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# SOIL SURVEY

# Clinton County Ohio

Surveyed by
Ohio Department of Natural Resources
Ohio Agricultural Experiment Station
United States Department of Agriculture

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
in Cooperation with
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Lands and Soil
and
OHIO AGRICULTURAL EXPERIMENT STATION

# HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Clinton County will serve various groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields, and it will add to the knowledge of soil scientists.

In making this survey, soil scientists walked over the fields and woodlands at intervals of 20 to 40 rods. At many places along these intervals, they examined surface soil, subsoil and parent material. They measured slopes with a hand level; noticed differences in growth of crops, weeds, and brush; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming, trees, wildlife, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then cartographers prepared from the photographs the detailed soil map in the back of this report. Fields, woods, roads, streams, and many other landmarks can be seen on the map.

## Locating the soils

Use the index to map sheets to locate your farm on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the sheet of the large map is found on which your farm is located, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map. Suppose, for example, an area located on the map has the symbol BbA1. The legend for the detailed map shows that this symbol identifies Birkbeck silt loam, 0 to 2 percent slopes. The Bb part of the symbol stands for Birkbeck silt loam. The A part of the symbol is given to all soils in the 0 to 2 percent slope range, and the final number refers to the degree of soil erosion. The figure 1 means slight erosion. All the other soil symbols have been made in the same way to show soil type, slope, and degree of erosion. All the soils mapped in Clinton County are described in the section "Descriptions of the Soils."

## Finding information

Special sections of the report will interest different groups of readers. The section "General Soil Areas" will be of interest mainly to those not familiar with the county.

*Farmers and those who work with farmers* can learn about the soils in the section "Descriptions of the Soils," and then turn to the section "Use and Management of the Soils." In this way they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The soils are grouped by capability units; that is, groups of soils that need similar management and respond in about the same way. For instance, in the section "Descriptions of the Soils," Birkbeck silt loam, 0 to 2 percent slopes, is shown to be in capability unit I-1. The management this soil needs will be stated under the heading "Capability unit I-1" in the section "Use and Management of the Soils."

*Soil scientists* will find information about how the soils were formed and how they were classified in the section "Genesis, Classification, and Morphology of the Soils."

*Engineers* and others who use soil as a material in construction will find helpful information in the section "Engineering Properties of the Soils."

*Students, teachers, and other users* will find information about the soils and their management in various parts of the report, depending on their particular interest.

## Technical assistance

The soil survey is not intended to be a source of all information needed for the successful operation of a farm in Clinton County. Information on crop varieties, fertilizers, soil conserving practices, and livestock management can be obtained from the county agricultural agent.

Farmers in Clinton County have organized the Clinton County Soil Conservation District. The district, through its officials, arranges for farmers to receive technical help from the Soil Conservation Service in planning good use and conservation of the soils on their farms. This soil survey is part of the technical assistance furnished to the Clinton County Soil Conservation District. The soils were surveyed by the Ohio Department of Natural Resources.

Specific conservation plans should be made for each farm. Assistance in the use or interpretation of information in this report is available from either the Soil Conservation Service or the Extension Service.

The "Guide to Mapping Units and Capability Units" at the end of the report will simplify the use of the map and the report. This guide gives the map symbol for each soil, the name of the soil, the page on which the soil is described, the capability unit in which the soil has been placed, and the page where the capability unit is described. Soil survey and engineering terms are defined in the Glossary in the back of the report.

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Fieldwork on the soil survey was completed in 1957. Unless indicated otherwise, all statements refer to conditions at the time of the survey.

# Contents

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# SOIL SURVEY OF CLINTON COUNTY, OHIO

REPORT BY DALE GARNER, OHIO DEPARTMENT OF NATURAL RESOURCES, AND RALPH MEEKER, SOIL CONSERVATION SERVICE

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OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF LANDS AND SOIL, IN COOPERATION WITH UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND OHIO AGRICULTURAL EXPERIMENT STATION

CLINTON COUNTY is in the southwestern part of Ohio (fig. 1). It has an area of about 412 square miles, or 263,680 acres. Wilmington, the county seat, is near the center of the county.

The county lies entirely in the glaciated region of Ohio. Approximately the northeastern three-fourths is covered by medium-textured drift of Wisconsin age and is the more naturally fertile part of the county. The rest of the county is covered by the much older, deeply leached drift of Illinoian age. The Illinoian till plain is known locally as the pin-oak flats.

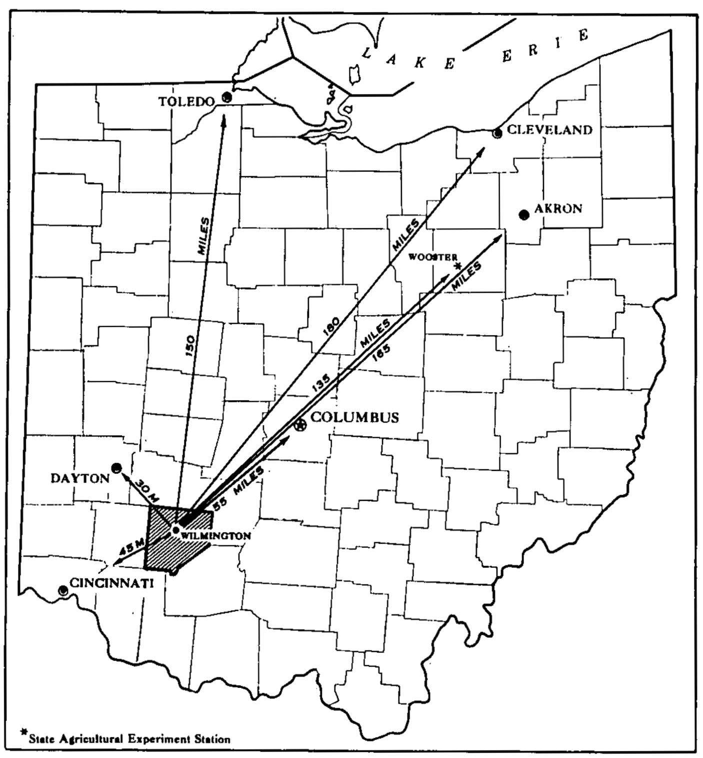


*Figure 1.*—Location of Clinton County in Ohio.

## *Nature of the Soil Survey*

Agriculture, as well as most other industries, has progressed through many stages to our present system of complex practices and management. Some changes have resulted from trial and error methods. Other changes have been made after thorough research by State and Federal experiment stations. Adequate soil survey information facilitates the adoption of many new agricultural practices and eliminates much of the costly trial and error method.

New agricultural practices cannot be feasibly tested on all soils. Experimental farms, located in several places in Ohio, however, conduct field studies on crops, fertilizers, and farming methods on a few soils whose characteristics are known. The results of the new practices on these soils can be applied to Clinton County if the soils in this county are known and compared with the experimental soils. The detailed soil survey of Clinton County provides the necessary information for making these comparisons.

Soil scientists, in making this survey, studied in detail the similarities and differences of the various soils in the county. At frequent intervals they bored or dug holes in order to examine soil characteristics (fig. 2). In many areas pits were dug so that the scientists could observe the characteristics of a particular soil type in greater detail. Samples of each soil horizon were taken from these pits and sent to the soils laboratory at Ohio State University for detailed mechanical and chemical analyses.

From the field examination, the scientist determined the color, texture, structure, consistence, drainage, reaction, and other information that enabled him to map the boundaries on aerial photographs and to name and classify the soil.

Soils are classified into series, types, and phases. The soil series includes all the soils that are nearly alike, within defined limits, in their characteristics other than texture of the surface soil. A place name is given to each series. Soils of the Reesville series, for example, were first described and mapped in Clinton County

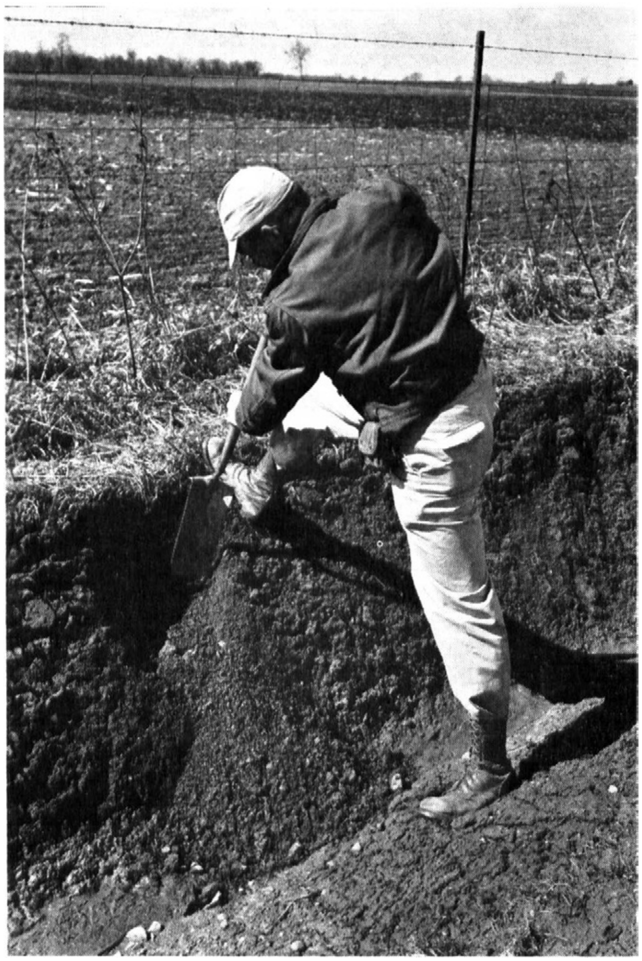

***Figure 2.*—Soil scientist probing soils for detailed examination.**

near the town of Reesville. The soil type is a subdivision of the soil series based on the texture of the surface soil. The soil-type name consists of the series name plus textural class name, determined primarily by the upper part of the soil. An example is Reesville silt loam. On the detailed soil map, most of the mapping units are phases of soil types, such as Reesville silt loam, 0 to 2 percent slopes. On the general soil map, in contrast, mapping units are associations of soil series. For example, one kind of general area is called the Reesville-Ragsdale area. It consists of soils of these two series and several other minor soils.

Many of the soils in Clinton County have been described and named by the Ohio Department of Natural Resources (*10*, *11*, *12*).[1] These reports were published while the survey of soils was in progress. Since that time, additional information has been obtained, and the names of a few soils have been changed to correlate them with the national soil classification.

The grouping of geographically associated soil series is called a general soil area, or soil association. Such a group may be formed on the basis of topographic position, parent material, slope, natural drainage, or other criteria. The next section describes twelve general soil areas in Clinton County.

