Milton soils. In some areas, the soil is at the base of more sloping Milton and Ritchey soils and at a slightly higher elevation than the nearby Odell soils. Most areas cover 10 to 40 acres. This soil has a profile that is similar to the one described as representative of the series, but the surface layer contains less clay and the subsoil is browner.

Included with this soil in mapping are small areas of Millsdale silty clay loam in narrow drainageways and small areas of Odell soils. Also included are spots of soils at the head of drainageways that have slopes of more than 2 percent.

This soil is used mainly for crops where it is artificially drained. It dries more quickly than the nearby Millsdale silty clay loam soil, and crops can be seeded earlier. Surface runoff is slow because the relief is nearly level. The high water table and the underlying limestone bedrock are severe limitations for most nonfarm uses. Capability unit IIIw-2.

MnB—Millsdale silt loam, 2 to 6 percent slopes. This gently sloping soil is on scattered small ridges at the head of drainageways and at the base of more sloping Milton and Ritchey soils. Most areas are long and cover about 5 to 15 acres. Slopes are 50 to 100 feet long. The soil has a profile similar to the one described as representative of the series, but the surface layer contains less clay and the subsoil is browner.

Included with this soil in mapping are small areas of Millsdale silty clay loam in drainageways and near the base of adjacent slopes. Also included are small areas of Odell soils.

This soil is used mainly for crops and pasture. It dries sooner than the nearby Millsdale silty clay loam soils, and crops can be seeded earlier. Because relief and the depth to limestone bedrock are more variable, drainage tile is more difficult to install in this soil than in Millsdale soils that are level. A more complex drainage system is required. The hazard of erosion is moderate because of the gentle slopes. The seasonal wetness and the underlying limestone bedrock are severe limitations for most nonfarm uses. Capability unit IIIw-2.

MoA—Millsdale silty clay loam, 0 to 2 percent slopes. This level to nearly level soil is in rather large, irregularly shaped depressions on uplands. Most areas cover about 4 to 50 acres. This soil has the profile described as representative of the series. There is little or no evidence of erosion.

Included with this soil in mapping are small areas of Randolph soils and a few areas where the depth to limestone bedrock is more than 40 inches. Also included are small areas, mainly near drainageways, where the surface layer is silt loam.

This soil is suited to crops where it is artificially drained. Undrained areas are generally too wet for cultivated crops. Runoff is slow, and water tends to pond on the surface. The soil dries more slowly in spring than the nearby Millsdale silt loams. The surface layer becomes cloddy if worked when wet. The seasonal wetness and the underlying limestone bedrock are limitations for farm uses and for most nonfarm uses. Capability unit IIIw-1.

MoB—Millsdale silty clay loam, 2 to 6 percent slopes. This gently sloping soil is on foot slopes and in the more sloping drainageways on uplands. Most areas cover about 4 to 10 acres. Slopes are 80 to 120 feet long. There is little or no evidence of erosion.

Included with this soil in mapping are small areas where the surface layer is silt loam and a few places where the depth to limestone bedrock is more than 40 inches. Also included are spots of soils where the depth to limestone bedrock is less than 20 inches. These spots are at the upper edge of foot slopes.

This soil dries more slowly in spring than nearby Millsdale silt loams. An artificial drainage system is difficult to install because of the gentle slopes, the seepage from nearby soil areas, and the variable depth to limestone bedrock. A more complex drainage system is required on this soil than on nearby level Millsdale soils. The seasonal wetness and the underlying limestone bedrock are limitations for farm uses and for most nonfarm uses. Capability unit IIIw-1.

Milton Series

The Milton series consists of well-drained, level to moderately steep soils. These soils are moderately deep to limestone bedrock (fig. 8). They formed in medium-textured glacial till and in material weathered from limestone bedrock. The depth to limestone bedrock ranges from 20 to 40 inches. The soils are on uplands adjacent to bottom lands and outwash terraces. Most areas are along the Miami and Stillwater Rivers, in the western and southern parts of the county. The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is dark yellowish-brown silty clay loam, clay loam, and

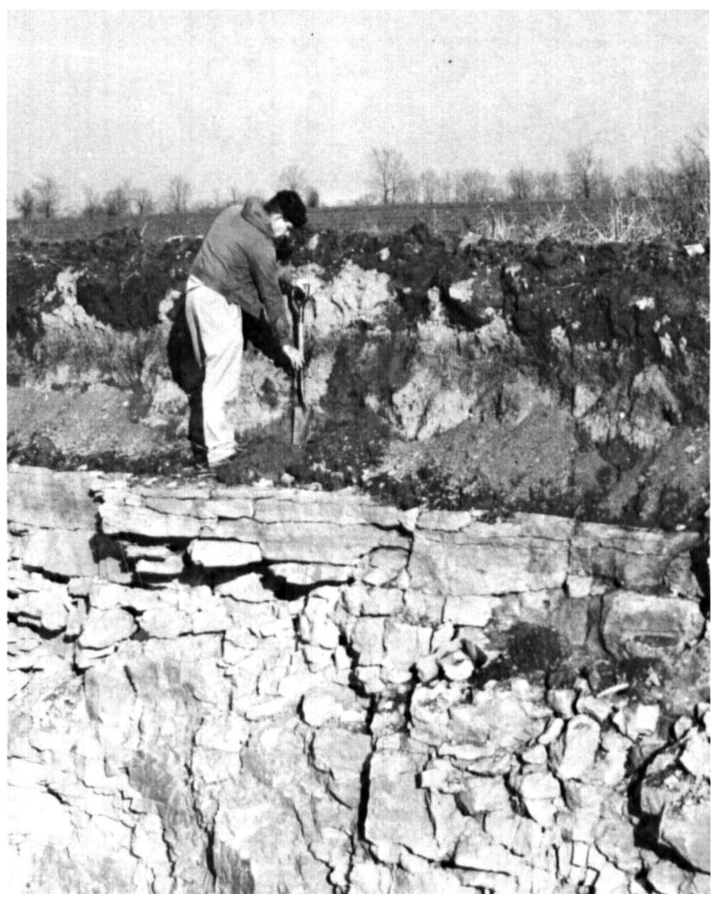

Figure 8.—**Milton soils are underlain by limestone bedrock.**

clay. It is 21 inches thick and contains some limestone fragments in the lower 10 inches. Limestone bedrock is at a depth of 29 inches.

Milton soils have a moderately deep root zone over limestone bedrock. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. The surface layer is medium in organic-matter content and is medium acid if it has not been limed. Permeability is moderately slow because the subsoil is clayey. The underlying limestone bedrock is fractured and water moves rapidly through it. The water table is deep.

Milton soils are used mainly for field crops. In some areas they are used for truck and nursery crops. Some areas, especially the sloping areas, are used for pasture or are left wooded. In the vicinity of Tipp City and West Milton, these soils are being used for housing developments. The soils dry and warm earlier in spring than most of the other well-drained soils on uplands.

Representative profile of Milton silt loam, 0 to 2 percent slopes, in a cultivated field in Union Township, southeast corner of SE¼NE¼ sec. 21, T. 6 N., R. 5 E.

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

B1t—8 to 12 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; thin patchy clay films on ped faces; medium acid; clear, smooth boundary.

B21t—12 to 19 inches, dark yellowish-brown (10YR 4/4) clay loam; strong, medium, subangular blocky structure; very firm; dark-brown (7.5YR 4/4) coatings; thin continuous clay films on ped faces; medium acid; gradual, smooth boundary.

B22t—19 to 25 inches, dark yellowish-brown (10YR 4/4) clay; strong, coarse, subangular and angular blocky structure; very firm; dark-brown (7.5YR 3/2) coatings; medium continuous clay films on ped faces; few small fragments of limestone; slightly acid; clear, wavy boundary.

IIB23t—25 to 29 inches, dark yellowish-brown (10YR 4/4) clay; strong, coarse, subangular blocky structure; very firm; dark brown (7.5YR 3/2) coatings; thick clay flows on ped faces; few fragments of weathered limestone; neutral; abrupt, wavy boundary.

IIR—29 inches, limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches, but in some places the depth to bedrock is greater than the thickness of the solum. The depth to bedrock varies within short distances. In some places there is a loess capping that is as thick as 12 inches. The solum below the loess capping is as much as 15 percent coarse fragments. The solum is very strongly acid to neutral in the upper part and neutral to mildly alkaline in the lower part.

The Ap horizon is brown (10YR 4/3) or dark grayish brown (10YR 4/2). In undisturbed areas there is a 2- to 4-inch A1 horizon that is very dark gray (10YR 3/1) or very dark brown (10YR 2/2) and a 4- to 6-inch A2 horizon that is brown (10YR 5/3) or pale brown (10YR 6/3).

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, silty clay loam, or clay. In some places there is a 2- to 6-inch horizon just above the bedrock that is darker in color and higher in clay content than the B horizon above it. In some places there is 2 to 5 inches of calcareous loam till above the bedrock.

In some places the limestone bedrock is very dense and hard, and in other places it is thinly bedded and fractured. It has intermixed soil material in the upper part in many places.

Milton soils are well-drained members of a drainage sequence that includes the somewhat poorly drained Randolph soils and the poorly drained and very poorly drained Millsdale soils. Milton soils are near these soils and are also near Ritchey and Miamian soils. Milton soils are deeper to limestone bedrock than Ritchey soils. They are shallower to limestone bedrock than Miamian soils.

MpA—Milton silt loam, 0 to 2 percent slopes. This level to nearly level soil is in irregularly shaped areas on broad ridgetops on uplands. Most areas cover about 5 to 50 acres. This soil has the profile described as representative of the series. The relief is generally uniform, but some areas are slightly concave. Nearly all of the original surface layer remains, and there is little or no evidence of erosion.

Included with this soil in mapping are small areas of Miamian limestone substratum and Randolph soils. Also included are a few areas of gently sloping Milton and Ritchey soils at the head of the drainageways.

This soil is suited to all crops commonly grown in the county. It dries and warms earlier in spring than nearby Miamian and Celina soils. Surface runoff is slow. This soil has a moderately deep root zone and is somewhat droughty during summer. The moderately slow permeability and the underlying limestone bedrock are limitations for many nonfarm uses. Capability unit IIs-1.

MpB—Milton silt loam, 2 to 6 percent slopes. This gently sloping soil is on low knolls and ridges at the head of drainageways. Most areas cover 5 to 40 acres. Slopes are generally 60 to 100 feet long. Nearly all of the original surface layer remains, and there is little evidence of erosion. The surface layer is mainly silt loam, but it is loam in a few spots. A few limestone flagstones are scattered on the surface in some areas.

Included with this soil in mapping are small areas of Miamian limestone substratum and Randolph soils.

This soil is used mainly for pasture and woodland. It is suited to most crops commonly grown in the county. It is moderately susceptible to erosion. The moderately slow permeability and the moderate depth to bedrock are limitations for many nonfarm uses. Capability unit IIe-1.

MpB2—Milton silt loam, 2 to 6 percent slopes, moderately eroded. This gently sloping soil is on low knolls and ridges and at the head of drainageways. Areas are variable in shape and size and cover about 5 to 16 acres. Slopes are 50 to 150 feet long. The plow layer is a mixture of the original surface soil and some of the subsoil. On the longer slopes, there are some scattered, short gullies, 1 foot to 2 feet deep. In a few areas some limestone flagstones are scattered on the surface.

Included with this soil in mapping are small areas of Ritchey, uneroded Milton, and Randolph soils. Also included are spots of soils that have slopes of more than 6 percent.

This soil is suited to most crops commonly grown in the county, but it is highly susceptible to erosion. The surface layer is lower in content of organic matter than that of uneroded Milton soils, and it has a lower capacity to absorb and retain moisture. Surface runoff is medium to high. Establishing plants, especially grasses, is more difficult on this soil than on uneroded Milton soils. The moderate depth to limestone and the moderately slow permeability are severe limitations for many nonfarm uses. Capability unit IIe-3.

MpC2—Milton silt loam, 6 to 12 percent slopes, moderately eroded. This sloping soil is on long, narrow side slopes at the head of drainageways and on hills or knolls on uplands. Most areas cover about 4 to 10 acres. Slopes are 50 to 100 feet long. The plow layer is a mixture of the original surface layer and some of the subsoil. In some areas a few, scattered, short gullies, 1 foot to 2 feet deep, are near the base of the slopes.

Included with this soil in mapping are small areas of uneroded Milton soils and moderately eroded Miamian limestone substratum soils. Also included are a few areas of this soil that are severely eroded. The surface layer is mainly subsoil material. These severely eroded areas are indicated on the soil map by a spot symbol. In some areas, a few scattered limestone flagstones are on the surface.

This soil is suited to crops, but it is highly susceptible to erosion. The surface layer is lower in content of organic matter, is more sticky when wet, and becomes harder when dry than the surface layer of uneroded Milton soils. The severe hazard of erosion is a limitation for farming. Slope and the moderately slow permeability are limitations for most nonfarm uses. Capability unit IIIe-1.

MpD2—Milton silt loam, 12 to 18 percent slopes, moderately eroded. This moderately steep soil is in narrow bands along the sides of valleys. Most areas cover 5 to 15 acres. Slopes are about 50 to 75 feet long. In cultivated areas the plow layer is a mixture of the original surface layer and some of the subsoil. On the longer slopes are some small, scattered gullies. A few, scattered limestone flagstones are on the surface in some areas.

Included with this soil in mapping are small areas of Ritchey soils, a few areas of uneroded Milton soils, and areas of soils that have slopes of more than 18 percent.

Most areas of this soil are in pasture or woodland, and a few areas are used for cultivated crops. The soil is suited to very limited use for cultivated crops. It is highly susceptible to erosion. The surface layer is lower in organic-matter content than that of uneroded Milton soils, and it has a lower capacity to absorb and retain moisture. Surface runoff is rapid. The moderately steep slopes are severe limitations for most nonfarm uses. Capability unit IVe-1.

Montgomery Series

The Montgomery series consists of very poorly drained, level to nearly level soils. These soils formed in water-laid silty clay, clay, and silty clay loam materials. They are mainly in large depressions in the Honey, Indian, and Leatherwood Creek valleys. Scattered small areas are in depressions on uplands throughout the county. The native vegetation was marsh grasses, sedges, and widely spaced hardwoods. Most areas have been cleared and used for crops.

In a representative profile, the surface layer is silty clay loam about 16 inches thick. It is very dark gray in the upper 11 inches and black in the lower 5 inches. The subsoil is mottled, dark-gray silty clay and silty clay loam 17 inches thick. The underlying material is mottled, gray silty clay loam to a depth of 68 inches.

Montgomery soils have a deep root zone if they are drained. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is neutral or mildly alkaline. Permeability is slow. The soils have a seasonal high water table for long periods in winter and spring if they are not artificially drained.

Montgomery soils are used mainly for crops. A few areas are in pasture or woodland. These soils dry and warm late in spring. Most cultivated areas are artificially drained.

Representative profile of Montgomery silty clay loam, in a cultivated field in Bethel Township, SW¼SE¼ sec. 24, T. 2 E., R. 9 N.

Ap—0 to 11 inches, very dark gray (10YR 3/1) silty clay loam; weak, medium, subangular blocky structure; slightly firm; few roots; neutral; clear, smooth boundary.

A1—11 to 16 inches, black (10YR 2/1) silty clay loam; weak, fine, angular blocky structure; firm; few roots; neutral; clear, smooth boundary.

B21g—16 to 27 inches, dark-gray (5Y 4/1) silty clay; few, fine, distinct, yellowish-brown (10YR 5/4) mottles and few, fine, faint, olive-gray (5Y 4/2) mottles; moderate, fine, angular blocky structure; firm; few roots; mildly alkaline; clear, wavy boundary.

B22g—27 to 33 inches, dark-gray (5Y 4/1) heavy silty clay loam; common, medium, distinct, olive-brown (2.5Y 4/4) mottles; weak, fine and medium, prismatic structure parting to moderate, medium, angular blocky; slightly firm; mildly alkaline; clear, wavy boundary.

Cg—33 to 68 inches, gray (5Y 5/1) silty clay loam; many, medium, distinct, olive-brown (2.5Y 4/4) mottles; massive; firm; mildly alkaline.

The solum is 30 to 42 inches thick. It is neutral or mildly alkaline in the upper part and mildly alkaline or moderately alkaline in the lower part. In places it is weakly calcareous in the lower part.

The Ap horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or very dark brown (10YR 2/2).

The B2g horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 2 or less. In some places there is a 6- to 10-inch B3 horizon that is the same color as the B2g horizon. The Bg horizon is mainly silty clay or silty clay loam, but in places there are 2- to 4-inch lenses of loam or light clay loam.

The C horizon is gray (10YR 5/1) or (5Y 5/1) or olive gray (5Y 5/2). It is mainly stratified silty clay loam, silty clay, and loam, but in some places there are 4- to 8-inch layers of fine sandy loam and silt loam.

Montgomery soils are near Linwood, Edwards, Algiers, and Westland soils. In a few areas they are also near Brookston and Pewamo soils. Montgomery soils lack the organic surface layers of Linwood and Edwards soils. They have a darker colored A horizon and are finer textured than Algiers soils. They are finer textured and contain more clay and less sand than Westland soils. Montgomery soils are underlain by lake-bed sediments, and Brookston and Pewamo soils are underlain by glacial till.

Mt—Montgomery silty clay loam. This is a level to nearly level soil in large areas on terraces and small areas in depressions on uplands. On uplands, the soil is underlain by loam glacial till at a depth of 5 feet or more. Most areas are variable in shape and cover 2 to 80 acres.

Included with this soil in mapping are spots of Algiers, Linwood, and Brookston soils, small areas of Westland soils near the large streams, small areas of soils at the base of sloping uplands that have a surface layer of silt loam, and some soils that have less clay in their subsoil than is defined as the range for the Montgomery series.

This soil is suited to crops. Surface runoff is slow, and there is little hazard of erosion. If it is artificially drained, the soil is suited to most crops commonly grown in the county. The surface layer is likely to become cloddy if tilled when too wet. Seasonal wetness is the main limitation. Water often ponds on this soil in wet periods. The soil is subject to occasional flooding in areas near the large streams. The high water table is a severe limitation for most nonfarm uses. Capability unit IIIw-3.

Ockley Series

The Ockley series consists of well-drained, nearly level to gently sloping soils. These soils formed in silty or loamy glacial outwash. They are underlain by stratified, calcareous sand and gravel at a depth of 40 to 60 inches. They are on outwash terraces bordering rivers and major streams in the county and are above normal flood levels. The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is brown and dark-brown silt loam 12 inches thick. The subsoil is brown to dark-brown silty clay loam and clay loam in the upper 11 inches, reddish-brown clay loam and dark reddish-brown clay in the next 14 inches, and dark reddish-brown gravelly loam in the lower 10 inches. Yellowish-brown, calcareous, stratified sand and gravel is between depths of 47 and 60 inches.

Ockley soils have a deep root zone. The capacity to store and release plant nutrients is moderate to high, and the available water capacity is high. The surface layer is medium in organic-matter content and is slightly acid or neutral. Permeability is moderate in the upper part of the soil and rapid in the coarse underlying material.

Ockley soils are used mainly for field crops. In a few areas they are used for nursery plants. The soils have few limitations that restrict their use, and they are suited to most crops commonly grown in the county.

Representative profile of Ockley silt loam, 0 to 2 percent slopes, in a cultivated field in Lost Creek Township, SW¼SE¼ sec. 34, T. 2 E., R. 11 N.

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable; few roots; slightly acid; abrupt, smooth boundary.

A&B—9 to 12 inches, 60 percent brown (10YR 4/3) and 40 percent dark-brown (7.5YR 4/4) silt loam; weak, medium, angular blocky structure; friable; few roots; slightly acid; clear, wavy boundary.

B21t—12 to 17 inches, brown (7.5YR 4/4) silty clay loam; weak, medium, prismatic structure parting to moderate, medium, angular blocky; firm; few roots; thin very patchy clay films on ped faces; slightly acid; clear, wavy boundary.

IIB22t—17 to 23 inches, dark-brown (7.5YR 4/4) clay loam; weak, medium, prismatic structure parting to moderate, fine and medium, angular blocky; firm; thin patchy clay films on ped faces; few roots; 5 percent gravel, ⅛ to 1 inch in diameter; slightly acid; clear, wavy boundary.

IIB23t—23 to 30 inches, reddish-brown (5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; thin, very patchy, dark reddish-brown (5YR 3/4) clay films on ped faces; few dark-brown (7.5YR 4/4) rust stains on sand grains; 5 percent gravel, ⅛ to 1 inch in diameter; neutral; clear, irregular boundary.

IIB24t—30 to 37 inches, dark reddish-brown (5YR 3/3) clay; weak, coarse, subangular blocky structure; firm; medium patchy clay films on ped faces; 10 percent gravel, ⅛ to 1 inch in diameter; few pale-brown (10YR 6/3) weathered limestone fragments; mildly alkaline; abrupt, irregular boundary.

IIB3t—37 to 47 inches, dark reddish-brown (5YR 3/3) gravelly loam; weak, coarse, subangular blocky structure; friable; thin very patchy clay films on vertical ped faces; common pale-brown (10YR 6/3) lime streaks; 25 percent gravel, ⅛ to 2 inches in diameter; mildly alkaline, calcareous; clear, irregular boundary.

IIC—47 to 60 inches, yellowish-brown (10YR 5/4) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 40 to 60 inches thick. The depth to calcareous material ranges from 34 to 53 inches. The loess mantle is 12 to 20 inches thick. The solum is medium acid to slightly acid in the upper part and neutral to mildly alkaline in the lower part. In many places it is weakly calcareous in the lower part.

The Ap horizon is brown (10YR 4/3) or dark grayish-brown (10YR 4/2) silt loam or loam.

In some places there is a 3- to 6-inch B1 horizon that is a dark yellowish brown (10YR 4/4). The Bt horizon and IIBt horizon have hue of 10YR to 5YR and value and chroma of 3 or 4. The IIB2t horizon is mainly clay loam or sandy clay loam and is 5 to 15 percent coarse fragments. The lower part of the IIB2t horizon in many places is clay 6 to 8 inches thick. The IIB3t horizon is 4 to 12 inches thick. It is dark reddish-brown (5YR 3/3) or reddish-brown (5YR 4/3 or 4/4) gravelly clay loam, gravelly loam, or gravelly sandy clay loam. It is 15 to 35 percent coarse fragments. The C horizon is commonly stratified sand and gravel, but in some places it is calcareous loam till. It is yellowish brown (10YR 5/4) or brown (10YR 5/3).

Ockley soils are well-drained members of a drainage sequence that includes the somewhat poorly drained Sleeth soils and the very poorly drained Westland soils. Ockley soils are commonly near Eldean and Wea soils. They are mapped with Martinsville soils in some areas. Ockley soils are deeper to sand and gravel than Eldean soils. They have a lighter colored A horizon than Wea soils. They contain more sand and gravel in the lower part of the B horizon and in the C horizon than Martinsville soils.

OcA—Ockley silt loam, 0 to 2 percent slopes. This level to nearly level soil is on stream terraces. Areas are long and narrow and cover 5 to 30 acres. There is little or no evidence of erosion. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of the Wea soils that are near drainageways and in slightly lower positions and a few areas of gently sloping Ockley soils that are on short breaks along terraces and at the head of drainageways.

This soil has few, if any, limitations for farming. It is well suited to all crops commonly grown in the county. The soil has good tilth within a wide range of moisture content. Surface runoff is slow, and the hazard of erosion is slight. The soil is well suited to irrigation. It has few limitations for most nonfarm uses. Capability unit I-1.

OcB—Ockley silt loam, 2 to 6 percent slopes. This gently sloping soil is on slope breaks along stream terraces. Areas are long and narrow and cover 3 to 20 acres.

Included with this soil in mapping are small areas of level to nearly level Ockley soils, moderately eroded spots, and areas of Eldean soils that are moderately deep to sand and gravel. Also included are some areas where this Ockley soil is slightly wet and moderately well drained.

This soil is moderately subject to erosion if cultivated. It is suited to most crops commonly grown in the county. Surface runoff is medium. The soil has good tilth within a wide range of moisture content. It has few limitations for most nonfarm uses. Capability unit IIe-1.

Odell Series

The Odell series consist of somewhat poorly drained, level to gently sloping soils. These soils formed in calcareous loam till. They are in scattered areas on uplands. The native vegetation was tall prairie grasses and some scattered mixed hardwoods, but most areas have been cleared.

In a representative profile the surface layer is silt loam about 16 inches thick. It is very dark brown in the upper 10 inches and very dark gray in the lower 6 inches. The subsoil is mottled, firm clay loam 22 inches thick. It is dark brown in the upper 5 inches, light olive brown in the next 13 inches, and yellowish-brown in the lower 4 inches. Light olive-brown loam till is between depths of 38 and 60 inches.

Odell soils have a moderately deep root zone. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is acid if it has not been limed. Permeability is moderate in the upper part of the soil and moderately slow in the underlying material. The soils have a seasonal high water table in winter and spring if they are not artificially drained.

Odell soils are used mainly for crops. Most cultivated areas have been artificially drained. The soils drain well with tile. They dry and warm late in spring if they are not artificially drained.

Representative profile of Odell silt loam, 0 to 2 percent slopes, in Union Township, NW¼NW¼ sec. 5, T. 6 N., R. 5 E.

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; weak, fine, subangular blocky structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A1—10 to 16 inches, very dark gray (10YR 3/1) heavy silt loam; few, medium, distinct, dark grayish-brown (2.5Y 4/2) mottles; moderate, fine, angular blocky structure; friable; common roots; slightly acid; clear, smooth boundary.

B21t—16 to 21 inches, dark-brown (10YR 4/3) clay loam; common, coarse, faint, dark grayish-brown (2.5Y 4/2) mottles and few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky and angular blocky structure; firm; common roots; thin, very patchy, very dark grayish-brown (10YR 3/2) clay films on ped faces; 2 percent pebbles; neutral; clear, smooth boundary.

B22t—21 to 34 inches, light olive-brown (2.5Y 5/4) clay loam; few, fine, faint, grayish-brown (2.5Y 5/2) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; common roots; thin, very patchy, very dark grayish-brown (10YR 3/2) clay films on ped faces; 5 percent pebbles; neutral; clear, wavy boundary.

B3—34 to 38 inches, yellowish-brown (10YR 5/4) clay loam; many, coarse, distinct, light brownish-gray (2.5Y 6/2) mottles; very weak, fine, subangular blocky structure; firm; 5 percent pebbles; mildly alkaline; clear, wavy boundary.

C—38 to 60 inches, light olive-brown (2.5Y 5/6) loam till; common, medium, distinct, yellowish-brown (10YR 5/4) mottles and few, fine, distinct, pale-brown (10YR 6/3) mottles; massive; friable; 10 percent pebbles; moderately alkaline, calcareous.

The solum is 24 to 42 inches thick. The depth to calcareous material ranges from 20 to 40 inches. The solum is slightly acid or neutral in the upper part and neutral or mildly alkaline and, in some places, weakly calcareous in the lower part.

The A horizon is very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), or very dark brown (10YR 2/2).

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is heavy loam, clay loam, or silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. It is loam or silt loam.

Odell soils are near Brookston, Crosby, Celina, and Corwin soils. In a few areas Odell soils are near Millsdale soils. Odell soils have a more brownish and less grayish B horizon than Brookston soils. They have a darker colored A horizon than Celina and Crosby soils. They are more mottled than Corwin soils. Odell soils are underlain by glacial till and are deeper to limestone bedrock than Millsdale soils.

OdA—Odell silt loam, 0 to 2 percent slopes. This level to nearly level soil is at a slightly higher elevation than Brookston soils in depressions and at a slightly lower elevation than Crosby and Celina soils. Most areas are about 5 to 25 acres in size. There is little or no evidence of erosion. This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of Brookston and Crosby soils and a few areas of Corwin soils.

This soil is used mainly for crops. It is commonly farmed with nearby larger areas of Brookston and Crosby soils. The soil has a seasonal high water table. If it is artificially drained, the soil is suited to all crops commonly grown in the county. Seasonal wetness is the main limitation for farm uses. The seasonal high water table is a limitation for most nonfarm uses. Capability unit IIw-2.

OdB—Odell silt loam, 2 to 6 percent slopes. This gently sloping soil is mainly near the base of the more sloping soils on uplands. It is at a slightly higher elevation than Brookston soils, which are in depressions. Most areas cover about 4 to 20 acres. Slopes are mainly convex and are 80 to 150 feet long.

Included with this soil in mapping are small areas of Crosby soils, a few areas of Brookston soils, and small areas of Corwin soils.

This soil is used mainly for crops. Runoff is more rapid on this soil than on level to nearly level Odell soils. The hazard of erosion is moderate. This soil has a seasonal high water table that is a limitation for most nonfarm uses. Capability unit IIw-2.

Pewamo Series

The Pewamo series consists of very poorly drained, level to nearly level soils. These soils formed in clay loam or silty clay loam glacial till. They are in depressions or along narrow drainageways on uplands in the northwestern part of the county. The native vegetation was mixed hardwoods and marsh grasses, but most areas have been cleared and are used for crops.

In a representative profile the surface layer is very dark grayish-brown silty clay loam about 10 inches thick. The subsoil is dark-gray silty clay loam in the upper 6 inches, dark-gray silty clay in the next 14 inches, and light olive-brown silty clay loam in the lower 5 inches. The underlying material is light olive-brown and olive-brown silty clay loam till between depths of 35 and 60 inches. The subsoil and underlying material are mottled with yellowish brown to olive gray.

Pewamo soils have a deep root zone if they are artificially drained. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is slightly acid or neutral. Permeability is moderately slow. Surface runoff is slow, and water often ponds. The soils have a seasonal high water table for long periods in winter and spring if they are not artificially drained.

Pewamo soils are used mainly for crops, but a few areas are in pasture or woods. Most cultivated areas have been artificially drained, and most crops grow well in these areas. The soils dry and warm late in the spring. They are not extensive in the county.

Representative profile of Pewamo silty clay loam, in a cultivated field in Newberry Township, SW¼NE¼ sec. 1, T. 9 N., R. 4 E.

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; very weak, fine, subangular blocky structure; firm; slightly acid; abrupt, smooth boundary.

B21tg—10 to 16 inches, dark-gray (10YR 4/1) silty clay loam; few, fine, faint, yellowish-brown (10YR 5/4) mottles; weak, fine, angular blocky structure; firm; very dark gray (10YR 3/1) ped coatings; thin patchy clay films on ped faces; 2 percent pebbles; neutral; clear, smooth boundary.

B22tg—16 to 30 inches, dark-gray (10YR 4/1) silty clay; common, medium, distinct, olive (5Y 5/4) mottles; moderate, fine and medium, angular blocky structure; firm; very dark gray (5Y 3/1) coatings on peds; thin continuous clay films on ped faces; 5 percent pebbles; neutral; clear, wavy boundary.

B3—30 to 35 inches, light olive-brown (2.5Y 5/4) silty clay loam; many, medium, distinct, olive-gray (5Y 5/2) mottles; weak, medium, angular blocky structure; firm; 5 percent pebbles; mildly alkaline; clear, wavy boundary.

C1—35 to 44 inches, light olive-brown (2.5Y 5/4) silty clay loam; many, medium, distinct, olive-gray (5Y 5/2) mottles; massive; firm; 5 percent pebbles; moderately alkaline, calcareous; clear, wavy boundary.

C2—44 to 60 inches, olive-brown (2.5Y 4/4) silty clay loam; many, medium, faint, grayish-brown (10YR 5/2) mottles; massive; firm; 10 percent pebbles; few light-gray (10YR 7/2) lime nodules; moderately alkaline, calcareous.

The solum is 30 to 50 inches thick. It is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. The lower part is weakly calcareous in some places. The solum is 0 to 15 percent coarse fragments.

The A horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). In some profiles there is a 2- to 3-inch A1 horizon that is black (10YR 2/1) or very dark brown (10YR 2/2) silty clay loam and is below the Ap horizon.

The B2tg horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam, clay loam, silty clay, or clay. The B3 horizon is 3 to 6 inches thick and in some places it is absent.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam or clay loam and is 5 to 15 percent coarse fragments.

Pewamo soils are very poorly drained members of a drainage sequence that includes the somewhat poorly drained Blount soils and the moderately well drained Glynwood soils. They are also near Brookston, Montgomery, and Millsdale soils. Pewamo soils have a finer textured B horizon and C horizon than Brookston soils. They are underlain by calcareous glacial till, and Montgomery soils are underlain by lakebed sediment. Pewamo soils lack the limestone bedrock that Millsdale soils have.

Pe—Pewamo silty clay loam. This level to nearly level soil is in depressions and drainageways in the northwestern part of the county. It is near Blount and Glynwood soils. Most areas cover about 2 to 10 acres. The surface layer is mainly silty clay loam, but it is silt loam in small areas at the base of steeper slopes.

Included with this soil in mapping are small areas of Blount and Glynwood soils.

This soil is suited to many crops commonly grown in the county if it is artificially drained. The surface layer is sticky and becomes hard if worked when wet. The soil is mainly in small areas, and its use is generally determined by the surrounding larger areas of Blount and Glynwood soils. The seasonal water table is the main limitation for nonfarm use. Capability unit IIw-3.

Quarries

Quarries are open excavations where the soil material has been removed and the underlying limestone bedrock has been mined. Quarries are most common in areas of Milton, Randolph, and Miamian soils. These soils have limestone bedrock at a depth of 4 feet or less.

Quarries range from 5 to 30 feet in depth and from 2 to 100 acres in size. The excavated soil material either is stockpiled around the rim of the quarry or has been removed. Stones are piled on the quarry floor or scattered along the rim.

The Brassfield Formation is the principal source of limestone being mined in the county. The limestone is used mainly in the processing of steel, for agricultural use, and as an aggregate in road construction. In a few areas, the overlying Dayton Formation is also mined.