[1] Italic numbers in parentheses refer to Literature Cited, page 110.

## General Soil Areas

After study of the soils and the way they are arranged, it is possible to make a general map that shows the main patterns of soils. Such a map is the colored general soil map in the back of this report. The general soil areas are also called soil associations. Each kind of general soil area, as a rule, contains a few major soils and several other minor soils, in a pattern that is characteristic although not strictly uniform. The soils within any one association, are likely to differ greatly among themselves in some properties, for example, slope, depth, or natural drainage. Thus, the general map does not show the kind of soil at any particular place, but a pattern of several different kinds of soils. The general map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

**1. Light-colored, well drained to moderately well drained soils on gently sloping to rolling uplands: Celina, Miami**

This general soil area occupies approximately 7 percent of the county. It consists mainly of the Celina and Miami soils. Both soils have developed on loamy, calcareous till of Wisconsin age that has a loess mantle up to 18 inches in thickness.

The soils in this area are intensively farmed, and if management is good, they are productive for crops commonly grown in the county (fig. 3). Erosion is the main hazard.

**2. Dark- and light-colored, very poorly drained to imperfectly drained soils on depressed to gently sloping topography: Brookston, Crosby**

This general soil area consists primarily of Brookston and Crosby soils. These soils have developed in calcareous till of Wisconsin age and a loess mantle up to 18 inches thick. The soils in this area are farmed intensively. If management is good, they produce well the crops commonly grown in the county. Drainage is the main problem.

**3. Sloping to steep, shallow soils underlain by limestone: Milton**

The light-colored, well-drained Milton soils are the dominant soils in this area. They have developed from a mantle of medium-textured till of Wisconsin age that overlies limestone bedrock. The overlying mantle of till is usually 20 to 60 inches in thickness, but the Milton shallow phases developed in a mantle of till that ranged from 10 to 20 inches in thickness.

The level, deeper Milton soils in this area are often intermingled with and surrounded by more productive soils. The shallow phases of the Milton soils and those on steep and very steep slopes are usually in pasture or forest.

*Figure 3.*—**Corn and soybeans are grown on many of the gently sloping soils. Yields are generally good.**

**4. Deep, light-colored, moderately well drained to well drained silty soils on rolling to hilly uplands: Xenia, Russell**

This general soil area occupies approximately 27 percent of the county. It consists primarily of the Xenia and the Russell soils. Both soils have developed in approximately 18 to 40 inches of loess, which overlies loamy, calcareous till of Wisconsin age.

The soils in this area are farmed intensively. If management is good, they are productive for crops commonly grown in the county. Erosion is the main problem. The steep and very steep Russell soils are usually in pasture or forest.

**5. Dark- and light-colored, very poorly drained to imperfectly drained, nearly level silty soils: Brookston, Fincastle**

This general soil area consists mainly of the Brookston and Fincastle soils. The soils have developed in Wisconsin till and a loess mantle up to 18 inches thick. They are farmed intensively. If they are well managed, they are productive for crops commonly grown in the county. Drainage is the main problem.

**6. Deep, light- and dark-colored, very poorly drained to imperfectly drained silty soils: Reesville, Ragsdale**

This general soil area occupies approximately 8 percent of the county. The soils have developed in silt more than 40 inches thick. The area consists primarily of the level or gently sloping Reesville and level or nearly level Ragsdale soils.

The soils in this area are intensively farmed, and with good management, they make up the most productive upland soil area in the county. Drainage is the main hazard.

**7. Light-colored, moderately well drained to well drained soils on gently sloping to steep topography on Illinoian till: Rossmoyne, Cincinnati**

This general soil area consists mainly of the Rossmoyne and Cincinnati soils. The Rossmoyne soils are the most extensive, and they occur on level to moderately steep slopes. The Cincinnati soils occur only in gently sloping to moderately steep areas. Soils of both series have developed in approximately 16 to 30 inches of loess, which overlies moderately fine to clayey till of Illinoian age.

The soils in this area are farmed moderately intensively and are productive for crops commonly grown in the county. Erosion is the main hazard.

**8. Imperfectly drained to poorly drained, deeply leached soils on nearly level or depressed areas: Avonburg, Clermont**

This general soil area occupies about 13 percent of the county. It is on the continuous, nearly level Illinoian till plain in the southern and southwestern parts of the county and is known as the pin-oak flats. The upper part of the soil has developed in silt; the lower part in till. The soils in this area are not farmed intensively and are less productive of crops commonly grown in the county. Drainage is difficult to establish on the Clermont soils.

**9. Well drained to somewhat excessively drained soils that have developed from recent alluvium, loess, and from sand and gravel outwash: Fox, Ockley, Williamsburg, Genesee**

This general soil area occurs throughout the county along stream terraces, outwash plains, and bottom lands. The soils generally have a light-colored surface soil. Slopes range from level or nearly level to very steep.

A large percentage of the soils with level or nearly level slopes is farmed intensively. Under good management, these soils are productive of crops commonly grown in the county. Erosion is the main hazard on the sloping areas. The soils with steeper slopes in this general soil area are generally used for pasture or forest.

**10. Dark-colored, very poorly drained, deep silty soils over sand and gravel: Westland**

This general soil area occurs mainly on level to nearly level outwash plains in the northeastern part of the county. The Westland soils are predominant. They have developed in medium to moderately fine textured material that overlies stratified sand and gravel of Wisconsin age.

The soils in this area are farmed intensively, and they are productive for crops commonly grown in the county if management is good. Drainage is the main hazard.

**11. Dark-colored, very poorly drained soils on moderately fine textured old alluvial deposits: Bonpas**

This general soil area occurs along the level or nearly level outer edge of the Cuba Moraine in the southern and southwestern parts of the county. The Bonpas soils are the dominant soils in these areas. They have developed in moderately fine textured old alluvial deposits.

The soils in this area are farmed intensively, and they are productive for crops commonly grown in the county if management is good. Drainage is the main hazard.

**12. Very poorly drained soils on flood plains: Algiers, Sloan**

This general soil area occurs on bottom lands along the major streams of the county. The Algiers soils are light colored, and the Sloan are dark colored. Both have developed in medium to moderately fine textured alluvium that washed from calcareous till in the uplands.

The soils are farmed intensively, and if management is good, they are productive for crops commonly grown in the county. Drainage is the main hazard.

# *Use and Management of the Soils*

This section is in three parts. The first explains how soils are grouped according to their capability and describes the capability units. The second gives estimates of the yields that can be obtained from each soil under two levels of management. The third describes general management of land in farms for crops, pasture, woodland, and wildlife.

## Land Capability Classification

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, grazing, or wood products. Clinton County has no class VIII soils.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated 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* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no susceptibility to erosion but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils 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 of soils for making many statements about their management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

For the purpose of discussing general agricultural management, the soils of Clinton County have been grouped into seven capability classes, numerous subclasses depending on the kind of limitation, and 22 capability units. The drainage referred to is the natural drainage of the soil.

Class I. Soils that have few limitations that restrict their use.
- (No subclasses.)
  - Capability unit I-1: Level to nearly level, well drained and moderately well drained, moderately deep to very deep soils on uplands and terraces.
  - Capability unit I-2: Level to nearly level, well drained and moderately well drained soils on bottom lands; crops not significantly damaged by floods.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe.—Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe-1: Gently sloping, well drained or somewhat excessively drained soils on uplands and terraces; shallow to moderately deep root zones.
  - Capability unit IIe-2: Gently sloping, well drained to moderately well drained, deep soils on uplands and terraces.
  - Capability unit IIe-3: Gently sloping, imperfectly drained soils having a moderately deep root zone. Internal drainage is a secondary limitation.
- Subclass IIw.—Soils that have moderate limitations because of excess water.
  - Capability unit IIw-1: Imperfectly drained and poorly drained soils on bottom lands.
  - Capability unit IIw-2: Imperfectly drained, light-colored soils on uplands or terraces.
  - Capability unit IIw-3: Imperfectly drained and poorly drained, light colored and moderately dark colored soils on uplands or terraces.
  - Capability unit IIw-4: Very poorly drained, dark-colored soils on uplands and terraces; effectively drained by use of tile.
- Subclass IIs.—Soils that have moderate limitations of moisture-holding capacity or tilth.
  - Capability unit IIs-1: Level to nearly level, somewhat excessively drained soils that have a shallow, droughty root zone.

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

Subclass IIIe.—Soils subject to severe erosion if they are not protected.

Capability unit IIIe-1: Sloping, well-drained and somewhat excessively drained soils on uplands and terraces; shallow to moderately deep root zones.

Capability unit IIIe-2: Gently sloping and moderately sloping, well drained to moderately well drained soils on uplands and terraces; moderately deep to deep root zones.

Capability unit IIIe-3: Gently sloping, imperfectly drained soils that are low in fertility.

Subclass IIIw.—Soils that have severe limitations because of excess water.

Capability unit IIIw-1: Poorly drained and imperfectly drained, light-colored soils on uplands.

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

Subclass IVe.—Soils subject to very severe erosion if they are cultivated and not protected.

Capability unit IVe-1: Moderately steep or hilly, slightly and moderately eroded soils on uplands; shallow to moderately deep root zones.

Capability unit IVe-2: Moderately steep or hilly, well drained to moderately well drained, deep soils on uplands and terraces.

Capability unit IVe-3: Sloping, severely eroded, well drained and moderately well drained soils.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw.—Soils too wet for cultivation; drainage or protection not feasible.

Capability unit Vw-1: Soils on bottom lands subject to crop-damaging floods.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture, woodland, or wildlife food and cover.

Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIe-1: Hilly to steep, slightly to moderately eroded, well drained to excessively drained soils.

Capability unit VIe-2: Moderately steep, severely eroded, well-drained soils.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIIe-1: Steep to very steep, slightly or moderately eroded, well drained to excessively drained soils.

Capability unit VIIe-2: Hilly to very steep, severely eroded, well drained to excessively drained soils.

## *Descriptions of the capability units*

Many soils in Clinton County have similar properties and have been placed in groups that have similar use and management requirements. This part of the report describes the 22 capability units of soils in the county and suggests the drainage, fertilization, erosion control practices, and cropping systems suitable for soils in each unit.

### CAPABILITY UNIT I-1

*Level or nearly level, well drained and moderately well drained, moderately deep to very deep soils on uplands and terraces*

The soils in this unit are friable and moderately permeable to air and moisture. Supplies of organic matter are medium in the surface soils. The moisture-supplying capacity for plants is medium to very high. Little or no erosion has occurred. Soils in this unit are:

Birkbeck silt loam, 0 to 2 percent slopes.
Celina silt loam, 0 to 2 percent slopes.
Milton silt loam, 0 to 2 percent slopes.
Ockley silt loam, 0 to 2 percent slopes.
Ockley silt loam, mixed substratum, 0 to 2 percent slopes.
Rossmoyne silt loam, 0 to 2 percent slopes.
Sardinia silt loam, 0 to 2 percent slopes.
Thackery silt loam, 0 to 2 percent slopes.
Thackery silt loam, mixed substratum, 0 to 2 percent slopes.
Uniontown silt loam, 0 to 2 percent slopes.
Williamsburg silt loam, 0 to 2 percent slopes.
Xenia silt loam, 0 to 2 percent slopes.

These soils are generally cultivated. Crop rotations should include 1 year of meadow in 3 years, or 2 years of meadow in 5 years. Yields of crops are medium to high. Higher yields can be obtained if crop residues are returned to the soil. If fertility in the soil is maintained at a high level, a good green-manure crop can be substituted for 1 year of meadow in the rotation.

The soils are also suited to pasture. Suitable legumes and grasses grow well if they are adequately limed and fertilized. Nitrogen applied to pastures will produce early forage.

Drainage and mechanical erosion control are generally not needed for these soils. Tile drains may be feasible for the moderately well drained soils in this group when they are used for high value crops.

The soils in this unit, except the Milton, Ockley, Thackery, and Williamsburg, are suitable for ponds. However, all proposed pond sites should be thoroughly investigated by deep borings. The Milton soils are underlain by limestone.

Woodlands on these soils reseed naturally if protected from fire and grazing. New plantations should consist of pine, but they are seldom started on these soils.

### CAPABILITY UNIT I-2

*Level to nearly level, well drained and moderately well drained soils on bottom lands; crops not significantly damaged by floods*

The soils in this unit are friable and have a deep root zone for growing plants. Supplies of organic matter are high in the upper soil layers. The moisture-supplying capacity is medium to high. Soils in this unit are:

Eel loam.
Eel silt loam.
Genesee loam.

Genesee loam, sandy substratum.
Genesee silt loam.
Genesee silt loam, sandy substratum.
Medway loam.
Medway silt loam.
Ross loam.
Ross silt loam.

Most of these soils are in crops. Row crops can be grown more regularly on them than on most other soils in the county. Crop rotations should include cover and green-manure crops whenever possible. The best results are obtained if meadow is grown at least 1 year in 4 years and green manure is plowed down every other year. Crop residue returned to the soil reduces somewhat the need for the regular inclusion of meadow in the crop rotation.

Forage production in dry weather is better on these soils than on most upland soils. Frequent mowings are needed to control weeds and to keep grasses from smothering the legumes.

Overflow from streams or runoff from adjacent slopes may cause flooding but does not usually cause significant crop damage. Dikes can be used to prevent stream flooding of these soils if the cost can be justified. Diversion terraces constructed along the bases of slopes help divert runoff from higher areas. Standing water in low spots can be drained through use of surface drains. Tile drains are generally not needed except to help dry out wet, low spots in fields.

Woodland on these soils reproduces naturally if protected from grazing and fire. New plantations are seldom started on these soils.

Areas of these soils on which flooding causes frequent crop damage are classified in capability unit Vw-1.

### CAPABILITY UNIT IIe-1

*Gently sloping; well drained or somewhat excessively drained soils on uplands and terraces; shallow to moderately deep root zones*

The soils in this unit are moderately permeable to air and water. The upper layers are medium in organic matter. The water-holding capacity of these soils varies, but it depends on the depth and nature of substrata. Soils in this unit are:

Edenton silt loam, 2 to 6 percent slopes, moderately eroded.
Fox silt loam, 2 to 6 percent slopes.
Fox silt loam, 2 to 6 percent slopes, moderately eroded.
Milton silt loam, 2 to 6 percent slopes.
Milton silt loam, 2 to 6 percent slopes, moderately eroded.
Ockley silt loam, 2 to 6 percent slopes.
Ockley silt loam, 2 to 6 percent slopes, moderately eroded.
Ockley silt loam, mixed substratum, 2 to 6 percent slopes.
Ockley silt loam, mixed substratum, 2 to 6 percent slopes, moderately eroded.

These soils are generally used for crops, but they are also suited to pasture and meadow. Erosion losses can be minimized by using a cropping sequence that includes at least 2 or 3 years of meadow in 5 years, depending on the length of slope. However, if fields are terraced, 1 year of meadow in 3 years is enough to protect the soil. Medium to high yields can be expected.

Good management should include erosion control, the plowing of plant residue into the soil, and the application of lime and fertilizer according to needs determined by soil tests. When the soils are properly limed and fertilized, grass and legumes that are suited to well-drained soils of this area will grow well. Nitrogen applied to pastures produces early forage.

Sand, gravel, or bedrock may prevent the construction of diversion terraces or other terraces and make many soils unsuitable for farm ponds. All soils in this unit, as a rule, are poor risks for ponds. If diversion and other terraces are feasible, outlets should be established before the erosion control structure is built. Waterways should be kept in sod. Crop rows on the contour should have a slight grade to allow for surface drainage. Rapidity of runoff is related to soil characteristics, to the length and steepness of slopes, and to the ground cover.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations should consist of pine, but they are seldom started on these soils.

### CAPABILITY UNIT IIe-2

*Gently sloping, well drained to moderately well drained, deep soils on uplands and terraces*

The soils in this unit are moderately permeable to air and water. Supplies of organic matter are medium in the surface layers. The risk of erosion is moderate. Soils in this unit are:

Birkbeck silt loam, 2 to 6 percent slopes.
Birkbeck silt loam, 2 to 6 percent slopes, moderately eroded.
Celina silt loam, 2 to 6 percent slopes.
Celina silt loam, 2 to 6 percent slopes, moderately eroded.
Cincinnati silt loam, 2 to 6 percent slopes.
Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded.
Miami silt loam, 2 to 6 percent slopes.
Miami silt loam, 2 to 6 percent slopes, moderately eroded.
Rossmoyne silt loam, 2 to 6 percent slopes.
Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded.
Russell silt loam, 2 to 6 percent slopes.
Russell silt loam, 2 to 6 percent slopes, moderately eroded.
Sardinia silt loam, 2 to 6 percent slopes.
Sardinia silt loam, 2 to 6 percent slopes, moderately eroded.
Thackery silt loam, 2 to 6 percent slopes.
Thackery silt loam, mixed substratum, 2 to 6 percent slopes.
Williamsburg silt loam, 2 to 6 percent slopes.
Williamsburg silt loam, 2 to 6 percent slopes, moderately eroded.
Xenia silt loam, 2 to 6 percent slopes.
Xenia silt loam, 2 to 6 percent slopes, moderately eroded.

These soils are generally used for crops, but they are also suited to pasture or meadow. If fields are terraced or farmed on the contour, the rotations should include 1 year of meadow in 3 years. If fields are cultivated without structures to control erosion, meadow should be grown 2 or 3 years in 5 years. Yields of crops are generally medium to high.

Management should include erosion control. Lime and fertilizer should be applied according to needs determined by soil tests and crop residue should be plowed into the soil.

Meadows should be properly limed and fertilized and planted to legumes and grasses suited to the naturally well drained and well drained soils of the uplands. The addition of nitrogen produces early forage.

Cultivation along the contour may provide good erosion control on relatively short slopes. The rows should have a slight grade to help surface drainage. Long, uniform slopes that are in cultivation should be terraced. Outlets ought to be located and constructed before the terraces are built. Waterways should be kept permanently in sod. Tile drains may be needed in scattered wet spots.

The soils in this capability unit, except for the Sardinia, Thackery, and Williamsburg, are generally good for farm ponds.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations should consist of pine, but they are seldom started on these soils.

### CAPABILITY UNIT IIe-3

*Gently sloping, imperfectly drained soils having a moderately deep root zone. Internal drainage is a secondary limitation*

The soils in this unit are medium in organic matter. They need control of erosion and improvement in drainage. The subsoils are slowly permeable, and in wet weather the water table is high. The soils in this capability unit are:

- Crosby silt loam, 2 to 6 percent slopes.
- Crosby silt loam, 2 to 6 percent slopes, moderately eroded.
- Fincastle silt loam, 2 to 6 percent slopes.
- Fincastle silt loam, 2 to 6 percent slopes, moderately eroded.
- Reesville silt loam, 2 to 6 percent slopes.
- Sleeth silt loam, mixed substratum, 2 to 6 percent slopes.

Crop rotations should include 1 year of meadow in 3 years, or 2 years of meadow in 4 years. If yields of general crops are poor, additional meadow should be grown. Fields should be cultivated on the contour and rows given enough grade for surface drainage without causing erosion.

Legumes and grasses suited to the soil grow well if they are adequately limed and fertilized. Pasture soils become dense and compacted if grazed when too wet.

Tile drains are feasible in these soils for removing excess water from subsoils and improving the root zone.

Tile drains in fields and permanent pastures should be laid 36 to 42 inches deep and at intervals of 50 to 80 feet. Tile should be covered by several inches of surface soil before the trench is filled. Poor pastures probably do not justify the expense of installing drain tile.

A system of drainage terraces may be needed on some areas of this soil to remove excess water. Sodded waterways built large enough to carry runoff from the biggest storms can be used to intercept runoff from higher land. Shallow ditches or furrows built on a slight grade are suitable for surface drainage, particularly on long-term pastures that do not justify a tile-drainage system.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations should consist of white pine and Norway spruce, but they are generally not started on these soils.

### CAPABILITY UNIT IIw-1

*Imperfectly drained and poorly drained soils on bottom lands*

The soils in this capability unit are flooded part of the time, and they need improvement in drainage. They are generally not acid in reaction, and only a limited response to heavy fertilization can be expected. Soils in this unit are:

- Algiers silt loam.
- Shoals silt loam.
- Sloan silty clay loam.



- Sloan silt loam.
- Sloan silt loam, overwashed.

Areas of these soils subject to infrequent flooding can be used mainly for crops. Row crops may predominate, but cover crops and green-manure crops should be grown frequently to improve soil structure and to provide organic matter.

Pastures on these soils are good and produce forage in dry weather. They should be mowed frequently to control weeds and to keep grasses from smothering the legumes. Plant mixtures should consist of at least one legume and one grass suitable for wet soil. Lime is seldom needed, but it and fertilizer should be applied in amounts determined by soil tests.