A few of the deeper quarries contain water and are used as fish ponds and for other kinds of recreation. Quarries that are adjacent to the larger streams are protected from flooding by levees made from the excavated soil material and rock refuse. Capability unit not assigned.

Randolph Series

The Randolph series consists of somewhat poorly drained, level to gently sloping soils. These soils are moderately deep to limestone bedrock. They formed in medium-textured glacial till and material that weathered from the limestone bedrock. They are on uplands adjoining the flood plains and outwash terraces of the Miami and Stillwater Rivers in the western and southern parts of the county. The native vegetation was a mixed stand of hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is dark-gray silty clay loam mottled with yellowish brown in the upper 3 inches and is yellowish-brown silty clay and clay mottled with gray in the lower 18 inches. The underlying material is mottled, light olive-gray very gravelly clay loam about 5 inches thick. Limestone bedrock is at a depth of 34 inches.

Randolph soils have a moderately deep root zone over the limestone bedrock. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. The surface layer is medium in organic-matter content and is acid if it has not been limed. Permeability is moderately slow. The soils have a seasonal high water table in winter and spring.

Randolph soils are used for pasture and crops. Most cultivated areas are artificially drained. The moderate depth to bedrock makes the installation of drainage tile difficult in some areas. The soils dry and warm later in spring than nearby Milton soils.

Representative profile of Randolph silt loam, 0 to 2 percent slopes, in a cultivated field in Union Township, NW¼SE¼ sec. 19, T. 6 N., R. 5 E.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; many fine roots; 3 percent black concretions; medium acid; abrupt, smooth boundary.

B1tg—8 to 11 inches, dark-gray (10YR 4/1) light silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, fine, subangular blocky structure; friable; common fine roots; thin, very patchy, yellowish-brown (10YR 5/4) clay films in pores; 60 percent patchy, dark grayish-brown (10YR 4/2), silty coatings on ped surfaces; 2 percent black concretions; medium acid; clear, smooth boundary.

B21tg—11 to 14 inches, yellowish-brown (10YR 5/4) silty clay; many, medium, distinct, gray (10YR 5/1) mottles; moderate, medium, angular blocky structure; firm; common fine roots; thin patchy clay films; gray (10YR 5/1) coatings on peds; 3 percent glacial pebbles; 1 percent black concretions; medium acid; clear, smooth boundary.

B22tg—14 to 22 inches, yellowish-brown (10YR 5/4) silty clay; common, fine, distinct, gray (10YR 5/1) mottles and few, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure parting to moderate, medium, angular blocky; firm; common fine roots; thin patchy clay films; gray (10YR 5/1) coatings on peds; 3 percent glacial pebbles; 1 percent fine black concretions; neutral; clear, smooth boundary.

B23tg—22 to 29 inches, yellowish-brown (10YR 5/4) clay; many, fine and medium, distinct, gray (10YR 5/1) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; firm; thin, continuous, dark-gray (10YR 4/1) clay films on faces of peds; 5 percent glacial pebbles; neutral; abrupt, smooth boundary.

IIC—29 to 34 inches, light olive-brown (2.5Y 5/4) very gravelly clay loam; common, fine, distinct, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles; massive; friable; 60 percent limestone fragments with rounded edges; 1 percent glacial pebbles; moderately alkaline, calcareous; abrupt, wavy boundary.

IIR—34 inches, light-gray (10YR 7/1, 7/2) limestone bedrock.

The solum is 20 to 40 inches thick. The depth to bedrock ranges from 20 to 40 inches, and it varies within short distances. Reaction ranges from neutral to medium acid in the A horizon and upper part of the B horizon and from neutral to mildly alkaline in the lower part of the B horizon.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 4/3), or dark gray (10YR 4/1). There is an A2 horizon in some places.

The B2t horizon is silty clay loam, clay loam, silty clay, or clay. It has a hue of 10YR or 2.5Y, a value of 4 to 6, and a chroma of 2 to 4.

In some places the limestone bedrock is hard and dense, but in other places it is fractured. In some places irregular tongues of clayey material extend into the partly weathered limestone.

Randolph soils are the somewhat poorly drained members of a drainage sequence that includes the poorly drained and very poorly drained Millsdale soils and the well-drained Milton soils. Randolph soils are near these soils and also near Blount, Crosby, and Ritchey soils. They are underlain by limestone bedrock, but Blount and Crosby soils are underlain by glacial till. Randolph soils are deeper to limestone bedrock and are more poorly drained than Ritchey soils.

RdA—Randolph silt loam, 0 to 2 percent slopes. This level to nearly level soil is at a slightly higher elevation than dark-colored Millsdale soils, which are in depressions. It is at a slightly lower elevation than better drained Milton soils. Most areas cover 5 to 25 acres. This soil has the profile described as representative of the series. It shows little or no evidence of erosion.

Included with this soil in mapping are small areas of dark-colored Millsdale soils in narrow drainageways, small areas of soils that are more than 40 inches deep to limestone bedrock, and small ridges of better drained Milton soils.

This soil is used mainly for crops where it is artificially drained. Surface runoff is slow. The seasonal high water table and moderate depth to bedrock are limitations for many nonfarm uses. Capability unit IIIw-2.

RdB—Randolph silt loam, 2 to 6 percent slopes. This gently sloping soil is on small, scattered knolls and on ridges at the head of drainageways. Most areas cover about 5 to 15 acres. Slopes are about 60 to 80 feet long. There is only slight evidence of erosion.

Included with this soil in mapping are small areas of dark-colored Millsdale soils in narrow drainageways and small areas of nearly level Randolph soils. Also included are a few small areas of steeper, better drained Milton soils on side slopes at the head of drainageways.

This soil is used for crops where it is artificially drained. It has a seasonal high water table and the hazard of erosion is moderate. An artificial drainage system is more difficult to design and install on this soil than on nearly level Randolph soils because this soil is more sloping, its relief is uneven, and the depth to limestone bedrock is more variable. The seasonal high water table and the moderate depth to bedrock are limitations for many nonfarm uses. Capability unit IIIw-2.

Ritchey Series

The Ritchey series consists of well-drained, gently sloping to very steep soils. These soils are shallow to limestone bedrock. They formed in medium-textured glacial till and material that weathered from limestone bedrock. The depth to limestone bedrock ranges from

10 to 20 inches. The soils are on long, narrow side slopes on uplands, along the Miami and Stillwater valleys. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 6 inches thick. The subsoil is brown and is 10 inches thick. It is silt loam in the upper 3 inches, silty clay loam in the next 5 inches, and silty clay in the lower 2 inches. Limestone bedrock is at a depth of 16 inches.

Ritchey soils have a shallow root zone over limestone bedrock. The capacity to store and release plant nutrients is moderate, and the available water capacity is low. Permeability is moderate.

Ritchey soils are used mainly for pasture and woodland. A few less sloping areas are used for crops. The soils dry and warm early in spring. They are more shallow and droughty than most of the surrounding till soils on uplands.

Representative profile of Ritchey silt loam, 6 to 18 percent slopes, in Union Township, NE¼SW¼ sec. 27, T. 6 N., R. 5 E.

Ap—0 to 6 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; many roots; slightly acid; clear, smooth boundary.

B1—6 to 9 inches, brown (7.5YR 4/4) heavy silt loam; moderate, fine, subangular blocky structure; friable; many fine roots; dark grayish-brown (10YR 4/2) fillings in root channels and worm tunnels; neutral; clear, smooth boundary.

B21t—9 to 14 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; common fine roots; thin patchy clay films on ped faces; few glacial pebbles; mildly alkaline; gradual, smooth boundary.

IIB22t—14 to 16 inches, brown (7.5YR 4/4) silty clay; moderate, medium, subangular blocky structure; firm; few fine roots; thin very patchy clay films on ped faces; 5 to 10 percent limestone fragments; moderately alkaline; abrupt, wavy boundary.

IIR—16 inches, hard limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 10 to 20 inches. The solum is medium acid to neutral in the upper part and neutral to moderately alkaline and, in places, calcareous in the lower part.

The Ap horizon is dark brown (10YR 4/3) or dark grayish brown (10YR 4/2). In uncultivated areas there is a 2- to 4-inch A1 horizon that is very dark grayish brown (10YR 3/2) and a 2- to 3-inch A2 horizon that is brown (10YR 4/3) or pale brown (10YR 6/3).

Some profiles lack a B1 horizon. The Bt horizon is brown (7.5YR 4/4) or dark yellowish-brown (10YR 4/4) silty clay loam, clay loam, silty clay, or clay. The B horizon commonly is 2 to 10 percent glacial pebbles. In some profiles there is a 1- to 4-inch B3 horizon that is limestone cobbles intermixed with loam. Tongues of the B3 horizon commonly extend down between the limestone flags and into the fractured limestone bedrock.

These Ritchey soils have slightly more clay in the B horizon than is defined as the range for the series, but this difference does not alter their use or behavior.

Ritchey soils are near Milton, Randolph, and Millsdale soils. A few areas of Ritchey soils are near Miamian and Hennepin soils. Ritchey soils are shallower to limestone bedrock than Milton, Randolph, and Millsdale soils. They are better drained than the Randolph and Millsdale soils. Ritchey soils are underlain by limestone bedrock, and Miamian and Hennepin soils are underlain by glacial till.

RhB—Ritchey silt loam, 2 to 6 percent slopes. This gently sloping soil is on shoulders and knolls in areas on uplands that are shallow to bedrock. It lies nearly parallel to the valley sides. Most areas are irregular in shape and cover about 5 to 15 acres.

Included with this soil in mapping are small areas of the moderately deep Milton and Randolph soils and moderately eroded Ritchey soils.

Nearly all of this soil has been cultivated. A few areas have grown to brush or are wooded. The moderate hazards of drought and erosion are limitations for farming. The shallow depth to limestone bedrock is a severe limitation for most nonfarm uses. Capability unit IIIe-3.

RhC—Ritchey silt loam, 6 to 18 percent slopes. This sloping to moderately steep soil is in narrow bands, about 100 to 200 feet wide, on shoulders on uplands. It is mainly in areas of about 5 to 12 acres, and it is on slope breaks along the top of more steeply sloping valley sides. This soil has the profile described as representative of the series. In cultivated areas, about 40 percent of the acreage is moderately eroded. In these areas the plow layer is a mixture of the original surface layer and some of the subsoil. Some areas have limestone flagstones on the surface. Limestone bedrock commonly crops out on the steeper areas.

Included with this soil in mapping are small areas of Milton soils and spots of soils that are less than 10 inches deep to limestone bedrock. Also included are a few spots of dark-colored soils in narrow drainageways.

This soil is suited to woodland, pasture, and occasional cultivated crops. The steeper areas are best suited to pasture or woods. The hazard of drought is moderate, and the hazard of erosion is severe. The shallow depth to bedrock and some moderately steep slopes are severe limitations for most nonfarm uses. Capability unit IVe-1.

RhE—Ritchey silt loam, 18 to 50 percent slopes. This steep to very steep soil is on side slopes overlooking the river valleys. Most areas lie between less sloping uplands and stream terraces or flood plains. Most areas cover about 5 to 30 acres. Slopes are about 80 to 200 feet long. They are mostly 18 to 50 percent, but in a few areas they range to 70 percent. The surface layer is 4 to 5 inches thick. About 10 to 15 percent of it is commonly covered with limestone flagstones.

Included with this soil in mapping are small areas that are less than 10 inches thick over limestone bedrock and soils that are underlain by greenish and grayish shale instead of limestone. Also included are small spots of dark-colored soils in narrow drainageways. Outcropping of limestone bedrock is common, especially in the steeper areas. These outcrops are indicated on the soil map by a special symbol.

This soil is suited to woods and pasture. It is not suited to crops because the erosion hazard is very severe and the drought hazard is severe. Surface runoff is very rapid. The shallowness to bedrock and the steep slopes are severe limitations for almost all nonfarm uses. Capability unit VIIe-1.

Rodman Series

The Rodman series consists of well-drained, steep and very steep soils. These soils are very shallow or shallow to calcareous sand and gravel. They formed in loamy and sandy glacial outwash. They are on gravelly outwash terraces and on kames and eskers, mainly in the Honey Creek area in Bethel Township.

In a representative profile the surface layer is very dark grayish-brown gravelly loam about 7 inches thick. The subsoil is dark yellowish-brown gravelly loam 8 inches thick. Brown, calcareous, stratified sand and gravel is between depths of 15 and 60 inches.

Rodman soils have a shallow root zone over the sand and gravel. The capacity to store and release plant nutrients is low, and the available water capacity is low. The surface layer is medium in organic-matter content. Permeability is moderately rapid in the upper part of the soil and rapid in the underlying material.

Rodman soils are very susceptible to drought and are poorly suited to most farm uses. They are a good source of sand and gravel.

Representative profile of Rodman gravelly loam, in an area of Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded, in a wooded area in Bethel Township, NW¼SE¼ sec. 6, T. 2 E., R. 9 N.

A1—0 to 7 inches, very dark grayish-brown (10YR 3/2) gravelly loam; weak, fine, granular structure; friable; many roots; 20 percent gravel; mildly alkaline; clear, wavy boundary.

B—7 to 15 inches, dark yellowish-brown (10YR 3/4) gravelly loam; weak, fine, subangular blocky structure; friable; few roots; 40 percent gravel, moderately alkaline, calcareous; abrupt, wavy boundary.

C—15 to 60 inches, brown (10YR 5/3) stratified sand and gravel; single grained; loose; 15 percent cobbles; moderately alkaline, calcareous.

The solum is 8 to 16 inches thick. Reaction of the solum is mildly alkaline or moderately alkaline, and the soil is mainly calcareous throughout.

The A horizon is very dark brown (10YR 2/2), very dark gray (10YR 3/1), or very dark grayish brown (10YR 3/2).

The B horizon is brown (10YR 5/3 or 7.5YR 5/4), dark yellowish-brown (10YR 3/4), or dark-brown (7.5YR 4/4) loam, gravelly loam, or gravelly sandy loam. Structure of the B horizon is weak or moderate, fine or medium, granular or subangular blocky.

The C horizon is brown (10YR 5/3) or yellowish brown (10YR 5/4).

Rodman soils are near Lorenzo, Eldean, Casco, and Hennepin soils. They have a weakly developed B horizon and contain less clay and more sand than Lorenzo, Eldean, and Casco soils. Rodman soils have a darker colored A horizon than Eldean and Casco soils. They are underlain by stratified sand and gravel, and Hennepin soils are underlain by glacial till.

In Miami County, Rodman soils are mapped only with Lorenzo soils.

Ross Series

The Ross series consists of well drained, level to nearly level soils. These soils formed in medium-textured alluvium. They are on flood plains along the Miami and Stillwater Rivers. The native vegetation was prairie grasses and some scattered mixed hardwoods.

In a representative profile the surface layer is very dark grayish-brown silt loam about 18 inches thick. The subsoil is dark-brown silt loam 8 inches thick. Brown silt loam and light yellowish-brown loam mottled with some grayish brown is between depths of 26 and 60 inches.

Ross soils have a deep root zone. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is neutral or mildly alkaline. Permeability is moderate. These soils are subject to occasional or rare flooding that restricts their use.

Ross soils are used mainly for row crops, but in some areas they are used for small grain and meadow. They are highly suited to row crops. A large acreage is protected from flooding by levees along the Miami River.

Representative profile of Ross silt loam, in Bethel Township, SW¼NW¼ sec. 36, T. 2 E., R. 9 N.

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure; friable; mildly alkaline; clear, smooth boundary.

A1—8 to 18 inches, very dark grayish-brown (10YR 3/2) heavy silt loam; moderate, fine and medium, angular blocky structure; friable; very dark brown (10YR 2/2) organic stains on some ped faces; neutral; clear, smooth boundary.

B—18 to 26 inches, dark-brown (10YR 3/3) heavy silt loam; weak, medium, subangular blocky structure; friable; mildly alkaline; abrupt, wavy boundary.

C1—26 to 45 inches, brown (10YR 4/3) silt loam; massive; friable; 5 percent pebbles; moderately alkaline, calcareous; abrupt, wavy boundary.

C2—45 to 60 inches, light yellowish-brown (2.5Y 6/4) loam; common, fine, faint, grayish-brown (2.5Y 5/2) mottles; massive; friable; 10 percent pebbles; moderately alkaline, calcareous.

The A horizon and the B horizon are neutral or mildly alkaline, and the C horizon is mildly alkaline or moderately alkaline. In some places the soil is calcareous throughout.

The A horizon is very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), or very dark gray (10YR 3/1). It is 24 to 28 inches thick.

The B horizon is dark-brown (10YR 3/3, or 4/3) or dark yellowish-brown (10YR 3/4) silt loam or loam. In some places there is a 2- to 4-inch subhorizon of sandy clay loam or clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. It is loam, silt loam, sandy loam, or light clay loam. In some areas stratified sand and gravel are common at a depth of 40 inches or more.

Ross soils are well drained members of the drainage sequence that includes the moderately well drained Medway soils. Ross soils are near Medway, Eel, Genesee, Shoals, and Wea soils. They are also near Ross variant soils. Ross soils lack the mottled B horizon that is in Medway, Eel, and Shoals soils. They have a darker colored A horizon than Eel, Genesee, and Shoals soils. Ross soils are weakly developed and contain less clay in the B horizon than Wea soils. They lack the limestone bedrock that underlies the Ross variant soils at a depth of 10 to 20 inches.

Rs—Ross silt loam. This level to nearly level soil is near Genesee and Wea soils along the Miami and Stillwater Rivers. It is generally at a slightly higher elevation than Genesee soils and at a slightly lower elevation than Wea soils. In a few places it is dissected by old abandoned river channels. Most areas cover 5 to 40 acres. The surface layer is mainly silt loam, but it is silty clay loam in small areas. Shell and snail fragments are common on the surface at the lower elevations adjacent to the rivers.

Included with this soil in mapping are small areas of slightly wetter Medway soils and lighter colored Genesee soils. Also included are some spots that have a buried, dark-colored soil at a depth of 36 inches or more, other spots where the dark-colored surface layer is slightly thinner than 24 inches, and some areas of soils along the Stillwater River, southeast of West Milton, that are underlain by cobbles and stones at a depth of 32 to 36 inches or more.

This soil is well suited to cultivated crops if it is protected from flooding. It has few, if any, limitations for crops. It has good tilth. Row crops can generally be planted and harvested during the nonflooding period. Flooding is the main limitation for farm and nonfarm uses. Capability unit IIw-4.

Ross Variant

The Ross variant consists of shallow, well-drained, level to nearly level soils. These soils formed in alluvium that is 10 to 20 inches deep to limestone bedrock. They are along the Stillwater River, mainly in Newberry Township. The soils formed under tall prairie grasses and some scattered, mixed hardwoods.

In a representative profile the surface layer is very dark gray silt loam in the upper 7 inches and black silty clay loam in the lower 6 inches. Fractured, light-gray sandy limestone bedrock is between depths of 13 and 20 inches. Hard limestone bedrock is at a depth of 20 inches.

These soils have a shallow root zone. The capacity to store and release plant nutrients is moderate, and the available water capacity is low. The surface layer is high in organic-matter content and is mildly or moderately alkaline. Permeability is moderate.

These soils are used for cultivated crops and pasture. A few areas are wooded. The soils are droughty during summer in most years.

Representative profile of Ross silt loam, shallow variant, in Newberry Township, NE¼NE¼ sec. 13, T. 9 N., R. 4 E.

Ap—0 to 7 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; many roots; few limestone cobbles; mildly alkaline; clear, smooth boundary.

A1—7 to 13 inches, black (10YR 2/1) silty clay loam; moderate, medium, angular blocky structure; slightly firm; few roots; few limestone flagstones and cobbles; moderately alkaline, slightly calcareous; abrupt, wavy boundary.

IIR1—13 to 20 inches, light-gray (2.5Y 7/2) sandy limestone rock material; pale-yellow (2.5Y 7/4) streaks and brown (7.5YR 4/4) stains; rock surface is coated and horizontal cracks (¼ to ½ inch wide) are filled with dark-brown (10YR 3/3) silty clay loam; rippable; moderately alkaline, calcareous; clear, wavy boundary.

IIR2—20 inches, hard limestone bedrock.

The A horizon is 10 to 20 inches thick. It is very dark gray (10YR 3/1), black (10YR 2/1), or very dark grayish brown (10YR 3/2). It has moderate, fine to medium, granular structure or weak to moderate, fine to medium, subangular or angular blocky structure. It is mildly or moderately alkaline.

The IIR1 horizon is 4 to 8 inches thick. Some profiles do not have a IIR1 horizon.

Bedrock is at a depth of 10 to 20 inches.

Ross variant soils are near Ross and Genesee soils. Unlike the Ross and Genesee soils, which are underlain by alluvium, the Ross variant soils are underlain by limestone bedrock.

Rt—Ross silt loam, shallow variant. This is a level to nearly level soil on high bottom lands in areas mainly of about 10 to 20 acres that parallel the Stillwater River in the northwestern part of the county. It is underlain by limestone bedrock at a depth of 10 to 20 inches. The surface layer is mainly silt loam, but it is silty clay loam in some small areas. The surface commonly has 5 to 10 percent limestone fragments.

Included with this soil in mapping are small areas of soils that are more than 20 inches deep to the limestone bedrock, spots of soils that have a lighter colored surface layer, and small areas of soils that have slopes of more than 2 percent.

This soil is suited to crops, but there is a moderate to severe drought hazard and crops are often damaged by lack of moisture during the growing season. There is little or no hazard of erosion. The soil is subject to flooding, but rarely during the growing season. Flooding and shallowness to bedrock are severe limitations for most nonfarm uses. Capability unit IIIs-1.

Shoals Series

The Shoals series consists of somewhat poorly drained, level to nearly level soils. These soils formed in medium-textured alluvium. They are on stream flood plains throughout the county and are generally adjacent to uplands. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is dark grayish-brown and grayish-brown silt loam mottled with brown and dark brown. It is 20 inches thick. The underlying material is mottled dark-brown silt loam between depths of 28 and 40 inches and is pale-brown, stratified, medium sand and fine gravel to a depth of 60 inches.

Shoals soils have a deep root zone when the water table is low. The capacity to store and release plant nutrients is moderate to high, and the available water capacity is high. The surface layer is medium in organic-matter content and is mildly alkaline. Permeability is moderate. The soils have a seasonal high water table in winter and spring, and flooding is a hazard. In some areas these soils receive additional water through seepage from adjacent uplands.

Shoals soils are used for crops if they are drained. Undrained areas are left wooded or are used for pasture.

Representative profile of Shoals silt loam, in a cultivated field in Bethel Township, SE¼SE¼ sec. 11, T. 2 E., R. 9 N.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; many roots; mildly alkaline, weakly calcareous; abrupt, smooth boundary.

B1g—8 to 14 inches, dark grayish-brown (2.5Y 4/2) silt loam; few, fine, distinct, brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; friable; many roots; mildly alkaline, calcareous; clear, wavy boundary.

B2g—14 to 28 inches, grayish-brown (10YR 5/2) silt loam; common, medium, faint, dark-brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; friable; few roots; 5 percent pebbles; moderately alkaline, calcareous; clear, wavy boundary.

C1—28 to 40 inches, dark-brown (10YR 4/3) silt loam; common, medium, faint, dark grayish-brown (10YR 4/2) mottles and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; massive; friable;

moderately alkaline, calcareous; abrupt, irregular boundary.

IIC2—40 to 60 inches, pale-brown (10YR 6/3) stratified medium sand and fine gravel; few, fine, faint, light yellowish-brown (10YR 6/4) mottles; single grained; loose; moderately alkaline, strongly calcareous.

The solum is 24 to 36 inches thick. The reaction of the solum is mildly alkaline or moderately alkaline, and in most places the soil is calcareous.

The Ap horizon is mainly dark grayish-brown (10YR 4/2) but is also brown (10YR 5/3) or grayish brown (10YR 5/2).

The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. It has few to common, faint to distinct mottles. The B horizon is loam, silt loam, or light clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is loam, silt loam, and fine sandy loam. Stratified layers of sand and gravel are common at a depth of 40 inches or more.

These Shoals soils dominantly have carbonates throughout and are slightly higher in reaction in the upper part of the solum than is defined as the range for the series, but this difference does not alter their use or behavior.

Shoals soils are somewhat poorly drained members of a drainage sequence that includes the well-drained Genesee soils and the moderately well drained Eel soils. Shoals soils are near these soils and also near Ross, Medway, Linwood, Algiers, Wallkill, and Shoals variant soils. Shoals soils are more poorly drained and are mottled nearer the surface than the Genesee, Eel, and Ross soils. They are not so dark colored as the Ross and Medway soils. Shoals soils lack the organic surface layer that is characteristic of Linwood soils and the dark-colored, buried soil that occurs in Algiers soils. They lack the organic underlying material that is characteristic of Wallkill soils and the underlying bedrock of the Shoals variant.

Sh—Shoals silt loam. This level to nearly level soil is in long, narrow areas on flood plains. Most areas cover about 2 to 30 acres.

Included with this soil in mapping are small areas of Eel, Algiers, and Medway soils and a few areas of soils that have a loam surface layer.

This soil is suited to most crops commonly grown in the county if it is artificially drained. It is subject to occasional flooding and has a seasonal high water table. In some areas, artificial drainage is difficult to achieve because drainage outlets are inadequate. There are a few small areas where this soil is so badly dissected by the stream channel that its use is restricted to pasture or woodland. The seasonal high water table and the hazard of flooding are severe limitations for most nonfarm uses. Capability unit IIw-1.

Shoals Variant

The Shoals variant consists of moderately deep, somewhat poorly drained, level to nearly level soils. These soils formed in medium textured alluvium. They are similar to the Shoals soils, but they are underlain by limestone bedrock at a depth of 20 to 40 inches. These soils are on narrow flood plains along small creeks near the Stillwater River, mainly in the southwestern part of the county. They are mostly adjacent to uplands.

In a representative profile the surface layer is dark-gray silt loam about 3 inches thick. The subsoil is grayish brown and is mottled with brown, light brownish gray, and yellowish brown. It is silt loam in the upper 5 inches, clay loam in the next 7 inches, and loam in the lower 7 inches. The underlying material is yellowish-brown loam mottled with gray. It is about 14 inches thick. Limestone bedrock is at a depth of 36 inches.

These soils have a moderately deep root zone over the limestone bedrock. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. The surface layer is medium in organic-matter content and is mildly alkaline. Permeability is moderate. The soils have a seasonal high water table in winter and spring and are subject to flooding. They commonly receive seepage from adjacent uplands.

These soils are used mainly for pasture and woods. Frequent flooding and seasonal wetness limit their use for cultivated crops. Artificial drainage is more difficult to install on these soils than on the other Shoals soils because of the underlying limestone bedrock.

Representative profile of Shoals silt loam, moderately shallow variant, in a pasture field in Monroe Township, SE¼SW¼ sec. 36, T. 7 N., R. 5 E.

A1—0 to 3 inches, dark-gray (10YR 4/1) silt loam; weak, medium, granular structure; friable; mildly alkaline, weakly calcareous: clear, wavy boundary.

B21g—3 to 8 inches, grayish-brown (2.5Y 5/2) silt loam; few, fine, faint, brown (10YR 4/3) mottles; moderate, fine, subangular blocky structure; friable; 3 percent pebbles; mildly alkaline, weakly calcareous; clear, wavy boundary.

B22g—8 to 15 inches, grayish-brown (2.5Y 5/2) light clay loam; common, medium, faint, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles: weak, fine, subangular blocky structure; friable; 5 percent pebbles; mildly alkaline, weakly calcareous; clear, irregular boundary.

B23g—15 to 22 inches, grayish-brown (10YR 5/2) loam; many, coarse, distinct, yellowish-brown (10YR 5/4) mottles; weak, coarse, subangular blocky structure; friable; 5 percent pebbles; mildly alkaline, weakly calcareous; clear, irregular boundary.

C—22 to 36 inches, yellowish-brown (10YR 5/4) loam; many, fine, distinct, gray (10YR 5/1) mottles; massive; friable; moderately alkaline, calcareous; abrupt, irregular boundary.

IIR—36 inches, light-gray (5Y 7/2) limestone bedrock.

The solum is 20 to 36 inches thick. The depth to limestone bedrock ranges from 20 to 40 inches but is variable within short distances. Reaction of the solum is mildly alkaline or moderately alkaline, and in most places the soil is calcareous.

The A horizon is dark gray (10YR 4/1), dark grayish brown (10YR 4/2), or very dark grayish brown (10YR 3/2).

The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is silt loam, loam, or light clay loam.

The C horizon is loam, silt loam, or fine sandy loam.

Shoals variant soils are near Shoals, Eel, and Medway soils on flood plains. They are shallower to limestone bedrock than all those soils.

Sk—Shoals silt loam, moderately shallow variant. This level to nearly level soil formed in alluvial material and is underlain by limestone bedrock at a depth of 20 to 40 inches. Most areas are long and narrow and cover about 5 to 20 acres.

Included in mapping are small areas where bedrock is at a depth of slightly more than 40 inches.

This soil is suited to pasture, woodland, or wildlife habitat. It is flooded more frequently and stays wet longer in spring than other Shoals soils. The use of this soil for cultivated crops is limited by flooding during the growing season and by seasonal wetness. Flooding and wetness are also limitations for nonfarm uses. Capability unit Vw-1.

Sleeth Series

The Sleeth series consists of somewhat poorly drained, level to nearly level soils. These soils formed in outwash material on terraces. They are underlain by stratified, calcareous sand and gravel at a depth of 40 to 56 inches. They are along drainageways and on low terraces bordering the rivers and major streams—above the normal level of flooding. The native vegetation was mixed hardwoods, but most wooded areas have been cleared.

In a representative profile the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsoil is olive-brown clay loam in the upper 16 inches, yellowish-brown clay loam in the next 6 inches, and grayish-brown sandy clay loam in the lower 10 inches. It has grayish-brown and olive-brown mottles. Light olive-brown, stratified calcareous sand and gravel is between depths of 42 and 60 inches.

Sleeth soils have a deep root zone when the water table is low. The capacity to store and release plant nutrients is moderate to high, and the available water capacity is high. The surface layer is medium in organic-matter content and is neutral or slightly acid. Permeability is moderate in the upper part of the soil and rapid in the coarse underlying material. The soils have a seasonal high water table in the winter and spring.

Sleeth soils are used mainly for crops. Most cultivated areas have been artificially drained. The soils generally drain well with tile.

Representative profile of Sleeth silt loam, 0 to 2 percent slopes, in a cultivated field in Concord Township, NE¼SE¼ sec. 33, T. 5 N., R. 6 E.

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; many roots; neutral; abrupt, smooth boundary.

B1t—10 to 16 inches, olive-brown (2.5Y 4/4) clay loam; moderate, medium, angular blocky structure; firm; few roots; thin, patchy, grayish-brown (10YR 5/2) clay films on ped faces; 5 percent pebbles; neutral; clear, smooth boundary.

B21t—16 to 26 inches, olive-brown (2.5Y 4/4) clay loam; many, medium, distinct, dark grayish-brown (10YR 4/2) mottles; moderate, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, grayish-brown (10YR 5/2) clay films on ped faces; 10 percent gravel; neutral; clear, wavy boundary.

B22t—26 to 32 inches, yellowish-brown (10YR 5/4) clay loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, dark grayish-brown (10YR 4/2) clay films on ped faces; 10 percent gravel; few dark concretions; mildly alkaline; clear, wavy boundary.

B3t—32 to 42 inches, grayish-brown (10YR 5/2) sandy clay loam; many, medium, distinct, olive-brown (2.5Y 4/4) mottles; weak, coarse, subangular blocky structure; friable; thin, very patchy, dark grayish-brown (10YR 4/2) clay films on pebbles and ped faces; 5 percent gravel; mildly alkaline, weakly calcareous; clear, irregular boundary.

C—42 to 60 inches, light olive-brown (2.5Y 5/4) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 40 to 56 inches thick. The depth to calcareous material ranges from 30 to 50 inches. The solum is neutral or slightly acid in the upper part and mildly alkaline in the lower part. In some places the B3 horizon is weakly calcareous.

The Ap horizon is dark grayish brown (10YR 4/2), dark gray (10YR 4/1), or grayish brown (10YR 5/2). In some places there is a grayish-brown (10YR 5/2) A2 horizon that is 2 to 3 inches thick.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, chroma of 2 to 4, and it is mottled. The B2t horizon is clay loam or silty clay loam in the upper part and clay loam or sandy clay loam in the lower part. It mainly has moderate, fine or medium, subangular or angular blocky structure. In some places the primary structure is weak, medium, and prismatic. The B3 horizon is gravelly clay loam, sandy clay loam, or gravelly loam.

The C horizon is dark grayish brown (10YR 4/2) to light olive brown (2.5Y 5/4).

Sleeth soils are somewhat poorly drained members of a drainage sequence that includes the very poorly drained Westland soils and the well drained Ockley soils. Sleeth soils are commonly near Eldean, Westland, and Casco soils. Sleeth soils are deeper to sand and gravel than Eldean and Casco soils, and they have mottles in the B horizon.

SlA—Sleeth silt loam, 0 to 2 percent slopes. This level to nearly level soil is mainly on outwash terraces. It is at a slightly higher elevation than Westland soils and at a slightly lower elevation than Eldean and Casco soils. The soil is also along drainageways in positions surrounded by Eldean and Casco soils. Most areas cover about 2 to 10 acres.

Included with this soil in mapping are small areas of Westland soils and a few areas of moderately well drained soils. Also included are areas of soils along narrow drainageways that have a darker colored surface layer.

This soil is suited to crops. It is suited to many commonly grown crops if it is artificially drained. Drained areas are easy to till and seed to crops. Surface runoff is slow, and there is little, if any, hazard of erosion. Seasonal wetness is the main limitation for crops. The seasonal high water table is a limitation for many nonfarm uses. Capability unit IIw-2.