Dikes can be used to prevent stream flooding on these soils if the cost is justified. Diversion terraces can be used to intercept runoff from higher land. Surface drainage ditches or waterways will help remove excess water, especially from low ponded areas. Properly installed tile systems generally will provide adequate drainage for these soils. In cultivated fields, tile should be laid 36 to 42 inches deep and at intervals of 50 to 75 feet. Tile drains may not be feasible in permanent pasture, but furrows or shallow ditches, or both, generally can remove enough water to improve production of pastures.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations are generally not started on these soils.

Areas of these soils on which flooding causes frequent crop damage are classified in capability unit Vw-1.

### CAPABILITY UNIT IIw-2

*Imperfectly drained, light-colored soils on uplands and terraces*

The soils in this capability unit are medium in organic matter. They are slowly permeable, and during wet periods they have a temporarily high, or perched, water table. They need improvement in drainage. They puddle and form clods if worked when too wet. The soils in this unit are:

- Crosby silt loam, 0 to 2 percent slopes.
- Fincastle silt loam, 0 to 2 percent slopes.
- Raub silt loam.
- Reesville silt loam, 0 to 2 percent slopes.
- Sleeth silt loam.
- Sleeth silt loam, mixed substratum, 0 to 2 percent slopes.

Medium yields of crops can be expected from these soils. Rotations should include meadow at least 1 year in 3 or 4 years. If yields of crops and forage are poor, additional time in the rotation should be allowed for meadow. Meadows, green-manure crops, and plant residue are needed to maintain tilth and to provide organic matter. All crops should be fertilized in amounts determined by soil tests.

Grasses and legumes that are suited to wet soils grow well in pastures if properly limed and fertilized. The soils in pastures become dense and compacted if grazed when too wet.

These soils are generally suitable for farm ponds. However, borings and other investigations should be made in the site, particularly in the Sleeth soils.

Normally these soils can be adequately drained through properly installed tile systems. In cultivated fields, tile should be laid 36 to 42 inches deep and at intervals of 50 to 80 feet. Tile should be blinded by several inches of surface soil. Permanent pastures or other areas that do not justify the expense of installing tile systems can be drained through a system of furrows and shallow ditches. Sodded waterways and diversion ditches can be used to intercept runoff from higher lands. All surface drains should be large enough to carry runoff from the biggest storms.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations should consist of spruce, but they are seldom started on these soils.

### CAPABILITY UNIT IIw-3

*Imperfectly drained and poorly drained, light colored and moderately dark colored soils on uplands or terraces*

The soils in this capability unit are slowly or very slowly permeable and, in wet seasons, may have temporarily high water tables. They need drainage to improve yields of crops and forage. Supplies of organic matter are medium or higher. The soils puddle and clod if worked when too wet. The soils in this unit are:

Blanchester silt loam.
Henshaw silt loam.

Crop rotations should include 1 year of meadow every 3 or 4 years. If yields of crops or forage are poor, additional time in the rotation should be allowed for meadow. Organic matter should be added to the soil by use of meadows, green-manure crops, or crop residues, or by use of all of these. Meadows are particularly needed on these soils to maintain tilth and organic matter. All crops should be limed and fertilized in amounts determined by soil tests.

Pasture and meadow should consist of grasses and legumes that will grow in wet soils. Lime and fertilizer should be applied as needed. If pastured when too wet, pasture soils become dense and compact.

Normally these soils can be drained through the use of properly installed tile systems. Such drainage improves the root zone and makes the soils more suitable for general crops. In fields, tile should be laid 30 to 36 inches deep and at intervals of 50 to 70 feet. Tile should be covered by several inches of surface soil before the trench is filled. In view of the slow permeability of these soils, surface drains ought to be used with the tile. Pasture production can be improved by removal of as much excess water as possible by furrows, shallow ditches, or both.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations are seldom started on these soils.

### CAPABILITY UNIT IIw-4

*Very poorly drained, dark-colored soils on uplands and terraces; effectively drained by use of tile*

The soils in this unit are in slight depressions or basinlike areas. They have a high water-holding capacity. Runoff is slow, and it may pond. Subsoils are moderately to slowly permeable, and, in wet periods, water tables may be temporarily high. If worked when too wet, the soils puddle and clod. If cropped intensively, they become dense and compact. The soils in this capability unit are:

Bonpas silt loam, overwashed.
Bonpas silty clay loam.
Brookston silt loam.
Brookston silt loam, overwashed.
Brookston silty clay loam.
Kokomo silt loam, overwashed.
Millsdale silty clay loam.
Ragsdale silty clay loam.
Ragsdale silt loam.
Westland silty clay loam.
Westland silt loam.
Westland silt loam, overwashed.
Westland silt loam, mixed substratum, overwashed.
Westland silty clay loam, mixed substratum.

These soils are very productive if properly managed. Such management includes adequate drainage, liming, fertilizing, timely tillage, and incorporation of large amounts of organic matter. Crop rotations should include 1 year of meadow every 3 or 4 years, depending on the amount of organic matter that is available from green-manure and cover crops. If cover and green-manure crops furnish the organic matter that these soils need, the frequency of meadow in crop rotations can be reduced and more of the tilled crops can be grown. High yields result from good soil tilth, the application of large quantities of fertilizer, and the production of large amounts of crop residues.

If these soils are properly fertilized and limed when needed, suitable legumes and grasses will grow well. The grazing of pastures when the soils are too wet causes compaction.

Drainage is needed to improve the root zone in soils used regularly for crops. Tile drains in fields should be laid 36 to 42 inches deep and at intervals of 60 to 75 feet. Joints should be covered by a layer of porous material for blinding. The Millsdale soil is fairly shallow to limestone, and the installation of tile may be difficult. Shallow drainage ditches are suitable for removing surface water, particularly from ponded areas. Runoff from higher land can be intercepted through use of diversion terraces or sodded waterways.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations are generally not started on these soils.

### CAPABILITY UNIT IIs-1

*Level to nearly level, somewhat excessively drained soils that have a shallow, droughty root zone*

The one soil in this unit is friable and fairly permeable throughout its depth. The root zone is shallow and underlain by porous gravel at depths of 24 to 42 inches. Little or no erosion has occurred. The surface soil is medium in organic matter. The soil in this unit is:

Fox silt loam, 0 to 2 percent slopes.

This soil can be planted early, and it is suitable for regular crops and for specialized crops grown under irrigation. It is droughty late in summer and early in fall, but crops yield well if they mature ahead of the droughty season. Rotations should include 1 year of meadow in 3 years, or 2 years of meadow in 5 years. A good green-manure crop can substitute for a year of meadow in the rotation. Manure and crop residue used efficiently help to overcome the droughty tendencies of this soil.

This soil is also suited to pasture. If the soil is properly limed and fertilized, grasses and legumes grow well. The addition of nitrogen produces early forage.

Drainage and mechanical erosion control are not needed. The soil is not suitable for ponds because of the porous gravelly substratum.

Woodlands on this soil reproduce naturally if protected from fire and grazing. Pine should be used in plantings, but new plantations are seldom started on these soils.

### CAPABILITY UNIT IIIe-1

*Sloping, well-drained and somewhat excessively drained soils on uplands and terraces; shallow to moderately deep root zones*

The soils in this unit are moderately permeable to air and water. Runoff is medium. Erosion is a moderate hazard, especially if the soils are in row crops. The soils in this unit are:

- Edenton silt loam, 6 to 12 percent slopes, moderately eroded.
- Fox silt loam, 6 to 12 percent slopes, moderately eroded.
- Milton silt loam, 6 to 12 percent slopes, moderately eroded.
- Ockley silt loam, 6 to 12 percent slopes, moderately eroded.
- Ockley silt loam, mixed substratum, 6 to 12 percent slopes, moderately eroded.

If fields are terraced, crop rotations should include 1 year of meadow in 3 years. If contour cultivation alone is practiced, the rotation should include 1 year of meadow in 3 years on short slopes, or 2 years of meadow in 4 years on long slopes. If fields are neither terraced nor cultivated on the contour, the soils can be safely cropped if the rotation consists of 1 year of a small grain and 1 year or more of meadow.

These soils are well suited to pasture. Grasses and legumes suited to well-drained soils of the area grow well if properly limed and fertilized. Additions of nitrogen produce early forage.

Sand, gravel, or bedrock prevents or makes difficult the construction of terraces on most of these soils. Fields that can be terraced should have outlets built and stabilized before the terraces are constructed. Runoff from higher lands can be intercepted through use of sodded waterways, which should be built large enough to carry runoff from the biggest storms. The use of lime and fertilizer, as well as seeding and mowing, is needed to produce a dense sod in waterways.

Woodlands on these soils reproduce naturally if protected from fire and grazing. Pine should be used in plantings, but new plantations are seldom started on these soils.

### CAPABILITY UNIT IIIe-2

*Gently sloping and moderately sloping, well drained to moderately well drained soils on uplands and terraces; moderately deep to deep root zones*

The soils in this capability unit have medium to rapid runoff. Erosion ordinarily is a moderate hazard, but it is a severe hazard in areas that are continually cultivated up and down the slopes (fig. 4). The soils in this unit are:

- Celina silt loam, 6 to 12 percent slopes, moderately eroded.
- Cincinnati silt loam, 6 to 12 percent slopes.
- Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded.
- Miami soils, 2 to 6 percent slopes, severely eroded.
- Miami silt loam, 6 to 12 percent slopes.
- Miami silt loam, 6 to 12 percent slopes, moderately eroded.
- Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded.
- Russell soils, 2 to 6 percent slopes, severely eroded.
- Russell silt loam, 6 to 12 percent slopes.
- Russell silt loam, 6 to 12 percent slopes, moderately eroded.
- Uniontown silt loam, 2 to 6 percent slopes, moderately eroded.
- Williamsburg silt loam, 6 to 12 percent slopes.
- Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded.
- Xenia silt loam, 6 to 12 percent slopes.
- Xenia silt loam, 6 to 12 percent slopes, moderately eroded.
- Xenia soils, 2 to 6 percent slopes, severely eroded.

Management of these soils should include use of rotations in which meadow is grown a large part of the time, as well as such erosion control practices as terracing, stripcropping, or contour farming, or all of these practices.