Stonelick Series

The Stonelick series consists of well-drained, level to nearly level soils. These soils formed in coarse-textured alluvial deposits. They are on flood plains next to and paralleling the Miami and Stillwater Rivers. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown loam about 15 inches thick. The underlying material is friable, brown sandy loam between depths of 15 and 38 inches and is brown stratified sand and loamy sand to a depth of 60 inches.

Stonelick soils have a moderately deep root zone. The capacity to store and release plant nutrients is low, and the available water capacity is low. The surface layer is medium in organic-matter content and is mildly alkaline. Permeability is moderately rapid.

Stonelick soils are used for mainly row crops and meadow. A few areas are in woods and pasture. The soils are droughty if they are used for crops. They are subject to occasional flooding that sometimes restricts their use. They are suited to crops if they are protected from floods. A large acreage is protected from flooding by levees along the Miami River.

Representative profile of Stonelick loam, in a cultivated field in Staunton Township, SE¼NE¼ sec. 4, T. 1 E., R. 10 N.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; weak, fine and medium, granular structure; friable; many roots; dark-brown (10YR 3/3) coatings on ped faces; mildly alkaline, weakly calcareous; clear, smooth boundary.

A1—6 to 15 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, subangular blocky structure; friable; 5 percent shell fragments; few roots; 10 percent worm casts; moderately alkaline, calcareous; abrupt, smooth boundary.

C1—15 to 38 inches, brown (10YR 4/3) sandy loam; very weak, medium, subangular blocky structure in upper part, massive in lower part; friable; few roots; 5 percent shell fragments; moderately alkaline, strongly calcareous; abrupt, wavy boundary.

C2—38 to 60 inches, brown (10YR 5/3) stratified sand and loamy sand; single grained; loose; 10 to 15 percent gravel; moderately alkaline, strongly calcareous.

The reaction is mildly alkaline or moderately alkaline, and this soil is calcareous throughout.

The Ap horizon is dark grayish brown (10YR 4/2) or brown (10YR 4/3 or 10YR 5/3).

The C horizon is loam, sandy loam, fine sandy loam, or light silt loam. Stratified layers of sand, loamy sand, or gravel are common at a depth of 36 or more inches. The C horizon ranges from brown (10YR 5/3, 10YR 4/3) to dark yellowish brown (10YR 4/4). In some places mottles that have a chroma of 2 or less are at a depth of 36 or more inches.

Stonelick soils are near Genesee and Eel soils. Stonelick soils are coarser textured and are sandier than Genesee and Eel soils. They lack the mottles that are characteristic of Eel soils.

St—Stonelick loam. This level to nearly level soil is on flood plains adjacent to the stream channel. Most areas are long and narrow and cover 3 to 35 acres. The relief is slightly undulating in some areas as a result of old stream braiding and oxbows. The surface layer is mainly loam, but it is sandy loam that is 10 percent gravel in some spots and it is silt loam in other spots.

Included with this soil in mapping are small areas of Genesee and Eel soils and small areas of darker colored sandy loams that are along the Stillwater River northeast of West Milton. Stonelick soils are generally at a slightly lower elevation than Genesee and Eel soils and are closer to the stream channels. Also included are small areas of riverwash in areas along the river channels.

This soil is suited to crops. The hazard of drought is moderate, and unprotected areas are subject to occasional flooding. The soil is also subject to stream channel erosion, and in some areas stream bank stabilization is needed to control erosion. The soil is less suited to winter-grown small grain, because of the flood hazard. Row crops can be planted and generally can be harvested during the nonflooding period. The soil has good tilth within a wide range of moisture content. The droughtiness and occasional flooding are the main limitations for farming and for many nonfarm uses. Capability unit IIs-2.

Wallkill Series

The Wallkill series consists of very poorly drained, nearly level to depressional soils that have a mineral surface layer underlain by muck. The muck formed in wet areas as the result of partial decomposition of the remains of plants, mainly trees, fibrous grasses, sedges, and reeds. The overlying alluvium was washed from nearby uplands. These soils are in scattered small areas on stream terraces or moraines, mainly in the southeastern part of the county.

In a representative profile the soil is dark grayish-brown silt loam to a depth of 27 inches. Gray mottles are below a depth of 10 inches. The underlying material is black, well-decomposed muck to a depth of 60 inches.

Wallkill soils have a deep root zone when the water table is low. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is medium in organic-matter content and is neutral or mildly alkaline. Permeability is moderate in the upper part of the soil and rapid in the muck underlying material when the water table is low.

The hazard of wetness is moderate. Unless the soils have been artificially drained, they have a high water table for long periods during the year. Drained areas are suited to cultivated crops, pasture, and meadow. Undrained areas are too wet for crops, but are suited to wildlife habitat in places. Tile and open ditches are used for drainage.

Representative profile of Wallkill silt loam, in a cultivated field in Elizabeth Township, NW¼SE¼ sec. 25, T. 2 E., R. 10 N.

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, subangular blocky structure; friable; many roots; mildly alkaline; clear, smooth boundary.

Bg—10 to 21 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint, gray (10YR 5/1) mottles; weak, medium, angular blocky structure; firm; few roots; mildly alkaline; clear, wavy boundary.

Cg—21 to 27 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, faint, gray (10YR 5/1) mottles; very weak, coarse, subangular blocky structure in the upper part, massive in the lower part; friable; few roots; very dark grayish-brown (10YR 3/2) organic stains; few dark concretions; mildly alkaline; abrupt, wavy boundary.

IIOa1—27 to 36 inches black (10YR/2/1) on broken face or when rubbed and pressed sapric material; 10 percent fiber when broken, none when rubbed and pressed; weak, coarse, subangular blocky structure; nonsticky when wet; neutral; clear, wavy boundary.

IIOa2—36 to 60 inches, black (10YR 2/1) on broken face or when rubbed and pressed sapric material; 30 percent fiber when broken, 5 percent when rubbed and pressed; massive; nonsticky when wet; mildly alkaline.

The thickness of the mineral alluvial material over the organic material ranges from 16 to 40 inches. The thickness of the organic layers ranges from 20 to 40 inches or more. The reaction is neutral or mildly alkaline throughout.

The Ap horizon is dark grayish brown (10YR 4/2) or dark gray (10YR 4/1).

In some places the Bg horizon is weakly expressed or is lacking. The B horizon and C horizon are dark grayish brown (10YR 4/2 or 2.5Y 4/2) or grayish brown (10YR 5/2 or 2.5Y 5/2).

The organic material is mostly sapric, but a few areas are hemic below a depth of 30 inches. The organic layers are black (10YR 2/1), very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2).

Wallkill soils are near Algiers, Linwood, and Shoals soils. Wallkill soils are underlain by muck, and Algiers and Shoals soils are underlain by mineral alluvium. The upper layers of Wallkill soils are mineral alluvium, which is lacking in Linwood soils.

Wa—Wallkill silt loam. This soil is in scattered small areas that cover about 5 to 15 acres. Included in mapping are spots of Linwood and Shoals soils.

Artificial drainage is needed before this soil can be used for crops. Drainage is difficult in some areas because suitable outlets are not available. The seasonal high water table is the main limitation for farming. The seasonal high water table and the low strength of the underlying organic material are severe limitations for most nonfarm uses. Capability unit IIw-1.

Warsaw Series

The Warsaw series consists of well-drained, nearly level soils. These soils are moderately deep to sand and gravel. They formed in loamy glacial outwash material along the Miami and Stillwater Rivers. The native vegetation was tall prairie grasses and a few scattered hardwoods, but now most areas are cultivated.

In a representative profile the surface layer is silt loam about 18 inches thick. It is very dark grayish-brown in the upper 9 inches and is black in the lower 9 inches. The subsoil is dark yellowish-brown and dark-brown clay loam and loam 19 inches thick. It is firm and contains some gravel in the lower part. Pale brown stratified sand and gravel is between depths of 37 and 60 inches.

Warsaw soils have a moderately deep root zone. The capacity to store and release plant nutrients is moderate, and the available water capacity is moderate. The surface layer is high in organic-matter content. Permeability is moderate in the upper part of the soil and rapid in the coarse underlying material.

These soils are used mainly for field crops. In some areas they are used for truck and nursery crops. A few areas are used as a source of sand and gravel. The drought hazard is moderate. Crops are damaged by lack of moisture during most growing seasons. These soils dry and warm early in spring. Irrigation is used in some areas, and the soils are well suited to irrigation. The soils have good tilth within a wide range of moisture content.

Representative profile of Warsaw silt loam, 0 to 2 percent slopes, in Monroe Township, SE¼SE¼ sec. 35, T. 4 N., R. 6 E. (Sample MM-32 in laboratory data table):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; mildly alkaline; clear, wavy boundary.

A1—9 to 18 inches, black (10YR 2/1) silt loam; moderate, fine and medium, angular blocky structure; slightly firm; common roots; mildly alkaline; clear, wavy boundary.

B1—18 to 23 inches, dark yellowish-brown (10YR 3/4) light clay loam; moderate, medium, angular blocky structure; slightly firm; few roots; mildly alkaline; clear, wavy boundary.

B21t—23 to 28 inches, dark-brown (10YR 4/3) loam; moderate, medium, angular blocky structure; firm; few roots; thin very patchy clay films on ped faces; mildly alkaline; clear, wavy boundary.

IIB22t—28 to 34 inches, dark yellowish-brown (10YR 3/4) loam; moderate, medium and coarse, subangular blocky structure; firm; few roots; thin very patchy clay films on ped faces; 10 percent pebbles; mildly alkaline; clear, irregular boundary.

IIB3t—34 to 37 inches, dark yellowish-brown (10YR 3/4) gravelly loam; weak, coarse, subangular blocky structure; firm; few roots; thin very patchy clay films on pebbles; 25 percent gravel; moderately alkaline, calcareous; abrupt, irregular boundary.

IIC—37 to 60 inches, pale-brown (10YR 6/3) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 24 to 40 inches thick. It is slightly acid to mildly alkaline in the upper part and mildly alkaline or moderately alkaline in the lower part. In most places the IIB3 horizon is calcareous. The depth to carbonates ranges from 20 to 38 inches.

The A horizon is 12 to 20 inches thick. The Ap horizon is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1).

The B2t horizon is loam, clay loam, sandy clay loam, or gravelly clay loam. In some places tongues of the B2t horizon extend 2 to 3 feet into the C horizon, and in some places a 2- to 4-inch, darker colored, strongly illuviated horizon is at the contact of the C horizon.

The proportion of sand and gravel in the C horizon varies greatly within short horizontal distances. The C horizon is pale brown (10YR 6/3) or brown (10YR 5/3).

Warsaw soils are near Westland, Eldean, Lorenzo, Ockley, Wea, and Casco soils. Warsaw soils are better drained than Westland soils and lack the mottles that those soils have. They have a darker colored A horizon than Eldean, Casco, and Ockley soils. Warsaw soils are deeper to sand and gravel than Lorenzo and Casco soils and are thinner to sand and gravel than Wea soils.

WdA—Warsaw silt loam, 0 to 2 percent slopes. This level to nearly level soil is on broad outwash terraces. Most areas cover about 5 to 80 acres.

Included with this soil in mapping are small areas of gently sloping soils at the head of drainageways and small areas of Wea soils in slight depressions.

This soil is suited to all crops commonly grown in the county. The major limitation for farming is moderate droughtiness. Surface runoff is slow. The soil has few limitations for most nonfarm uses. Capability unit IIs-1.

Wea Series

The Wea series consists of well-drained, level to nearly level soils. These soils formed in loamy glacial outwash materials. In some areas the outwash is mantled with a thin loess deposit. The soils are underlain by calcareous stratified sand and gravel at a depth of 40 to 66 inches. They are on the slightly higher positions adjacent to flood plains along the Miami and Stillwater Rivers. The native vegetation was tall prairie grasses.

In a representative profile the surface layer is silt loam about 18 inches thick. It is very dark grayish brown in the upper 10 inches and is dark brown in the lower 8 inches. The subsoil is dark-brown clay loam, is 26 inches thick, and is gravelly in the lower 3 inches. Brown stratified sand and gravel is between depths of 44 and 60 inches.

Wea soils have a deep root zone. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is slightly acid or neutral. Permeability is moderate in the upper part of the soil and rapid in the coarse underlying material.

These soils are used mainly for field crops, but some truck and nursery crops are grown. The soils have few limitations that restrict their use. The soils are well suited to irrigation, and some areas are irrigated.

Representative profile of Wea silt loam, 0 to 2 percent slopes, in a cultivated field in Bethel Township, SW¼NE¼ sec. 6, T. 1 E., R. 9 N.

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, granular structure; friable; many roots; neutral; clear, smooth boundary.

A1—10 to 18 inches, dark-brown (10YR 3/3) silt loam; weak, medium, subangular blocky structure; friable; many roots; neutral; clear, smooth boundary.

IIB21t—18 to 27 inches, dark-brown (10YR 4/3) clay loam; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, dark-brown (7.5YR 3/2) clay films on ped faces; 5 percent gravel; few, very dark brown (10YR 2/2), organic coatings on ped faces; neutral; clear, smooth boundary.

IIB22t—27 to 41 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, dark reddish-brown (5YR 3/3) clay films; 5 to 10 percent gravel; few, very dark brown (10YR 2/2), organic coatings on ped faces and in root channels; neutral; clear, irregular boundary.

IIB3—41 to 44 inches, dark-brown (7.5YR 3/2) gravelly clay loam; massive; firm; 25 percent gravel; few weathered fragments of limestone; moderately alkaline; abrupt, irregular boundary.

IIC—44 to 60 inches, brown (10YR 5/3) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 40 to 66 inches thick. The depth to calcareous material ranges from 36 to 64 inches. In some places there is a silty loess capping that is 10 to 18 inches thick. The reaction of the solum is neutral or slightly acid in the upper part and neutral to moderately alkaline in the lower part. In some places the B3 horizon is weakly calcareous.

The A horizon is 16 to 20 inches thick. The Ap horizon is very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2), or very dark gray (10YR 3/1).

The Bt horizon has hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is clay loam, silty clay loam, or sandy clay loam and is 5 to 15 percent gravel in places. The B3 horizon is gravelly clay loam or gravelly loam and generally is 15 to 25 percent gravel. It has hue of 7.5YR, value of 3, and chroma of 2 or 3.

The C horizon is yellowish brown (10YR 5/4), brown (10YR 5/3), or pale brown (10YR 6/3).

Wea soils are near Casco, Eldean, Ross, Genesee, Warsaw, Lorenzo, Ockley, and Westland soils. Wea soils have a darker colored A horizon than Casco, Eldean, Genesee, and Ockley soils. They have more distinctly developed horizons and have a finer textured B horizon than Ross soils. They are deeper to the underlying sand and gravel than Casco, Eldean, Warsaw, and Lorenzo soils. Wea soils are better drained than Westland soils and do not have mottles in the B horizon.

WeA—Wea silt loam, 0 to 2 percent slopes. This level to nearly level soil is on low stream terraces midway in elevation between the uplands and the flood plains. It is at a slightly lower elevation than Eldean and Ockley soils. The soil is mainly in broad, irregularly shaped areas that cover about 10 to 50 acres. In a few areas, it is in small, narrow drainageways. The surface layer is dominantly silt loam, but it is loam in a few scattered small areas. Nearly all of the original surface layer remains, and there is little, if any, evidence of erosion.

Included with this soil in mapping are small narrow areas of gently sloping soils at the head of drainageways and spots of very poorly drained Westland soils in narrow drainageways. Also included are small areas of Warsaw and Ross soils.

This soil is well suited to all crops commonly grown in the county. It has good tilth within a wide range of moisture content. Surface runoff is slow, and the hazard of erosion is slight. The soil has few limitations for either farm or nonfarm uses. Capability unit I-1.

Westland Series

The Westland series consists of very poorly drained, level to nearly level soils. These soils formed in loamy outwash material. Calcareous sand and gravel are at a depth of 40 to 60 inches. The soils are in slight depressions on outwash terraces, mainly in Bethel Township. The native vegetation was mixed hardwoods and marsh grasses.

In a representative profile the surface layer is black silty clay loam about 18 inches thick. The subsoil is dark-gray clay loam in the upper 3 inches, dark-gray gravelly clay loam in the next 11 inches, and grayish-brown gravelly loam in the lower 13 inches. Light brownish-gray stratified sand and gravel is between depths of 45 and 60 inches.

Westland soils have a deep root zone when the water table is low. The capacity to store and release plant nutrients is high, and the available water capacity is high. The surface layer is high in organic-matter content and is slightly acid or neutral. Permeability is moderately slow in the upper part of the soil and is rapid in the coarse underlying material. The soils have a seasonal high water table for long periods in winter and spring if they are not artificially drained.

These soils are used mainly for crops. A few areas are in woods and pasture. Most cultivated areas are artificially drained. These soils generally drain well with tile and open ditches.

Representative profile of Westland silty clay loam, in a cultivated field in Bethel Township, SE¼SE¼ sec. 4, T. 2 E., R. 9 N.