Crop rotations on these soils should include at least 3 years of meadow in 5 years. However, if fields are terraced, stripcropped, or cultivated along the contour, the frequency of meadow in the rotation can be reduced. Rotations for terraced fields should consist of 1 year of a row crop, 1 year of a small grain, and 1 year of

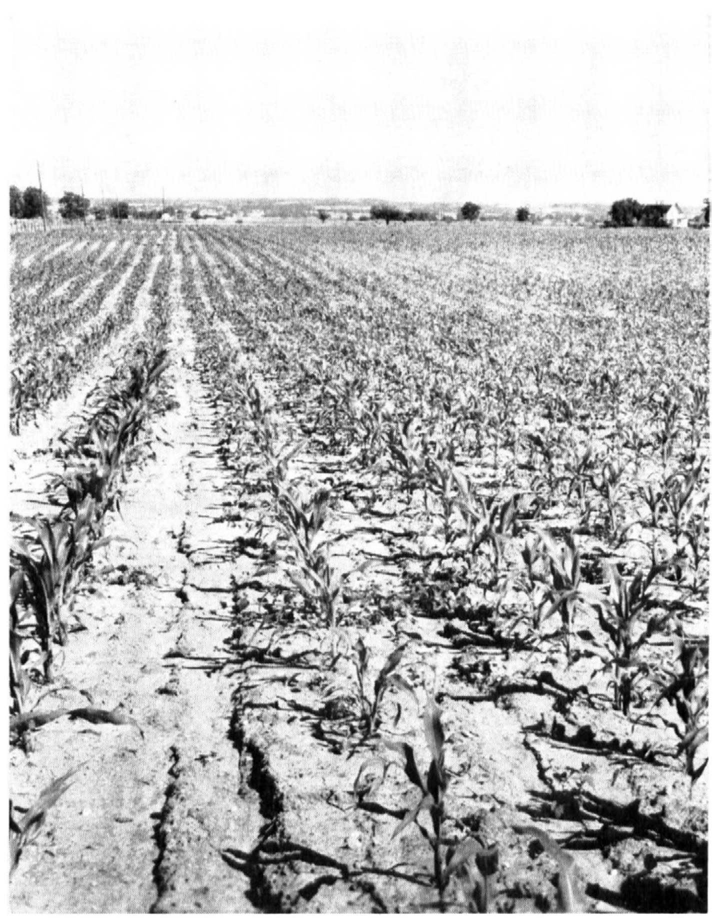

***Figure 4.*—Corn on Miami soils. Erosion is evident between rows.**

meadow. One year of a small grain and 1 year or more of meadow may be used when erosion control practices are not well adapted to the soils.

The soils are well suited to pasture. Grasses and legumes suited to the well drained and moderately well drained soils of the area grow well if they are properly limed and fertilized. Nitrogen fertilization produces early pasture.

If terraces are feasible on long, even slopes of fields, outlets should be built and stabilized before the terraces are constructed. Fields on short slopes probably can be protected well enough if cultivated along the contour and rows are given a slight grade to help surface drainage. Runoff from higher land can be intercepted by grassed waterways and diversion terraces. Wet spots and seepy areas in fields can be tiled to help them dry out more rapidly.

The soils in this capability unit, except the Williamsburg, are suitable for farm ponds.

Woodlands on these soils reproduce naturally if protected from fire and grazing. Pines should be used in plantings, but new plantations are seldom started on these soils.

### CAPABILITY UNIT IIIe-3

*Gently sloping, imperfectly drained soils that are low in fertility*

The soils in this capability unit are slowly permeable, and they need drainage. They are not very productive and will puddle and clod if worked when too wet. Supplies of organic matter are medium. Soils in this unit are:

Avonburg silt loam, 2 to 6 percent slopes.
Avonburg silt loam, 2 to 6 percent slopes, moderately eroded.

A crop rotation on these soils should include at least 1 year of meadow every 3 years. In areas where yields of crops and forage are poor, or on the stronger slopes that need protection from erosion, additional time in the rotation should be allowed for meadow. Organic matter, lime, and fertilizers are needed in adequate amounts to improve the productivity of these soils. Excellent management, including drainage, is needed to obtain good crop yields. Artificial drainage is more difficult on these soils than on those of capability unit IIe-3.

Grasses and legumes suited to wet soils grow well if properly limed and fertilized. If trampled by livestock when too wet, these soils become dense and compact.

Tile drains do not work well because these soils are slowly permeable. Field bedding and shallow, open ditches used together are more feasible and economical than tile. Pastures can be drained enough by furrows or shallow ditches to improve the growth of forage plants. The drainage system should remove excess surface water without causing erosion. Erosion control structures should be built to facilitate rather than to interfere with surface drainage. The risk of erosion is moderate.

Woodlands on these soils reproduce naturally if protected from fire and grazing. Pin oak, covering some places in almost pure stands, is one of the main species in the woodlands. It grows rapidly and has desirable characteristics. The trees should be managed for harvest when they are about 50 years old. Mine timbers, piling, and crossties could be produced. New plantations are seldom started on these soils.

### CAPABILITY UNIT IIIw-1

*Poorly drained and imperfectly drained, light-colored soils on uplands*

The soils in this capability unit are slowly to very slowly permeable, and they need drainage. They are not very productive and will puddle (fig. 5) and clod if worked when too wet. Fertility is low, and supplies of organic matter are medium to low. Soils in this unit are:

Avonburg silt loam, 0 to 2 percent slopes.
Clermont silt loam.
Delmar silt loam.

A crop rotation on these soils should include at least 1 year of meadow every 3 years. In areas where yields of crops and forage are poor or on the stronger slopes that need protection from erosion, additional time in the rotation should be allowed for meadow. Very good management, including drainage, is needed for good yields. Productivity can be improved by draining the soil and applying lime, fertilizer, and organic matter in proper amounts. Artificial drainage is more difficult on these soils than in those of capability unit IIw-2.

Grasses and legumes suited to wet soils grow well if properly limed and fertilized. These soils, however, be-

***Figure 5.*—Clermont silt loam puddles and is difficult to manage.**

come dense and compact if trampled by livestock when too wet.

Because the permeability of these soils is slow to very slow, tile drains do not work well. A tile system spaced closely enough to provide good drainage is usually too expensive for use with general farm crops. Field bedding and shallow, open ditches used together are usually more feasible and economical than tile. Pastures can be drained enough through the use of furrows or shallow ditches to improve the growth of plants. Land leveling that fills in low spots also helps drainage.

Woodlands should reproduce naturally if protected from fire and grazing (fig. 6). Pin oak, occurring in places as almost pure stands, is one of the main species in the woodlands. This species grows rapidly and has other good qualities. The trees should be managed for harvest when they are about 50 years old. Products could be mine timber, crossties, and piling. New plantations of trees are seldom started on these soils.

***Figure 6.*—Pin oak, soft maple, and swamp white oak growing on poorly drained Clermont silt loam.**

CAPABILITY UNIT IVe-1

*Moderately steep or hilly, slightly and moderately eroded soils on uplands; shallow to moderately deep root zones*

The soils in this capability unit are well drained. Runoff is medium to rapid. Soils in this unit are:

- Edenton silt loam, 12 to 18 percent slopes, moderately eroded.
- Milton silt loam, shallow, 2 to 6 percent slopes.
- Milton silt loam, shallow, 6 to 12 percent slopes, moderately eroded.
- Milton silt loam, 12 to 18 percent slopes, moderately eroded.
- Milton silt loam, shallow, 12 to 18 percent slopes, moderately eroded.

These soils are generally not suited to intensive cultivation. If they are cropped, a suitable rotation is one that includes at least 4 years of meadow in 6 years. Careful management is needed to control erosion.

The soils are well suited to pasture (fig. 7). Grasses and legumes suited to well-drained soils grow well if they are properly limed and fertilized. Nitrogen fertilization produces early pasture because of the good natural soil drainage.

Because of steepness, shallowness, or unfavorable material in the substrata, these soils are generally not suitable for terraces. Where diversion terraces are feasible, the outlets should be built and stabilized before the diversion terrace is constructed. Waterways should be grassed and made large enough to carry runoff from the biggest storms. A dense sod should be maintained by adequate

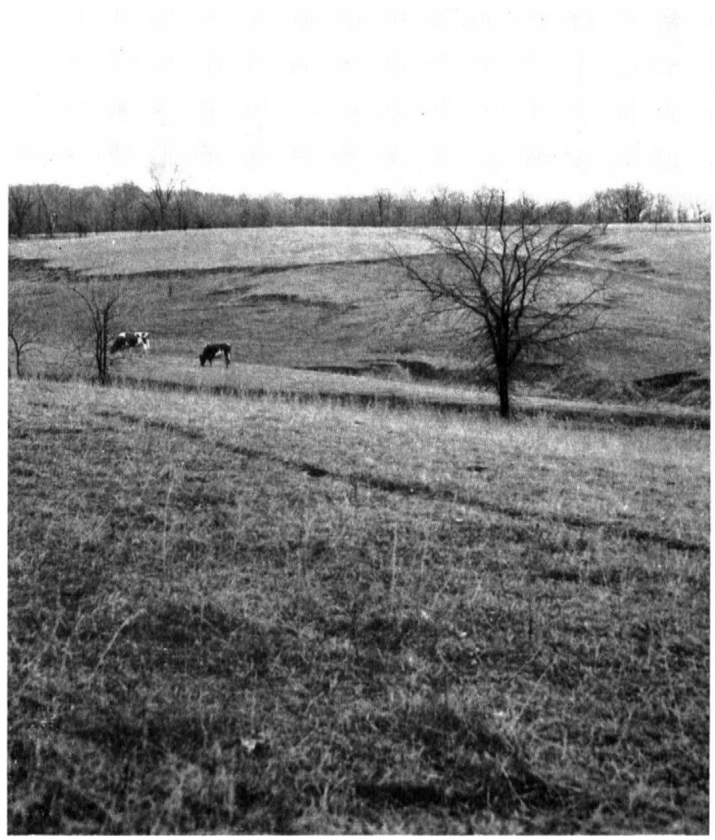

***Figure 7.*—Spring pasture on the Milton soils. Slopes in background have been eroded.**

liming and fertilizing and by seeding and mowing. The soils in this unit are not suitable for ponds.

Woodlands on these soils reproduce naturally if protected from fire and grazing. Pine is suggested for planting, but new plantations are seldom started on these soils.

CAPABILITY UNIT IVe-2

*Moderately steep or hilly, well drained to moderately well drained, deep soils on uplands*

The soils in this capability unit have rapid runoff. The risk of erosion is high, especially if the soils are in row crops. These soils have a moderately deep to deep root zone. Soils in this unit are:

Miami silt loam, 12 to 18 percent slopes.
Miami silt loam, 12 to 18 percent slopes, moderately eroded.
Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded.
Russell silt loam, 12 to 18 percent slopes.
Russell silt loam, 12 to 18 percent slopes, moderately eroded.
Williamsburg silt loam, 12 to 18 percent slopes, moderately eroded.

If these soils are cropped, rotations should include at least 4 years of meadow in 6 years. Careful management and the control of erosion are necessary.

The soils are well suited to pasture. Grasses and legumes suitable for well-drained soils grow well if properly limed and fertilized. Nitrogen fertilization produces early pasture.

Because of steepness, these soils are generally not suitable for terraces. If diversion terraces are feasible, the outlets ought to be built and stabilized before the main structures are started.

Waterways should be grassed and made large enough to carry runoff from the biggest storms. A dense sod should be maintained by use of adequate lime and fertilizer and by regular seeding and mowing. Except the Williamsburg, all soils in the unit are suitable for ponds.

Woodlands reproduce naturally on these soils if protected from fire and grazing. Pine is suggested for planting, but new plantations are seldom started on these soils.

CAPABILITY UNIT IVe-3

*Sloping, severely eroded, well drained and moderately well drained soils*

The soils in this unit are naturally moderately well drained to well drained. They are eroded to the extent that all the surface soil has been removed from most of the area of these soils; consequently, the plow layer is now predominantly subsoil. This severely eroded condition creates special problems in management, whatever the proposed land use. Soils in this unit are:

Edenton soils, 6 to 12 percent slopes, severely eroded.
Miami soils, 6 to 12 percent slopes, severely eroded.
Rossmoyne soils, 6 to 12 percent slopes, severely eroded.
Russell soils, 6 to 12 percent slopes, severely eroded.
Xenia soils, 6 to 12 percent slopes, severely eroded.

These soils usually should be kept in permanent vegetation most of the time because of the poor physical condition of the plow layer. They should be cultivated only to the extent necessary to reseed them to long-term meadow consisting of mixtures of grasses and legumes. Small areas of these soils in fields that consist predominantly of soils that are suitable for tillage should be given large applications of manure or organic matter to improve their condition so they can be more easily worked with the rest of the field.

Terraces or diversions may be needed to divert runoff and to prevent continued erosion. If they are used, outlets should be established ahead of construction. Use sod waterways, if feasible, wherever water concentrates and flows in natural drainageways.

These soils are moderately well adapted to pasture, but a good stand of desirable pasture plants may be more difficult to obtain and maintain than on the less eroded soils. An application of manure at the time of seeding might increase chances of obtaining a good stand. Regulation of grazing and periodic applications of manure and fertilizer will help maintain the pasture stand. These soils may need less lime than the less eroded soils because the underlying limy materials are nearer the surface.

If new forest plantings are desired on these soils, pines are recommended.

CAPABILITY UNIT Vw-1

*Soils on bottom lands subject to crop-damaging floods*

The soils in this capability unit are well drained to very poorly drained. They are:

Algiers silt loam.
Eel loam.
Eel silt loam.
Genesee loam.
Genesee loam, sandy substratum.
Medway loam.
Medway silt loam.
Ross loam.
Ross silt loam.
Shoals silt loam.
Sloan silt loam.
Sloan silt loam, overwashed.
Sloan silty clay loam.

Because of flooding, these soils are used only for pasture and woodland. Good pastures can be established, and they are reasonably productive in dry weather. Mixtures of legumes and grasses suitable for wet soils should be planted and properly fertilized to obtain the best production of forage. In addition, pastures should be mowed frequently enough to control weeds and keep grasses from smothering the legumes.

Pastures should not be grazed following floods because silt deposited on the foliage may have a bad effect if eaten by animals. The silt, however, is washed off in subsequent rains. Grazing while soils are wet should not be allowed because the trampling of livestock will pit and compact the soil and damage the plants. Tile drains are not economical in pastures, but enough surface drainage can be used to improve forage production.

Woodlands on these soils reproduce naturally if protected from fire and grazing. New plantations are usually not started on these soils.

Areas of these soils on which crops are not frequently damaged by floods are classified in capability units I-2 or IIw-1.

### CAPABILITY UNIT VIe-1

*Hilly to steep, slightly to moderately eroded, well drained to excessively drained soils*

The soils in this capability unit are subject to erosion if not kept in permanent vegetation. Some areas are shallow to bedrock. The soils in this unit are:

- Casco, Rodman, and Fox soils, 18 to 25 percent slopes, moderately eroded.
- Edenton and Fairmount soils, 18 to 25 percent slopes, moderately eroded.
- Fox and Casco soils, 12 to 18 percent slopes, moderately eroded.
- Miami and Hennepin silt loams, 18 to 25 percent slopes.
- Miami and Hennepin silt loams, 18 to 25 percent slopes, moderately eroded.
- Milton silt loam, shallow, 18 to 25 percent slopes, moderately eroded.
- Russell silt loam, 18 to 25 percent slopes.
- Russell silt loam, 18 to 25 percent slopes, moderately eroded.
- Williamsburg silt loam, 18 to 25 percent slopes, moderately eroded.

These soils should be used for pasture and woodland. Because these soils are droughty, native pastures are not dependable in dry weather and may be easily damaged by overgrazing. Additional forage from other sources will be needed. Grasses and deep-rooted legumes suited to well-drained soils grow well if properly limed and fertilized. Deep-rooted legumes can be seeded by the trash-mulch method. This method consists of disking the sod thoroughly to prepare a seedbed and then seeding legumes. The legumes will improve the quality of the forage and the production during dry weather. Nitrogen fertilization on pastures produces early forage.

Land that is too steep to be fertilized or mowed should be in woodland. New plantations are frequently started on these soils and should consist of pine planted in the open or exposed areas. Established woodlands reproduce naturally if protected from fire and grazing.

### CAPABILITY UNIT VIe-2

*Moderately steep, severely eroded, well-drained soils*

The soils in this capability unit have lost nearly all their original surface soil through erosion. Their surface layers are now mostly original subsoil material. The soils in this unit are:

- Edenton soils, 12 to 18 percent slopes, severely eroded.
- Miami soils, 12 to 18 percent slopes, severely eroded.
- Milton soils, shallow, 12 to 18 percent slopes, severely eroded.
- Russell soils, 12 to 18 percent slopes, severely eroded.

These soils should be kept in permanent vegetation. They are moderately well suited to pasture, but good stands of pasture plants are difficult to establish. Manure, applied to the soil at seeding time, improves the chances of obtaining a good stand. After the pasture is established, manuring, fertilizing, and proper control of grazing are needed to maintain stands and the production of forage. Less lime may be needed on these soils than on the less severely eroded soils because materials high in lime may be near the surface (fig. 8).

Slopes that are too rough to be mowed or fertilized should be in woodland. New plantations of pine should be started in open, exposed areas. The trees should be planted in contour furrows where feasible.

### CAPABILITY UNIT VIIe-1

*Steep to very steep, slightly or moderately eroded, well drained to excessively drained soils*

The soils in this capability unit are subject to erosion if not protected by a cover of living vegetation. Some areas are shallow to bedrock. The soils in this unit are:

- Casco and Rodman soils, 25 to 50 percent slopes, moderately eroded.
- Edenton and Fairmount soils, 25 to 50 percent slopes, moderately eroded.
- Hennepin and Miami soils, 25 to 50 percent slopes.
- Hennepin and Miami soils, 25 to 50 percent slopes, moderately eroded.
- Milton silt loam, shallow, 25 to 50 percent slopes, moderately eroded.
- Russell and Hennepin silt loams, 25 to 50 percent slopes.
- Russell and Hennepin silt loams, 25 to 50 percent slopes, moderately eroded.

These soils should be used for pasture and woodland. Because of steepness, roughness, and the difficulties of mowing and fertilizing, the soils have only a limited suitability for pasture. Native pastures on these droughty soils are not dependable in dry weather and may easily be damaged through overgrazing. Supplies of forage from pastures on these soils should, therefore, be supplemented by forage from other pastures. Forage can be improved in quality and quantity on the more favorable areas of these soils by mowing weeds and controlling the competition from woody sprouts.

Land that is too steep for pasture should be in woodland. New plantations can be started on these soils in open, exposed areas. Pine is suitable and should be planted in contour furrows if feasible. Grazing and fire should be controlled so that existing woodlands can reproduce naturally.

*Figure 8.*—**Limestone is exposed on many steep slopes of the Milton soils.**

CAPABILITY UNIT VIIe-2

*Hilly to very steep, severely eroded, well drained to excessively drained soils*

The soils in this capability unit have lost nearly all their original surface soil through erosion. Their surface layers are now mostly original subsoil material. Soils in this unit are:

Edenton and Fairmount soils, 18 to 25 percent slopes, severely eroded.
Fox, Casco, and Rodman soils, 12 to 25 percent slopes, severely eroded.
Gullied land.
Hennepin and Miami soils, 25 to 50 percent slopes, severely eroded.
Miami and Hennepin soils, 18 to 25 percent slopes, severely eroded.
Milton soils, shallow, 25 to 50 percent slopes, severely eroded.
Russell soils, 18 to 25 percent slopes, severely eroded.
Russell and Hennepin soils, 25 to 50 percent slopes, severely eroded.

These soils should be kept in permanent vegetation. Steepness, roughness, and the difficulties of mowing and fertilizing limit their suitability for pasture. Good stands of desirable pasture plants are more difficult to establish on these soils than on the less eroded soils. Establishment is made easier on the lesser slopes if a mulch such as manure is applied to the soil at seeding time. Control of grazing and periodic applications of manure and fertilizer are needed to maintain a good stand. Less lime may be needed on these soils than on the less severely eroded soils because materials high in lime may be near the surface.

Woodland is the best use for most of these soils. New plantations should be started in open, exposed areas and consist of pine. If feasible, the planting should be made in contour furrows.

## Estimated Yields of Crops

Table 1 shows, for each soil in the county, the average annual yields per acre of the principal crops that were obtained over a period of about 5 years (1953-1958) under average management and improved management.