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; weak, medium, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

A1—7 to 18 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, angular blocky structure; friable; neutral; clear, wavy boundary.

B1tg—18 to 21 inches, dark-gray (10YR 4/1) clay loam; few, fine, distinct, light olive-brown (2.5Y 5/4) mottles; moderate, medium, subangular blocky structure; firm; thin very patchy clay films on ped faces; neutral; clear, wavy boundary.

IIB2tg—21 to 32 inches, dark-gray (5Y 4/1) gravelly clay loam; many, medium, distinct, light olive-brown (2.5Y 5/4) mottles; moderate, medium, subangular blocky structure; firm; thin patchy clay films on ped faces; 15 percent gravel; neutral; clear, irregular boundary.

IIB3g—32 to 45 inches, grayish-brown (2.5Y 5/2) gravelly loam; few, fine, faint, light olive-brown (2.5Y 5/6) mottles; weak, medium, subangular blocky structure; friable; 20 percent gravel; mildly alkaline, weakly calcareous; abrupt, irregular boundary.

IIC—45 to 60 inches, light brownish-gray (10YR 6/2) stratified sand and gravel; single grained; loose; moderately alkaline, calcareous.

The solum is 40 to 60 inches thick. Depth to calcareous material ranges from 32 to 54 inches. The reaction of the solum is slightly acid or neutral in the upper part and neutral to moderately alkaline in the lower part. In most places the lower part of the solum is weakly calcareous.

The A horizon is very dark brown (10YR 2/2), black (10YR 2/1), or very dark grayish brown (10YR 3/2).

The Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 or less. It is clay loam, gravelly clay loam, and silty clay loam. In many places there are 3- to 5-inch subhorizons of loam or sandy clay loam. The B3g horizon is the same color as the Bt horizon.

The C horizon is light brownish gray (10YR 6/2), grayish brown (10YR 5/2), or dark gray (10YR 4/1).

Westland soils are poorly drained members of a drainage sequence that includes the somewhat poorly drained Sleeth soils and the well-drained Ockley soils. Westland soils are near these soils and also near Elden, Wea, Warsaw, and Montgomery soils. They have more mottles in the B horizon than Eldean, Warsaw, and Wea soils and have a darker colored A horizon than Eldean soils. Westland soils are coarser textured and contain more sand than Montgomery soils.

Wt—Westland silty clay loam. This is a level to nearly level soil on broad, slightly depressed flats on outwash terraces. Most areas cover 5 to 25 acres.

Included with this soil in mapping are small areas of Montgomery and Algiers soils and spots of Wea and Warsaw soils at slightly higher elevations. Also included are some narrow areas of Shoals soils adjacent to the stream channel and small areas of gently sloping soils.

This soil is suited to most crops commonly grown in the county if it is artificially drained. Surface runoff is slow, and there is little, if any, hazard of erosion. Seasonal wetness is the main limitation. The surface layer becomes cloddy if tilled when it is wet. A seasonal high water table is a severe limitation for most nonfarm uses. Capability unit IIw-3.

Formation and Classification of the Soils

This section lists the factors and processes of soil formation and describes the effects they have had on the formation of soils in Miami County. It also explains the current system of soil classification and places the soil series in categories of the comprehensive classification system. The soil series in this county, including a profile representative of each series, are described in the section "Descriptions of the Soils." The last part of this section shows laboratory data for selected soils.

Factors of Soil Formation

Soils form through the actions of weathering and biotic activity on rock and unconsolidated soil materials that have been deposited or accumulated by geologic activity. The characteristics of the soil at any given point depend on the interrelationships of five factors: the physical and mineralogical composition of the parent material; the climate under which the parent material has formed into soil; the living organisms, or biology, in and on the soil; the relief, or form of the land; and the length of time that the soil has developed by combined activity of soil-forming factors. Because different factors are dominant in different places, many kinds of soil have been formed.

Parent material

Parent material is the unconsolidated mass of material in which a soil forms. Most soils in Miami County formed in glacial till of Wisconsin age. The content of calcium carbonate in the till ranges from 25 to 45 percent. In most places the till is thick, but in some places it is thin over bedrock. Miamian, Celina, Crosby, and Brookston soils are examples of soils that formed in thick deposits of till and are deep to bedrock. Milton soils formed in thin deposits of till and are moderately deep to limestone bedrock.

Some soils in this county formed in glacial outwash that contains much sand and gravel. Eldean and Wea soils are examples. In most places these soils are good sources of sand and gravel. In some places the coarse-textured outwash has been covered with silty and loamy deposits, and Ockley and Westland soils formed in these places.

Soils on flood plains formed in material that washed from nearby uplands. These soils have very little profile development. Genesee and Shoals soils are examples.

Climate

The climate of Miami County is humid, temperate, and continental. During the formation of the soils it was favorable for physical and chemical weathering and for biological activity.

Rainfall has supplied sufficient percolating water to leach carbonates to a moderate depth, as in the Miamian, Celina, and Crosby soils. Frequent rains produced wetting and drying cycles that favor translocation of clay minerals and the formation of soil structure, as in the Miamian and Ockley soils.

Temperature variations favored physical and chemical weathering of the soil material. Freezing and thawing furthered the development of soil structure. The warm summer accelerated the chemical weathering of primary minerals.

Both rainfall and temperature have been conducive to plant growth and the subsequent accumulation of organic matter in all the soils. Additional information about the climate is given in the section "General Nature of the County."

Living organisms

The vegetation at the time of settlement in Miami County was hardwood forest in which beech, maple, oak, hickory, and ash were the most abundant trees. There were grassy clearings on well-drained sites and marshy openings in poorly drained swales.

Soils that formed in the forested areas are acid and moderately fertile. They include Miamian, Crosby, and Blount soils. The well-drained grassy clearings have dark, less acid, and more fertile soils. Examples are Corwin and Odell soils. In marshy swales are very poorly drained, dark, fertile soils, including Brookston, Millsdale, and Westland soils.

Small animals, insects, worms, and roots form channels that make the soil permeable. Animals mix the soil materials and contribute organic matter. Worm channels or casts are plentiful in the highly organic surface layer of Corwin and Odell soils. Crawfish channels are common in the more poorly drained Brookston, Westland, and Montgomery soils.

The activities of man also affect soil formation. Plowing and planting introduce vegetative changes. Some areas are drained, some are irrigated, and in places the soil material is removed for construction purposes. Also, the use of lime and fertilizer changes the chemistry of the soils. Each of these activities, in its own way, affects the formation of the soil.

Relief

Many of the differences among soils in this county are caused by differences in topography. For example, Miamian, Celina, and Crosby soils formed in similar conditions, except for natural drainage, which depends mainly on topography. Well-drained Miamian soils are in areas where surface and internal drainage are good. Moderately well drained Celina soils are in areas of more gently sloping topography where the water table is seasonally high for brief but significant periods. Somewhat poorly drained Crosby soils are mainly level or nearly level, and surface runoff is slow. These soils have a seasonal high water table for significant periods.

Poorly drained or very poorly drained soils in Miami County are level to nearly level and are mainly in depressions. In these areas, runoff is slow to ponded, and silty and clayey materials accumulate. Because organic matter decomposes slowly in wet soils, most poorly drained and very poorly drained soils have a thick, dark-colored surface layer. Pewamo, Brookston, and Millsdale soils are examples. The muck soils, such as Edwards soils, are in swampy depressions where the soil material is saturated most of the time.

The steeper soils in any series are generally thinner than the more gently sloping soils. This is the result of more rapid runoff and greater erosion on the steeper soils.

Time

Time is needed for the other soil-forming factors to produce their effects. The age of a soil is indicated, to some extent, by the degree of formation of its profile. In many places, however, factors other than time are responsible for most of the differences in the different soils. If the parent material weathers slowly, the profile develops slowly. If slopes are steep, so that soil is removed almost as fast as it is formed, distinct horizons are not developed. The steep and very steep Rodman soils, for example, have a very weakly expressed subsoil.

Most soils in the county, however, have a well-formed profile. These include the Miamian, Ockley, Celina, and Crosby soils. But on the flood plains, frequent depositions of fresh sediment periodically interrupt the soil-forming process. Ross and Genesee soils are examples of soils on flood plains in which horizons other than the surface layer are not well developed.

Processes of Soil Formation

The factors of soil formation discussed previously largely control or influence four soil-forming processes (*12*) : additions, losses, alterations, and transfers. Some processes promote differences within a soil and others retard or preclude differences.

In this county the most obvious example of an addition to the soil is that of organic matter. Soils that formed under deep-rooted grasses or that have a high water table which restricts decomposition of organic matter, have a deep, dark-colored surface horizon. Examples are the Brookston or Wea soils. Some organic matter accumulates as a thin surface mat in most of the soils. This dark layer is generally obliterated by cultivation, however, and severe erosion may remove all evidence of this addition to the profile.

Montgomery, Westland, and Millsdale soils are seasonally waterlogged; they continually accumulate bases brought in by ground water. In these soils, more bases generally are added than are lost. Medway, Shoals, Ross, Eel, and Genesee soils periodically receive soil material from floodwaters. Additions of lime and fertilizer to cultivated areas counteract, or even exceed, normal losses of plant nutrients.

Leaching of carbonates from calcareous parent materials is one of the most significant examples of losses that precede many other chemical changes in the solum. Most of the glacial till in Miami County has a high carbonate content (25 to 45 percent).

Leaching has removed the carbonates from most of the soils to a depth of 2 feet or more. Thus, the upper 2 feet of most soils now is acid. Other minerals in the soil are subject to the same chemical weathering, but their resistance is higher and removal is slower. Following the removal of carbonates, the alteration of such minerals as biotite and feldspars causes changes of color within the profile. When free iron oxides are segregated by a fluctuating high water table they produce gray colors and mottling, as in Brookston and Millsdale soils. If a seasonal high water table does not occur within the profile, brownish colors result, and these have stronger chroma or redder hue than those of the C horizon.

Seasonal wetting and drying of the soil profile is largely responsible for the transfer of clay from the A horizon to the ped surfaces in the B horizon. The fine clay becomes suspended in percolating water that moves through the surface layer and is carried by the water to the subsoil. There, the fine clays are deposited on the ped surfaces by drying or by precipitation caused by free carbonates. The transfer of fine clay accounts for the clay coatings on ped surfaces in the B horizon, as in the Eldean, Celina, and Miamian soils.

Transformations of mineral compounds occur in most soils. The results are most apparent if the development of horizons is not affected by rapid erosion or by accumulation of material at the surface. The primary silicate minerals are weathered chemically to produce secondary minerals, mainly those of the layer-lattice silicate clays. Most of the layer-lattice clays remain in the soil profile, but are transferred from the upper horizons to the lower ones.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Survey in 1965. Because this system is under continual study, readers interested in development of the current system should search the latest literature available (*15*).

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great groups, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Miami County are placed in four categories of the current system. Classes of the current systems are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Moll-i-sol).

SUBORDER. Each order is subdivided into suborders that are based primarily on those soils characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of water-logging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquoll,* (*Aqu,* meaning water or wet, and *oll,* from Mollisol).

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquolls (*Hapl,* meaning simple horizons, *aqu* for wetness or water, and *oll,* from Mollisols).

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Algiers [1]	Fine-loamy, mixed, non-acid, mesic	Aquic Udifluvents	Entisols.
Blount	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols.
Brookston	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Celina	Fine, mixed, mesic	Aquic Hapludalfs	Alfisols.
Corwin	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Crosby	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols.
Eel [2]	Fine-loamy, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols.
Eldean	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Genesee [3]	Fine-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisols.
Glynwood	Fine, illitic, mesic	Aquic Hapludalfs	Alfisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Linwood	Loamy, mixed, euic, mesic	Terric Medisaprists	Histosols.

TABLE 8—*Classification of soil series*—Continued

Series	Family	Subgroup	Order
Lorenzo	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiudolls	Mollisols.
Martinsville [4]	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Medway	Fine-loamy, mixed, mesic	Fluvaquentic Hapludolls	Mollisols.
Miamian	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Millsdale	Fine, mixed, mesic	Typic Argiaquolls	Mollisols.
Milton	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Montgomery	Fine, mixed, mesic	Typic Haplaquolls	Mollisols.
Ockley	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Odell	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Pewamo	Fine, mixed, mesic	Typic Argiaquolls	Mollisols.
Randolph	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Ritchey [5]	Loamy, mixed, mesic	Lithic Hapludalfs	Alfisols.
Rodman	Sandy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Ross	Fine-loamy, mixed, mesic	Cumulic Hapludolls	Mollisols.
Ross variant	Loamy, mixed, mesic	Lithic Hapludolls	Mollisols.
Shoals [6]	Fine-loamy, mixed, non-acid, mesic	Aeric Fluvaquents	Entisols.
Shoals variant	Fine-loamy, mixed (calcareous), mesic	Aeric Fluvaquents	Entisols.
Sleeth	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Stonelick	Coarse-loamy, mixed (calcareous), mesic	Typic Udifluvents	Entisols.
Wallkill	Fine-loamy, mixed, non-acid, mesic	Thapto-Histic Fluvaquents	Entisols.
Warsaw	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiudolls	Mollisols.
Wea	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Westland	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.

[1] Algiers soils in this county are taxadjuncts to the Algiers series. They have more structure development in the B2 horizon than Algiers soils elsewhere. They are classified as Dystric Fluventic Eutrochrepts, in the fine-loamy, mixed, mesic family.
[2] Eel soils in this county are taxadjuncts to the Eel series because they have carbonates throughout the solum and are dominantly mildly alkaline in the surface layer.
[3] Genesee soils in this county are taxadjuncts to the Genesee series because they have carbonates throughout the solum.
[4] Martinsville soils in this county are taxadjuncts to the Martinsville series because they have a solum slightly thinner than that of Martinsville soils elsewhere.
[5] Ritchey soils in this county are taxadjuncts to the Ritchey series because they have slightly more clay in the subsoil than Ritchey soils elsewhere. They are classified as Lithic Hapludalfs in the clayey, mixed, mesic family.
[6] Shoals soils in this county are taxadjuncts to the Shoals series because they have carbonates throughout the soil and have slightly higher reaction in the upper part of the solum than Shoals soils elsewhere. They are classified as Aeric Fluvaquents in the fine-loamy, mixed (calcareous), mesic family.

of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups can also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplaquolls (a typical Haplaquoll).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae. An example is the fine, mixed, mesic family of Typic Haplaquolls.

SERIES. The series has the narrowest range of characteristics of the categories in the classification system. It is defined in the section "How This Survey Was Made." A detailed description of each soil series in the county is given in the section "Descriptions of the Soils."

Some of the soils in this county do not fit in a series that has been recognized in the classification system, but recognition of a separate series would not serve a useful purpose. Such soils are named for the series they strongly resemble because they differ from those series in ways too small to be of consequence in interpreting their use or behavior. Soil scientists designate such soils as taxadjuncts to the series for which they are named. In this survey, soils named in the Algiers, Eel, Genesee, Martinsville, Ritchey, and Shoals series are taxadjuncts to those series.

Laboratory Data

Laboratory data are given in table 9 for soil profiles representing nine soil series in Miami County. Profile descriptions for these series are given either in the section, "Descriptions of the Soils," or in this section. The profile descriptions given in this section represent part of the range of the series, but represent a smaller part of the series in the county than the profiles described in the series description. Data given in table 9 were obtained by laboratory analyses at the Agronomy Department, Ohio Agricultural Research and Development Center (OARDC), Columbus, Ohio. The soils analyzed were selected to add to the knowledge of Ohio soils and to aid in their proper classification and interpretation.

Published and unpublished laboratory data are available for nearly all Miami County series. Published laboratory data are available in soil surveys of nearby counties. Unpublished laboratory data are on file at the Agronomy Department OARDC, Columbus, Ohio; the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus, Ohio; and the Soil Conservation Service, State Office, Columbus, Ohio.

The following paragraphs outline some of the procedures used to obtain the data presented in table 9.

Particle size distribution data were obtained by the pipette method outlined by Steele and Bradfield (*13*), but using sodium hexametaphosphate as the dispersing agent and a 10 gm. soil sample. The sand fractions were determined by sieving. The fine silt and coarse clay ($20.0.2\mu$) were determined by sedimentation and the fine clay ($<0.2\mu$) was determined by sedimentation in a centrifuge. Coarse silt was obtained by substracting sand, fine silt, and clay from the total sample. The percentage of organic matter was determined by a dry combustion method. Extractable bases were extracted with a neutral solution of ammonium acetate. The extractable K in this solution was determined by a flame photometer (*11*). Extractable Ca and Mg in this solution were determined by the EDTA titration method (*4*). Extractable H (which also includes titratable Al) was determined by the triethanolamine method (*11*), and cation exchanges capacities were calculated by the summation of extractable cations. Calcium carbonate equivalent was determined by the quantitative gasometric method (*5*). All pH measurements were made using a 1:1 soil-water ratio.

Brookston, Crosby, Genesee, and Warsaw profiles from which samples were taken are described in the section "Descriptions of the Soils." The Glynwood, Miamian, Millsdale, Milton, and Randolph profiles from which samples were taken are described in the following paragraphs.

GLYNWOOD SERIES

Profile of Glynwood silt loam (MMS3) in SW¼ NW¼ sec. 6, T. 8 N., R. 5 E., Newberry Township. This profile was sampled to help classify Glynwood soils. It differs from the profile described as representative of the series by being under wooded vegetation.

O1—2 inches to 0, leaf litter.

A1—0 to 3 inches, very dark gray (10YR 3/1) silt loam; moderate, fine and medium, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2—3 to 8 inches, grayish-brown (2.5Y 5/2) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; strongly acid; gradual, smooth boundary.

B1—8 to 11 inches, brown (10YR 5/3) light silty clay loam; few, medium, distinct, grayish-brown (2.5Y 5/2) mottles; moderate, fine and medium, subangular blocky structure; firm; common roots; strongly acid; clear, smooth boundary.

IIB21t—11 to 14 inches, dark yellowish-brown (10YR 4/4) silty clay; few, medium, faint, grayish-brown (10YR 5/2) mottles; weak, medium, prismatic structure parting to moderate, fine, angular blocky; firm; few roots; thin, patchy, pale-brown (10YR 6/3) clay films on ped faces; few pebbles; slightly acid; clear, smooth boundary.

IIB22t—14 to 18 inches, yellowish-brown (10YR 5/6) clay; few, medium, distinct, grayish-brown (10YR 5/2) and dark grayish-brown (10YR 4/2) mottles; moderate, medium and coarse, prismatic structure parting to moderate, medium, angular and subangular blocky; firm; few roots; thin, continuous, grayish-brown (10YR 5/2) clay films on ped faces; few pebbles; slightly acid; gradual, smooth boundary.

IIB23t—18 to 24 inches, dark yellowish-brown (10YR 3/4) clay; few, medium, distinct, dark grayish-brown (10YR 4/2) and yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to moderate, medium, angular and subangular blocky; firm; few roots; thin patchy clay films on ped faces; few pebbles; neutral; gradual, wavy boundary.

IIB3t—24 to 29 inches, dark-brown (10YR 3/3) clay loam; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to weak, fine, angular blocky; firm; thin patchy clay films on vertical ped faces; few pebbles; mildly alkaline, calcareous; gradual, wavy boundary.

IIC—29 to 44 inches, dark grayish-brown (10YR 4/2) clay loam; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; firm; 5 to 10 percent limestone fragments and black shale; mildly alkaline, calcareous.

MIAMIAN SERIES

Profile of Miamian silt loam, limestone substratum (MM-18) in SE¼NE¼ sec. 16, T. 4 N., R. 6 E., Monroe Township. This profile was sampled to help identify Miamian, limestone substratum soils. It differs from the profile described as representative of the series by being underlain by limestone bedrock at a depth of less than 80 inches.

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, medium and coarse, granular structure; friable; neutral; few roots; abrupt, smooth boundary.

B1—9 to 12 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; firm; few roots; neutral; clear, smooth boundary.

TABLE 9.—*Laboratory data*

[Analyses by the Agronomy Department, Ohio Agricultural

Soil series and sample number	Horizon	Depth	USDA texture	Particle-size distribution: Very coarse sand (2–1 mm)	Coarse sand (1–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)
		Inches		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Brookston, MM–17.	Ap	0–11	Silty clay loam	1.3	3.2	2.7	6.8	4.8
	Blg	11–17	Silty clay loam	1.9	2.6	2.3	5.7	4.4
	B2tg	17–31	Silty clay loam	2.2	3.7	2.9	6.2	4.1
	B3tg	31–39	Silty clay loam	2.3	3.2	2.8	6.4	4.4
	C	39–60	Loam	3.8	6.5	4.9	10.2	9.1
Crosby, MM–20.	Ap	0–8	Silt loam	1.5	3.1	3.1	6.6	5.4
	B&A	8–11	Silty clay loam	.5	1.5	1.3	2.9	3.2
	B21t	11–20	Silty clay	.4	1.1	1.2	3.5	3.8
	B22t	20–24	Silty clay loam	1.2	2.1	2.3	7.2	7.2
	B3	24–28	Loam	4.0	4.6	3.7	9.2	8.8
	C	28–60	Loam	4.9	6.5	5.0	11.4	9.4
Genesee, MM–22.	Ap	0–11	Silt loam	.7	1.6	1.3	6.4	9.5
	B	11–25	Silt loam	.8	2.9	1.9	8.8	11.3
	C1	25–43	Loam	2.5	6.7	4.9	17.8	12.8
	C2	43–60	Coarse sand	22.9	42.9	15.5	6.1	2.0
Glynwood, MM–S3.	A1	0–3	Silt loam	-------	-------	-------	-------	-------
	A2	3–8	Silt loam	-------	-------	-------	-------	-------
	B1	8–11	Silty clay loam	-------	-------	-------	-------	-------
	IIB21t	11–14	Silty clay	-------	-------	-------	-------	-------
	IIB22t	14–18	Clay	-------	-------	-------	-------	-------
	IIB23t	18–24	Clay	-------	-------	-------	-------	-------
	IIB3t	27–29	Clay loam	-------	-------	-------	-------	-------
	IIC1	40–44	Clay loam	-------	-------	-------	-------	-------
Miamian, limestone substratum, MM–18.	Ap	0–9	Silt loam	.8	3.1	2.9	7.9	6.5
	B1	9–12	Silt loam	1.5	2.6	2.8	7.6	5.7
	B21t	12–24	Clay loam	2.8	4.9	3.8	9.9	6.1
	B22t	24–28	Clay loam	1.4	3.3	3.7	10.3	6.9
	B3t	28–35	Clay loam	2.7	4.2	3.0	8.0	5.7
	C	35–53	Loam	7.3	8.8	6.2	4.4	9.7
Millsdale, MM–15.	Ap	0–7	Silty clay loam	.9	2.5	2.3	4.8	4.7
	A1	7–12	Silty clay	1.4	2.7	2.1	4.1	3.2
	B21tg	12–16	Silty clay	1.6	2.3	1.7	3.1	2.6
	B22tg	16–21	Silty clay	.7	1.4	1.2	2.5	2.2
	B23tg	21–28	Clay loam	1.3	3.3	2.0	9.0	8.3
	IIB3tg	28–34	Sandy loam	1.1	5.6	4.7	38.9	25.7
Milton, MM–19.	Ap	0–9	Silt loam	2.0	3.8	2.7	7.3	5.1
	B1t	9–13	Clay loam	2.3	3.6	3.0	7.7	6.0
	B21t	13–28	Clay loam	3.0	4.6	3.9	9.6	6.4
	IIB22t	28–33	Clay loam	4.6	6.4	4.5	11.8	7.7
Randolph, MM–12.	Ap	0–8	Silt loam	1.1	1.7	1.4	2.1	2.0
	A	8–10	Silt loam	.5	1.7	1.1	1.7	1.6
	B1tg	10–15	Silty clay loam	1.1	2.2	1.1	1.6	1.5
	B21t	15–21	Clay	.4	.8	.8	3.2	2.1
	IIB22t	21–29	Clay	.0	.6	.9	19.6	21.7
	IIC	29–34	Clay	.1	.5	.4	6.0	6.2
Warsaw, MM–32.	Ap	0–9	Silt loam	.8	3.5	1.6	6.1	8.5
	A1	9–18	Silt loam	1.1	4.5	3.3	5.8	6.9
	B1	18–23	Clay loam	2.8	8.5	2.5	4.9	5.9
	B21t	23–28	Loam	4.3	10.3	3.0	5.6	6.0
	IIB22t	28–34	Loam	7.9	14.1	4.9	5.8	5.7
	IIB3t	34–37	Loam	9.7	9.5	4.4	8.1	8.2
	IIC	37–60	Sand	19.3	52.9	14.9	2.5	.6

for selected soils

Research and Development Center (OARDC), Columbus]

Particle-size distribution—Continued				Reaction	Organic-matter content	Calcium carbonate equivalent	Extractable cations (milliequivalents per 100 grams of soil)				Sum of extractable cations	Sum of bases	Base saturation
Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)	Fine clay (<0.0002 mm)				H	Ca	Mg	K			
Percent	*Percent*	*Percent*	*Percent*	*pH*	*Percent*	*Percent*					*Meq per 100 gm of soil*	*Meq per 100 gm of soil*	*Percent*
18.8	47.7	33.5	19.0	6.6	5.0	------	7.9	16.0	4.7	.47	29.1	21.2	73
16.9	46.6	36.5	18.7	6.7	1.9	------	5.5	14.4	5.1	.36	25.4	19.9	78
19.1	46.7	34.2	17.7	7.1	1.2	------	3.1	11.4	4.2	.33	19.0	15.9	84
19.1	47.2	33.7	16.7	7.6	------	1.3	------	------	------	------	------	------	------
34.5	45.1	20.4	9.0	8.1	------	30.6	------	------	------	------	------	------	------
19.7	62.0	18.3	3.9	6.2	2.1	------	5.2	6.4	2.2	.26	14.1	8.9	63
9.4	53.4	37.2	18.8	6.1	.9	------	5.5	10.3	6.3	.55	22.6	17.1	76
10.0	48.6	41.4	23.6	6.7	.7	------	6.8	15.2	7.6	.37	30.0	23.2	77
20.0	45.6	34.4	18.2	7.7	------	5.6	------	------	------	------	------	------	------
30.3	48.3	21.4	8.6	8.3	------	34.4	------	------	------	------	------	------	------
37.2	44.3	18.5	7.3	8.3	------	34.3	------	------	------	------	------	------	------
19.5	55.9	24.6	6.9	8.0	3.3	17.6	------	------	------	------	------	------	------
25.7	50.8	23.5	7.1	8.1	2.9	13.9	------	------	------	------	------	------	------
44.7	37.0	18.3	6.1	8.2	1.9	22.4	------	------	------	------	------	------	------
89.4	6.6	4.0	1.4	8.4	.3	40.6	------	------	------	------	------	------	------
15.4	66.8	17.8	------	7.1	------	------	5.8	15.8	4.9	.44	26.9	21.1	78
16.2	60.9	22.9	------	5.3	------	------	9.1	5.2	2.4	.17	16.9	7.8	46
13.8	56.8	29.4	------	5.4	------	------	8.5	7.7	2.9	.22	19.3	10.8	56
14.2	43.0	42.8	------	6.4	------	------	8.0	14.6	4.5	.39	27.5	19.5	71
13.5	35.2	51.3	------	6.3	------	------	8.2	14.0	5.1	.50	27.8	19.6	70
17.4	32.9	49.7	------	6.8	------	------	5.2	15.7	5.8	.51	27.2	22.0	81
22.1	43.3	34.6	------	7.8	------	26.3	------	------	------	------	------	------	------
26.4	42.7	30.9	------	7.8	------	31.2	------	------	------	------	------	------	------
21.2	62.3	16.5	2.9	7.1	2.1	------	3.3	5.5	1.1	.37	10.3	7.0	68
20.2	53.2	26.6	10.6	6.7	.9	------	4.4	6.0	1.6	.33	12.3	7.9	64
27.5	33.6	38.9	21.1	6.0	.9	------	7.6	7.6	3.7	.33	19.2	11.6	60
25.6	35.5	38.9	21.7	5.7	.9	------	6.5	7.0	3.3	.33	17.1	10.6	62
23.6	38.3	38.1	22.9	7.2	------	1.4	------	------	------	------	------	------	------
36.4	48.6	15.0	5.6	8.2	------	39.6	------	------	------	------	------	------	------
15.2	46.8	38.0	12.6	7.2	5.1	1.8	5.0	20.9	9.2	.77	35.9	30.9	86
13.5	45.0	41.5	16.7	7.2	3.9	1.7	5.7	21.5	10.3	.48	38.0	32.3	85
11.3	44.1	44.6	21.8	7.3	2.0	1.0	5.4	20.0	8.8	.46	34.7	29.3	84
8.0	47.2	44.8	22.0	7.2	1.4	.4	4.5	18.5	8.2	.44	31.6	27.1	86
24.7	39.8	35.5	17.2	7.5	------	3.7	3.1	13.8	7.5	.34	24.7	21.6	87
76.0	13.7	10.3	5.7	7.8	------	39.9	------	------	------	------	------	------	------
20.9	62.1	17.0	4.5	6.4	2.6	------	5.1	6.2	1.5	1.09	13.9	8.8	65
22.6	49.0	28.4	10.3	5.7	1.0	------	7.6	5.2	2.1	.82	15.7	8.1	52
27.5	34.1	38.4	21.6	4.9	.9	------	10.7	6.2	2.8	.51	20.2	9.5	47
35.0	33.3	31.7	17.1	7.4	------	8.0	------	------	------	------	------	------	------
8.3	71.7	20.0	4.2	6.1	2.2	------	6.6	7.2	3.9	.15	17.9	11.3	63
6.6	72.4	21.0	5.8	6.2	1.3	------	5.5	6.7	3.5	.14	15.8	10.3	65
7.5	65.3	27.2	10.5	6.3	.8	------	6.2	9.7	4.5	.20	20.6	14.4	70
7.3	37.2	55.5	31.6	6.7	1.4	------	7.5	18.7	7.9	.52	34.6	27.1	78
42.3	15.0	42.7	23.8	7.6	------	44.2	------	------	------	------	------	------	------
13.2	17.7	69.1	27.5	7.4	------	13.5	------	------	------	------	------	------	------
20.5	54.5	25.0	5.2	7.6	------	10.9	------	------	------	------	------	------	------
21.6	56.1	22.3	5.4	7.7	------	.5	------	------	------	------	------	------	------
24.6	48.2	27.2	9.5	7.7	------	.3	------	------	------	------	------	------	------
29.2	44.0	26.8	10.4	7.8	------	.6	------	------	------	------	------	------	------
37.5	35.9	26.6	11.2	7.8	------	.4	------	------	------	------	------	------	------
39.9	39.5	20.6	7.9	7.9	------	13.1	------	------	------	------	------	------	------
90.2	4.5	5.3	3.8	8.4	------	5.6	------	------	------	------	------	------	------

B21t—12 to 24 inches, dark-brown (7.5YR 4/4) heavy clay loam; moderate, medium, angular blocky structure; firm; thin continuous clay films on ped faces; slightly acid; gradual, smooth boundary.

B22t—24 to 28 inches, dark-brown (7.5YR 4/4) heavy clay loam; moderate, medium and coarse, angular and subangular blocky structure; firm; thin continuous clay films on ped faces; few dark concretions; 5 percent pebbles; slightly acid; clear, smooth boundary.

B3t—28 to 35 inches, dark-brown (10YR 4/3) clay loam; weak, coarse, subangular blocky structure; firm; thin patchy clay films on ped faces; common medium dark concretions; few, fine, reddish-brown (5YR 4/4) stains; 10 percent pebbles; neutral; clear, smooth boundary.

C—35 to 53 inches, yellowish-brown (10YR 5/4) loam till; massive; friable; 10 percent pebbles; moderately alkaline, calcareous; abrupt, smooth boundary.

IIR—53 inches, light yellowish-brown (10YR 6/4) limestone bedrock.

MILLSDALE SERIES

Profile of Millsdale silty clay loam (MM-15) in NE¼NE¼ sec. 28, T. 2 E., R. 9 N., Bethel Township. This profile was sampled to help identify Millsdale soils. It differs from the profile described as representative of the series by having a grayer and sandier B horizon.

Ap—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm; neutral; abrupt, smooth boundary.

A1—7 to 12 inches, black (10YR 2/1) light silty clay; moderate, fine and medium, angular blocky structure; firm; neutral; abrupt, smooth boundary.

B21tg—12 to 16 inches, black (10YR 2/1) silty clay; few, medium, faint, very dark grayish-brown (10YR 3/2) mottles; moderate, medium, angular blocky structure; firm; thin patchy clay films on ped faces; neutral; clear, smooth boundary.

B22tg—16 to 21 inches, olive-gray (5Y 4/2) silty clay; many, medium, distinct, dark yellowish-brown (10YR 4/4) and light olive-brown (2.5Y 5/6) mottles; moderate, medium and coarse, angular blocky structure; firm; thick continuous clay films on ped faces; few black (10YR 2/1) ped coatings; neutral; abrupt, smooth boundnary.

B23tg—21 to 28 inches, olive-gray (5Y 5/2) clay loam; common, medium, distinct, light olive-brown (2.5Y 5/6) and yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure parting to moderate, coarse, subangular blocky; firm; thin clay films on ped faces; many partly weathered limestone fragments; mildly alkaline; abrupt, irregular boundary.

IIB3tg—28 to 34 inches, gray (N 6/0) sandy loam; common, fine, distinct, light olive-brown (2.5Y 5/6) and dark yellowish-brown (10YR 4/4) mottles; very weak, coarse, subangular blocky structure; friable; 60 percent partly weathered limestone fragments; very patchy thin clay films along channels and bridging sand grains; mildly alkaline; abrupt, smooth boundary.