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

[Estimates in columns A are based on average management, and those in columns B on improved management. See text for definitions of these levels of management. Absence of a yield indicates the soil is not suited to the crop. Soils not used extensively for any of the stated crops are omitted from the table]

| Soil | Corn | | Wheat | | Soybeans | | Alfalfa and grass hay | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Tons* | *Tons* |
| Algiers silt loam | 75 | 110 | 20 | 35 | 22 | 29 | 3.5 | 4.0 |
| Avonburg silt loam, 0 to 2 percent slopes | 50 | 90 | 18 | 28 | 20 | 25 | 2.5 | 3.3 |
| Avonburg silt loam, 2 to 6 percent slopes | 50 | 90 | 18 | 28 | 20 | 25 | 2.5 | 3.3 |
| Avonburg silt loam, 2 to 6 percent slopes, moderately eroded | 48 | 88 | 17 | 27 | 18 | 23 | 2.5 | 3.3 |
| Birkbeck silt loam, 0 to 2 percent slopes | 75 | 110 | 25 | 35 | 22 | 29 | 2.8 | 3.4 |
| Birkbeck silt loam, 2 to 6 percent slopes | 75 | 110 | 25 | 35 | 22 | 29 | 2.8 | 3.4 |
| Birkbeck silt loam, 2 to 6 percent slopes, moderately eroded | 71 | 105 | 25 | 35 | 21 | 29 | 2.8 | 3.4 |
| Blanchester silt loam | 55 | 95 | 21 | 29 | 21 | 29 | 3.2 | 3.9 |
| Bonpas silty clay loam | 80 | 115 | 22 | 30 | 22 | 30 | 3.5 | 4.5 |
| Bonpas silt loam, overwashed | 80 | 115 | 22 | 30 | 22 | 30 | 3.5 | 4.5 |
| Brookston silty clay loam | 80 | 115 | 22 | 30 | 22 | 30 | 3.5 | 4.5 |
| Brookston silt loam | 80 | 115 | 22 | 30 | 22 | 30 | 3.5 | 4.5 |
| Brookston silt loam, overwashed | 80 | 115 | 22 | 30 | 22 | 30 | 3.5 | 4.5 |
| Celina silt loam, 0 to 2 percent slopes | 70 | 105 | 25 | 40 | 22 | 29 | 2.8 | 3.4 |
| Celina silt loam, 2 to 6 percent slopes | 70 | 105 | 25 | 35 | 21 | 29 | 2.8 | 3.4 |
| Celina silt loam, 2 to 6 percent slopes, moderately eroded | 68 | 103 | 22 | 33 | 19 | 28 | 2.7 | 3.3 |
| Celina silt loam, 6 to 12 percent slopes, moderately eroded | 60 | 90 | 22 | 33 | 19 | 28 | 2.7 | 3.3 |
| Cincinnati silt loam, 2 to 6 percent slopes | 64 | 102 | 24 | 35 | 21 | 28 | 2.8 | 3.4 |
| Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded | 62 | 100 | 23 | 33 | 20 | 27 | 2.7 | 3.3 |
| Cincinnati silt loam, 6 to 12 percent slopes | 64 | 96 | 23 | 35 | 21 | 28 | 2.8 | 3.4 |
| Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded | 62 | 94 | 22 | 33 | 20 | 27 | 2.7 | 3.3 |
| Clermont silt loam | 50 | 90 | 18 | 28 | 20 | 25 | 2.5 | 3.1 |
| Crosby silt loam, 0 to 2 percent slopes | 60 | 97 | 22 | 35 | 22 | 30 | 2.6 | 3.2 |
| Crosby silt loam, 2 to 6 percent slopes | 57 | 92 | 22 | 35 | 22 | 29 | 2.6 | 3.2 |
| Crosby silt loam, 2 to 6 percent slopes, moderately eroded | 55 | 88 | 21 | 34 | 19 | 28 | 2.6 | 3.2 |
| Delmar silt loam | 52 | 92 | 18 | 28 | 20 | 25 | 2.5 | 3.1 |
| Edenton silt loam, 2 to 6 percent slopes, moderately eroded | 55 | 80 | 23 | 33 | 20 | 25 | 2.8 | 3.3 |
| Edenton silt loam, 6 to 12 percent slopes, moderately eroded | 53 | 75 | 22 | 33 | 20 | 25 | 2.8 | 3.3 |
| Edenton silt loam, 12 to 18 percent slopes, moderately eroded | 45 | 56 | 18 | 28 | 19 | 23 | 2.8 | 3.3 |
| Edenton soils, 6 to 12 percent slopes, severely eroded | 39 | 50 | 17 | 27 | 18 | 22 | 2.5 | 2.9 |
| Eel loam | 68 | 107 | 21 | 40 | 22 | 30 | 3.5 | 4.5 |
| Eel silt loam | 68 | 107 | 21 | 40 | 22 | 30 | 3.5 | 4.5 |
| Fincastle silt loam, 0 to 2 percent slopes | 60 | 97 | 22 | 35 | 22 | 30 | 2.6 | 3.2 |
| Fincastle silt loam, 2 to 6 percent slopes | 57 | 92 | 22 | 35 | 22 | 29 | 2.6 | 3.2 |
| Fincastle silt loam, 2 to 6 percent slopes, moderately eroded | 56 | 89 | 21 | 34 | 20 | 29 | 2.6 | 3.3 |
| Fox silt loam, 0 to 2 percent slopes | 58 | 95 | 27 | 39 | 17 | 28 | 2.8 | 3.3 |
| Fox silt loam, 2 to 6 percent slopes | 58 | 95 | 27 | 39 | 17 | 28 | 2.8 | 3.3 |
| Fox silt loam, 2 to 6 percent slopes, moderately eroded | 56 | 90 | 26 | 38 | 16 | 25 | 2.8 | 3.2 |

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

| Soil | Corn | | Wheat | | Soybeans | | Alfalfa and grass hay | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Tons* | *Tons* |
| Fox silt loam, 6 to 12 percent slopes, moderately eroded | 50 | 82 | 22 | 34 | 16 | 25 | 2. 8 | 3. 2 |
| Fox and Casco soils, 12 to 18 percent slopes, moderately eroded | 46 | 70 | 20 | 30 | 15 | 24 | 2. 7 | 3. 1 |
| Genesee loam | 70 | 107 | 24 | 40 | 22 | 30 | 3. 5 | 4. 5 |
| Genesee loam, sandy substratum | 70 | 107 | 24 | 40 | 22 | 30 | 3. 5 | 4. 5 |
| Genesee silt loam | 70 | 107 | 24 | 40 | 22 | 30 | 3. 5 | 4. 5 |
| Genesee silt loam, sandy substratum | 70 | 107 | 24 | 40 | 22 | 30 | 3. 5 | 4. 7 |
| Henshaw silt loam | 60 | 100 | 20 | 29 | 19 | 28 | 2. 6 | 3. 2 |
| Kokomo silt loam, overwashed | 85 | 118 | 23 | 35 | 25 | 35 | 3. 5 | 4. 5 |
| Medway loam | 73 | 107 | 21 | 40 | 22 | 30 | 3. 5 | 4. 5 |
| Medway silt loam | 73 | 107 | 21 | 40 | 22 | 30 | 3. 5 | 4. 5 |
| Miami silt loam, 2 to 6 percent slopes | 64 | 100 | 25 | 35 | 20 | 28 | 2. 8 | 3. 4 |
| Miami silt loam, 2 to 6 percent slopes, moderately eroded | 59 | 92 | 22 | 35 | 19 | 26 | 2. 7 | 3. 3 |
| Miami silt loam, 6 to 12 percent slopes | 64 | 100 | 24 | 35 | 20 | 28 | 2. 8 | 3. 4 |
| Miami silt loam, 6 to 12 percent slopes, moderately eroded | 59 | 90 | 22 | 35 | 19 | 26 | 2. 7 | 3. 1 |
| Miami silt loam, 12 to 18 percent slopes | 54 | 90 | 21 | 34 | 20 | 26 | 2. 8 | 3. 4 |
| Miami silt loam, 12 to 18 percent slopes, moderately eroded | 50 | 88 | 20 | 33 | 19 | 24 | 2. 7 | 3. 1 |
| Miami soils, 2 to 6 percent slopes, severely eroded | 50 | 78 | 17 | 25 | 18 | 22 | 2. 5 | 2. 9 |
| Miami soils, 6 to 12 percent slopes, severely eroded | 39 | 50 | 17 | 24 | 18 | 22 | 2. 5 | 2. 9 |
| Miami soils, 12 to 18 percent slopes, severely eroded | | | | | | | 2. 5 | 2. 9 |
| Millsdale silty clay loam | 80 | 115 | 22 | 30 | 22 | 30 | 3. 5 | 4. 5 |
| Milton silt loam, 0 to 2 percent slopes | 65 | 103 | 28 | 40 | 20 | 28 | 2. 8 | 3. 4 |
| Milton silt loam, 2 to 6 percent slopes | 58 | 95 | 25 | 35 | 20 | 28 | 2. 8 | 3. 4 |
| Milton silt loam, 2 to 6 percent slopes, moderately eroded | 56 | 93 | 23 | 33 | 19 | 25 | 2. 7 | 3. 3 |
| Milton silt loam, 6 to 12 percent slopes, moderately eroded | 51 | 87 | 22 | 32 | 19 | 24 | 2. 7 | 3. 3 |
| Milton silt loam, 12 to 18 percent slopes, moderately eroded | 44 | 81 | 20 | 32 | 19 | 24 | 2. 7 | 3. 3 |
| Milton silt loam, shallow, 2 to 6 percent slopes | 49 | 73 | 25 | 35 | 19 | 25 | 2. 7 | 3. 3 |
| Milton silt loam, shallow, 6 to 12 percent slopes, moderately eroded | 46 | 71 | 22 | 34 | 18 | 22 | 2. 6 | 3. 2 |
| Milton silt loam, shallow, 12 to 18 percent slopes, moderately eroded | 45 | 70 | 20 | 33 | 17 | 21 | 2. 6 | 3. 2 |
| Milton soils, shallow, 12 to 18 percent slopes, severely eroded | | | | | | | 2. 4 | 2. 9 |
| Ockley silt loam, 0 to 2 percent slopes | 67 | 105 | 28 | 40 | 22 | 29 | 3. 2 | 3. 9 |
| Ockley silt loam, 2 to 6 percent slopes | 66 | 105 | 27 | 39 | 21 | 28 | 3. 2 | 3. 9 |
| Ockley silt loam, 2 to 6 percent slopes, moderately eroded | 61 | 103 | 26 | 37 | 20 | 25 | 2. 8 | 3. 3 |
| Ockley silt loam, 6 to 12 percent slopes, moderately eroded | 58 | 102 | 24 | 34 | 20 | 25 | 2. 8 | 3. 3 |
| Ockley silt loam, mixed substratum, 0 to 2 percent slopes | 67 | 105 | 28 | 40 | 22 | 29 | 3. 2 | 3. 9 |
| Ockley silt loam, mixed substratum, 2 to 6 percent slopes | 67 | 105 | 27 | 39 | 21 | 28 | 3. 2 | 3. 9 |
| Ockley silt loam, mixed substratum, 2 to 6 percent slopes, moderately eroded | 65 | 103 | 27 | 39 | 20 | 25 | 2. 8 | 3. 3 |
| Ockley silt loam, mixed substratum, 6 to 12 percent slopes, moderately eroded | 65 | 103 | 24 | 34 | 20 | 35 | 2. 8 | 3. 3 |
| Ragsdale silty clay loam | 80 | 120 | 22 | 30 | 25 | 35 | 3. 5 | 4. 5 |
| Ragsdale silt loam | 80 | 120 | 22 | 30 | 25 | 35 | 3. 5 | 4. 5 |
| Raub silt loam | 66 | 102 | 24 | 36 | 23 | 31 | 2. 6 | 3. 2 |
| Reesville silt loam, 0 to 2 percent slopes | 65 | 100 | 22 | 35 | 22 | 30 | 2. 6 | 3. 2 |
| Reesville silt loam, 2 to 6 percent slopes | 65 | 100 | 22 | 35 | 22 | 30 | 2. 6 | 3. 2 |
| Ross loam | 78 | 110 | 27 | 42 | 23 | 31 | 3. 5 | 4. 5 |
| Ross silt loam | 78 | 110 | 27 | 42 | 23 | 31 | 3. 5 | 4. 5 |
| Rossmoyne silt loam, 0 to 2 percent slopes | 63 | 100 | 23 | 34 | 19 | 28 | 2. 8 | 3. 4 |
| Rossmoyne silt loam, 2 to 6 percent slopes | 62 | 98 | 23 | 34 | 19 | 28 | 2. 8 | 3. 4 |
| Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded | 57 | 90 | 23 | 33 | 19 | 27 | 2. 7 | 3. 3 |
| Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded | 57 | 89 | 23 | 33 | 19 | 27 | 2. 7 | 3. 3 |
| Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded | 57 | 80 | 20 | 30 | 19 | 25 | 2. 7 | 3. 3 |
| Rossmoyne soils, 6 to 12 percent slopes, severely eroded | 35 | 50 | 17 | 27 | 18 | 22 | 2. 5 | 2. 9 |
| Russell silt loam, 2 to 6 percent slopes | 67 | 100 | 25 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Russell silt loam, 2 to 6 percent slopes, moderately eroded | 62 | 93 | 24 | 34 | 21 | 28 | 2. 8 | 3. 4 |
| Russell silt loam, 6 to 12 percent slopes | 66 | 95 | 23 | 33 | 20 | 27 | 2. 8 | 3. 4 |
| Russell silt loam, 6 to 12 percent slopes, moderately eroded | 60 | 90 | 22 | 32 | 19 | 26 | 2. 8 | 3. 4 |
| Russell silt loam, 12 to 18 percent slopes | 57 | 90 | 22 | 32 | 19 | 26 | 2. 8 | 3. 4 |
| Russell silt loam, 12 to 18 percent slopes, moderately eroded | 55 | 86 | 20 | 31 | 19 | 25 | 2. 8 | 3. 4 |
| Russell soils, 2 to 6 percent slopes, severely eroded | 44 | 58 | 18 | 26 | 18 | 24 | 2. 5 | 2. 9 |
| Russell soils, 6 to 12 percent slopes, severely eroded | 40 | 55 | 18 | 26 | 18 | 24 | 2. 5 | 2. 9 |
| Russell soils, 12 to 18 percent slopes, severely eroded | | | | | | | 2. 5 | 2. 9 |
| Sardinia silt loam, 0 to 2 percent slopes | 63 | 99 | 22 | 34 | 21 | 29 | 2. 8 | 3. 4 |
| Sardinia silt loam, 2 to 6 percent slopes | 62 | 98 | 22 | 33 | 20 | 28 | 2. 8 | 3. 4 |
| Sardinia silt loam, 2 to 6 percent slopes, moderately eroded | 60 | 96 | 21 | 32 | 19 | 27 | 2. 8 | 3. 4 |
| Shoals silt loam | 60 | 95 | 22 | 35 | 20 | 30 | 2. 6 | 3. 2 |
| Sleeth silt loam | 60 | 97 | 22 | 35 | 20 | 30 | 2. 6 | 3. 2 |
| Sleeth silt loam, mixed substratum, 0 to 2 percent slopes | 60 | 97 | 22 | 35 | 22 | 29 | 2. 6 | 3. 2 |
| Sleeth silt loam, mixed substratum, 2 to 6 percent slopes | 57 | 92 | 22 | 35 | 22 | 29 | 2. 6 | 3. 2 |
| Sloan silty clay loam | 75 | 110 | 24 | 35 | 23 | 32 | 3. 5 | 4. 5 |
| Sloan silt loam | 75 | 110 | 24 | 35 | 23 | 32 | 3. 5 | 4. 5 |
| Sloan silt loam, overwashed | 75 | 110 | 24 | 35 | 23 | 32 | 3. 5 | 4. 5 |