IIR—34 inches, very pale brown (10YR 7/4) limestone bedrock.

MILTON SERIES

Profile of Milton silt loam (MM-19) in SE¼SW¼ sec. 21, T. 4 N., R. 6 E., Monroe Township. This profile was sampled to help identify Milton soils. It differs from the profile described as representative of the series by being very strongly acid in the B horizon.

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, medium and coarse, granular structure; friable; slightly acid; abrupt, smooth boundary.

B1t—9 to 13 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, fine and medium, subangular blocky structure; firm; few patchy clay films on ped faces; medium acid; clear, smooth boundary.

B21t—13 to 28 inches, brown (7.5YR 4/4) heavy clay loam; moderate, medium, angular and subangular blocky structure; firm; thin continuous clay films on ped faces; few dark concretions; very strongly acid; clear, smooth boundary.

IIB22t—28 to 33 inches, dark-brown (10YR 4/3) clay loam; moderate, medium, subangular blocky structure; firm; thin, continuous, dark-brown (7.5YR 3/2) clay films on vertical ped faces; 10 percent limestone fragments, ¼ to 1 inch in diameter; common dark concretions; mildly alkaline; abrupt, wavy boundary.

IIR—33 inches, light yellowish-brown (10YR 6/4) limestone bedrock.

RANDOLPH SERIES

Profile of Randolph silt loam (MM-12) in SE¼SE¼ sec. 18, T. 6 N., R. 5 E., Union Township. This profile was sampled to help identify Randolph soils. It is similar to the one described as representative of the series but has an A2 horizon.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—8 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, distinct, dark yellowish-brown (10YR 4/4) and light brownish-gray (10YR 6/2) mottles; moderate, medium, granular structure; friable; slightly acid; clear, smooth boundary.

B1tg—10 to 15 inches, grayish-brown (10YR 5/2) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) and pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; firm; thin patchy clay films on ped faces; 3 percent glacial pebbles; slightly acid; clear, smooth boundary.

B21t—15 to 21 inches, light yellowish-brown (10YR 6/4) clay; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; firm; thin, patchy, very dark brown (10YR 2/2) and very dark grayish-brown (10YR 3/2) clay films on ped faces; thick continuous clay films on ped faces and along vertical cracks; 5 percent pebbles; neutral; clear, wavy boundary.

IIB22t—21 to 29 inches, light yellowish-brown (10YR 6/4) channery clay; moderate, medium, subangular blocky structure; firm; thin, patchy, very dark brown (10YR 2/2) and very dark grayish-brown (10YR 3/2) clay films on ped faces; 45 percent limestone fragments; mildly alkaline; abrupt, irregular boundary.

IIC—29 to 30 inches, yellowish-brown (10YR 5/6) very channery clay; massive; very firm; patchy black (10YR 2/1) and very dark brown (10YR 2/2) coatings on stone fragments; 80 percent limestone fragments; mildly alkaline; abrupt, irregular boundary. This horizon is discontinuous.

IIR—30 inches, light yellowish-brown (10YR 6/4) limestone bedrock.

General Nature of the County

Miami County was first settled in 1797. In 1807 Miami County was formed from a part of Montgomery County, and Staunton was made the first county seat. A year later, Troy, after it was platted, became the county seat.

The county's most valuable natural resources are soil and water. Sand and gravel and limestone are other important natural resources. There are no known deposits of coal, gas, or oil in the county.

Climate

The climate of Miami County is continental (*8*). It is marked by wide annual, daily, and day-to-day ranges of temperature. Summers are moderately warm and humid; a few days have a temperature of 90° F or higher. Winters are reasonably cold and cloudy, and an average of up to 4 days have subzero temperatures. The average date of the last freeze (32°) in spring is about May 1, and the first freeze in fall is about October 15. The average length of the growing season is about 168 days.

Precipitation in Miami County varies widely from year to year, which is characteristic of continental climates, but it is normally abundant and well distributed throughout the year. The least amount of precipitation occurs in the fall. Showers and thundershowers account for most of the rainfall in the growing season.

Data from the weather station at the Dayton Municipal airport are listed in table 10. This information is fairly representative of temperature and precipitation conditions in Miami County.

Soil moisture goes through a seasonal cycle each year. It reaches its lowest point in October and is replenished in winter and early in spring when precipitation exceeds the water lost by evaporation. Because the water needs of all crops reach a maximum in July and August, and rainfall is almost always insufficient to meet those needs, there is a progressive drying of all soils.

TABLE 10.—*Temperature and precipitation data*

[Data from records kept at the Municipal Airport, Dayton, Ohio]

Month	Temperature [1]			Precipitation	
	Average daily maximum	Average daily minimum	Monthly average	Average monthly total [1]	Mean monthly total of snow and sleet [2]
	°F	°F	°F	Inches	Inches
January	37	22	30	3.18	6.8
February	39	23	31	2.32	5.4
March	48	30	39	3.12	5.8
April	61	41	51	3.32	.6
May	72	51	62	3.37	([3])
June	81	62	72	4.10	0
July	85	65	75	3.53	0
August	84	64	74	2.88	0
September	77	56	67	2.59	0
October	66	45	56	2.23	.1
November	50	34	42	2.67	2.5
December	39	24	31	2.37	6.2
Year	62	43	52	36.04	27.4

[1] Climatological standard normals (1931–1960).
[2] Length of record is 25 years.
[3] Trace.

Physiography, Relief and Drainage

Miami County is in the Till Plains section of the Central Lowlands physiographic province. It is characterized by generally nearly level topography except for minor relief in areas along streams and small areas of kames and low recessional moraines. The moraines were formed as long belts of higher land during temporary halts in the retreat of the final stage of the Wisconsin glacier.

The highest point in the county, 1,155 feet above sea level, occurs along the county line, 1.75 miles north of Lena. The lowest spot, 770 feet above sea level, occurs along the eastern side of the Miami River on the Miami-Montgomery County line. Most land in Miami County lies between the 900 and 1,100 foot contours.

Relief near the rivers ranges from 50 feet on the upper part of the Stillwater River to 110 feet on the lower part, and 70 feet on the upper part of the Great Miami River to 130 feet on the lower part. This relief occurs in relatively short distances and the topography is sloping to very steep.

All of the county is within the watershed of the Great Miami River. The two major watercourses within the county are the Upper Miami River and its Stillwater tributary, which flow roughly parallel to one another in a south-southeasterly direction across the county. The Mad River tributary, outside the county, drains the southeast corner of Bethel Township.

Harris Creek, Greenville Creek, Painter Creek, and Ludlow Creek enter the Stillwater River from the west. Spring Creek, Lost Creek, and the Honey Creek tributaries enter the Miami River from the east. The area between the two rivers is drained by minor watercourses.

Much of the till plain is nearly level to gently sloping on watershed divides and consists of many very poorly drained to somewhat poorly drained soils.

Geology

Most of the soils on uplands of Miami County formed in two or more distinguishable layers of geologic parent materials.

The uppermost layers of many soils on uplands formed in loess, a windblown dust deposit. This silty layer is seldom more than 12 inches thick. It was mostly deposited shortly after the main ice mass of the glacier receded northward about 15,000 years ago.

The dominant geologic parent material in Miami County is glacial till. This deposit is a mixture of unassorted boulders, stones, gravel, sand, silt, and clay and is spread across the entire county.

Miami County was glaciated more than once, but former deposits were reworked or covered by till and outwash of the Wisconsin age (*6, 17*). This mantle varies in thickness from a few inches where bedrock is exposed to more than 200 feet where it fills old preglacial stream valleys. Wide, low, slightly hummocky ridges of till built up where the glacier stopped for awhile or moved southward briefly. These ridges are recessional moraines. Parts of the Farmersville, Union City, and Bloomer moraines extend across Miami County (*7*). Generally, moraines contain more boulders than most other till areas.

Glacial melt water has sorted and deposited many areas of sand and gravel in Miami County. These glacial outwash deposits are mainly along the major streams, but small deposits are scattered throughout the county. Some outwash areas are capped with finer sediments.

A few deposits in Miami County are lake-laid sediments during temporary glacial ponding. These sediments are mostly silt and clay.

The bedrock in Miami County is a consolidated, parallel-bedded layer of sedimentary rocks. Most of the outcropping bedrock is limestone and dolomite. A small amount of shale outcrops is at the base of the limestone layers. These bedrock formations lay across the broad Cincinnati arch, the crest of which crosses the eastern side of the county in a generally northeasterly direction. Piqua lies on the west flank of the arch and strata beds dip northwest at a low angle, probably about 10 feet per mile (*9*).

The uppermost part of the bedrock strata is the Dayton dolomite. Immediately below is the Brassfield limestone. Both are members of the Silurian System and are hard and light gray or buff colored. The Brassfield limestone is particularly high in calcium carbonate and is quarried at Piqua for steel processing. It is often a fair aquifer for water wells at its lower level.

The lowest and oldest rocks exposed in the county are shales that are in the upper Richmond Group of the Ordovician System. These shales are typically soft, calcareous, and greenish gray or bluish gray. They weather to a putty-like consistency when exposed and are very slowly permeable to water.

Farming

According to the 1969 United States Census of Agriculture, Miami County had 1,715 farms, totaling 224,071 acres. The average size of a farm was 130.6 acres. Most farms, however, were 260 to 499 acres in size. Owners or part owners operated 80.7 percent of the farms.

About 53 percent of the market value of all agricultural products sold in 1969 came from the sale of livestock, poultry, and related products. Cattle and calves brought the most income, followed by hogs and sheep, dairy products, and poultry and poultry products. About 43 percent of farm income and sales came from crops, including nursery plants and hay. Grains were the most economically important crop, followed by nursery and greenhouse plants, and tomatoes and other truck crops. Tobacco, another specialty crop, accounted for little more than 1 percent of total income from crops.

On commercial farms, about 52,000 acres were in field corn, 42,000 in soybeans, 18,000 acres in wheat, 6,540 acres in oats, and 9,000 acres in hay.

According to the 1967 Ohio Soil and Water Conservation Needs Inventory (*10*) about 80 percent of Miami County was used for crops. This same study reported that about 50 percent of the acreage used for crops was receiving adequate conservation treatment. Also, about one-third of the acreage used for crops was in need of drainage for optimum crop production.

Transportation

In Miami County, federal, state, and county roads provide a complete network for transportation. The county is crossed east and west by U.S. Highway 36 and by four state highways; there is access to Interstate Highway 70 just south of the Miami County and Montgomery County line. The county is crossed north and south by Interstate Highway 75 and four state highways. The county is served by three railroad lines. The Dayton Municipal Airport is just south of the county line near Vandalia.

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Glossary

Aggregate, Soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Buried soil. A developed soil, once exposed but now overlain by more recently formed soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or some soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

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 and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized, but only five are characteristic of the soils in Miami County.

Well-drained soils are nearly free from mottling and are commonly coarse textured or are of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Esker (geology). A narrow, winding ridge or mound of stratified gravelly and sandy drift that was deposited by a subglacial stream.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt-water as it flowed from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Horizon, soil. A layer of soil, approximately paralled to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils have moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

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. It may be limited either by the infiltration capacity of the soil or by the rate at which water is applied to the surface soil.

Intensive cropping. Maximum use of the land through the frequent growing of harvested crops.

Kame. (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are these: Terminal, lateral, medial, ground.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past and state of rapid decomposition.

Parent material. Disintegrated and partly weathered rock from whics soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made becaue of difference in the oil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the naural landscape.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Natural	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Root zone. The part of the soil that is penetrated, or can be penetrated, by plant roots.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

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 it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in and the section "General Management of the Soils for Farming" for general information about management.

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page
Ag	Algiers silt loam	53	IIw-1	8
BlA	Blount silt loam, 0 to 2 percent slopes	54	IIw-2	8
BlB	Blount silt loam, 2 to 6 percent slopes	54	IIw-2	8
BlB2	Blount silt loam, 2 to 6 percent slopes, moderately eroded	54	IIIe-4	10
Bs	Brookston silty clay loam	55	IIw-3	9
CeA	Celina silt loam, 0 to 2 percent slopes	56	I-1	7
CeB	Celina silt loam, 2 to 6 percent slopes	56	IIe-1	8
CeB2	Celina silt loam, 2 to 6 percent slopes, moderately eroded	57	IIe-3	8
CoA	Corwin silt loam, 0 to 2 percent slopes	57	I-1	7
CoB	Corwin silt loam, 2 to 6 percent slopes	57	IIe-1	8
CrA	Crosby silt loam, 0 to 2 percent slopes	58	IIw-2	8
CrB	Crosby silt loam, 2 to 6 percent slopes	58	IIw-2	8
Ed	Edwards muck	59	VIw-1	12
Ee	Eel silt loam	60	IIw-4	9
ElA	Eldean loam, 0 to 2 percent slopes	61	IIs-1	9
ElB	Eldean loam, 2 to 6 percent slopes	61	IIe-2	8
ElB2	Eldean loam, 2 to 6 percent slopes, moderately eroded	62	IIe-2	8
EmA	Eldean silt loam, 0 to 2 percent slopes	62	IIs-1	9
EmB	Eldean silt loam, 2 to 6 percent slopes	62	IIe-2	8
EoC2	Eldean-Casco gravelly loams, 6 to 12 percent slopes, moderately eroded	62	IVe-2	11
EoD2	Eldean-Casco gravelly loams, 12 to 18 percent slopes, moderately eroded	62	VIe-1	12
EpD3	Eldean-Casco complex, 6 to 18 percent slopes, severely eroded	63	VIe-1	12
ErB	Eldean-Miamian complex, 2 to 6 percent slopes	63	IIe-2	8
ErC	Eldean-Miamian complex, 6 to 12 percent slopes	63	IIIe-1	10
Gn	Genesee silt loam	64	IIw-4	9
GwB	Glynwood silt loam, 2 to 6 percent slopes	65	IIe-1	8
GwB2	Glynwood silt loam, 2 to 6 percent slopes, moderately eroded	65	IIIe-2	10
GwC2	Glynwood silt loam, 6 to 12 percent slopes, moderately eroded	65	IIIe-2	10
GwD2	Glynwood silt loam, 12 to 18 percent slopes, moderately eroded	65	IVe-1	11
GyC3	Glynwood clay loam, 6 to 12 percent slopes, severely eroded	65	IVe-1	11
GyD3	Glynwood clay loam, 12 to 18 percent slopes, severely eroded	66	VIe-1	12
Ln	Linwood muck	67	IIw-5	9
LrE2	Lorenzo-Rodman gravelly loams, 18 to 50 percent slopes, moderately eroded	68	VIIs-1	12
MaB	Martinsville and Ockley loams, till substratum, 2 to 6 percent slopes	68	IIe-1	8
Md	Medway silt loam	69	IIw-4	9
MhA	Miamian silt loam, 0 to 2 percent slopes	70	I-1	7
MhB	Miamian silt loam, 2 to 6 percent slopes	71	IIe-1	8
MhB2	Miamian silt loam, 2 to 6 percent slopes, moderately eroded	71	IIe-3	8
MhC2	Miamian silt loam, 6 to 12 percent slopes, moderately eroded	71	IIIe-1	10
MhD2	Miamian silt loam, 12 to 18 percent slopes, moderately eroded	71	IVe-1	11
MkA	Miamian silt loam, limestone substratum, 0 to 2 percent slopes	71	I-1	7
MkB	Miamian silt loam, limestone substratum, 2 to 6 percent slopes	71	IIe-1	8
MkB2	Miamian silt loam, limestone substratum, 2 to 6 percent slopes, moderately eroded	72	IIe-3	8
MkC2	Miamian silt loam, limestone substratum, 6 to 12 percent slopes, moderately eroded	72	IIIe-1	10
MlC3	Miamian clay loam, 6 to 12 percent slopes, severely eroded	72	IVe-1	11
MlD3	Miamian clay loam, 12 to 18 percent slopes, severely eroded	72	VIe-1	12
MmE	Miamian and Hennepin silt loams, 18 to 25 percent slopes	72	VIe-1	12
MmF	Miamian and Hennepin silt loams, 25 to 50 percent slopes	73	VIIe-1	12
MnA	Millsdale silt loam, 0 to 2 percent slopes	73	IIIw-2	10
MnB	Millsdale silt loam, 2 to 6 percent slopes	74	IIIw-2	10
MoA	Millsdale silty clay loam, 0 to 2 percent slopes	74	IIIw-1	10
MoB	Millsdale silty clay loam, 2 to 6 percent slopes	74	IIIw-1	10
MpA	Milton silt loam, 0 to 2 percent slopes	75	IIs-1	9
MpB	Milton silt loam, 2 to 6 percent slopes	75	IIe-1	8

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Soil Survey of Miami County, Ohio

E R R A T U M

The General Soil Map in the soil survey of Miami County, Ohio has the wrong color (yellow) in Soil Association No. 4 located in Range R. 6 E. and Township T. 4 N. The correct color for Soil Association No. 4 is green, as shown on the map legend. The association number and soil description are correct as printed.

This erratum should be inserted in each publication next to the General Soil Map located in front of the detailed maps.

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