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

| Soil | Corn | | Wheat | | Soybeans | | Alfalfa and grass hay | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Tons* | *Tons* |
| Thackery silt loam, 0 to 2 percent slopes | 65 | 103 | 24 | 40 | 22 | 29 | 2. 8 | 3. 4 |
| Thackery silt loam, 2 to 6 percent slopes | 63 | 98 | 24 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Thackery silt loam, mixed substratum, 0 to 2 percent slopes | 75 | 110 | 25 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Thackery silt loam, mixed substratum, 2 to 6 percent slopes | 75 | 110 | 25 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Uniontown silt loam, 0 to 2 percent slopes | 65 | 103 | 22 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Uniontown silt loam, 2 to 6 percent slopes, moderately eroded | 60 | 90 | 21 | 35 | 21 | 29 | 2. 8 | 3. 4 |
| Westland silty clay loam | 78 | 110 | 22 | 30 | 22 | 30 | 3. 5 | 4. 5 |
| Westland silt loam | 78 | 110 | 22 | 30 | 22 | 30 | 3. 5 | 4. 5 |
| Westland silt loam, overwashed | 78 | 110 | 22 | 30 | 22 | 30 | 3. 5 | 4. 5 |
| Westland silt loam, mixed substratum, overwashed | 80 | 115 | 22 | 30 | 22 | 30 | 3. 5 | 4. 5 |
| Westland silty clay loam, mixed substratum | 80 | 115 | 22 | 30 | 22 | 30 | 3. 5 | 4. 5 |
| Williamsburg silt loam, 0 to 2 percent slopes | 66 | 104 | 24 | 34 | 22 | 29 | 2. 8 | 3. 4 |
| Williamsburg silt loam, 2 to 6 percent slopes | 62 | 98 | 22 | 34 | 21 | 29 | 2. 8 | 3. 4 |
| Williamsburg silt loam, 2 to 6 percent slopes, moderately eroded | 57 | 90 | 21 | 33 | 20 | 28 | 2. 8 | 3. 4 |
| Williamsburg silt loam, 6 to 12 percent slopes | 62 | 98 | 22 | 34 | 21 | 29 | 2. 8 | 3. 4 |
| Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded | 57 | 90 | 21 | 33 | 20 | 28 | 2. 8 | 3. 4 |
| Williamsburg silt loam, 12 to 18 percent slopes, moderately eroded | 47 | 86 | 20 | 30 | 19 | 27 | 2. 8 | 3. 3 |
| Xenia silt loam, 0 to 2 percent slopes | 75 | 110 | 25 | 40 | 22 | 29 | 2. 8 | 3. 4 |
| Xenia silt loam, 2 to 6 percent slopes | 65 | 105 | 25 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Xenia silt loam, 2 to 6 percent slopes, moderately eroded | 63 | 91 | 24 | 34 | 21 | 28 | 2. 8 | 3. 4 |
| Xenia silt loam, 6 to 12 percent slopes | 63 | 95 | 25 | 35 | 22 | 29 | 2. 8 | 3. 4 |
| Xenia silt loam, 6 to 12 percent slopes, moderately eroded | 60 | 90 | 24 | 34 | 21 | 28 | 2. 8 | 3. 4 |
| Xenia soils, 2 to 6 percent slopes, severely eroded | 44 | 58 | 18 | 26 | 18 | 24 | 2. 5 | 2. 9 |
| Xenia soils, 6 to 12 percent slopes, severely eroded | 40 | 50 | 18 | 26 | 18 | 24 | 2. 5 | 2. 9 |

In columns A are estimates of yields obtained under the management farmers commonly use. This level of management usually included a variable rotation consisting of 1 or 2 years of corn, 1 year of a small grain, and 1 year of meadow. Fertilizers were applied to corn in the row at the rate of 10 to 15 pounds of nitrogen and 40 to 60 pounds each of phosphate ($P_2O_5$) and potash ($K_2O$) per acre. Fertilizers on meadows varied from none to 12 to 24 pounds per acre each of phosphate and potash. Normal amounts of crop residues were returned to the soil.

In columns B are estimates of yields obtained by applying the best information now available to increase production. This consists of liming soils according to needs determined by soil tests and applying fertilizer in amounts sufficient to meet the needs for near-maximum yields. The amounts of fertilizer needed vary with the present fertility status of the soil. Recommendations of the Ohio Agricultural Experiment Station, which accompany the soil test data, are designed to bring soil fertility to the level needed for near-maximum production. The application of fertilizer must be supplemented by the use of seed of improved plant varieties, timely tillage, and other operations, and by weather that favors good yields. All practices needed to control erosion, to conserve moisture, organic matter, and tilth, and to improve drainage where necessary were effectively applied. It was assumed that irrigation would not be used.

These yields may not apply directly to specific fields for any particular year. Soils vary from field to field, management differs slightly from farm to farm, and weather is not the same from year to year. The estimates are intended only as a guide to the relative productivity of the soils and an indication of how the soils respond to improved management. Seasonal weather can have a profound effect on the success or failure of a crop. Good seedbed preparations and good crop stands may be difficult to obtain in some seasons. Therefore, the crops that were planted and not harvested, have not been considered in these estimates.

Estimates of yields are based on interviews with farmers; on direct observations by the county agent, the soil conservationist of the Soil Conservation Service, and the soil survey party chief of the Ohio Division of Lands and Soil; and on results obtained in field trials and experiments at the Ohio Agricultural Experiment Station.

## General Management of Land in Farms

Successful farming requires an understanding of soil management and proper land use. This part of the soil survey report provides the basic information for the conservation and improvement of cropland, pasture, woodland, and wildlife.

### *Management of cropland*

In general farming, crops are grown for sale or for use as feed. The economical growing of crops requires soil management that fits the soil. If management is good, corn, wheat, soybeans, meadow, and most other crops suited to the county can be grown.

An adequate supply of plant nutrients and organic matter, a good root zone for plants, and the proper balance of air and water are needed to grow crops efficiently. Drainage, control of erosion, and the use of lime, fertilizers, crop rotations, and suitable crop varieties are important management practices needed to improve yields.

The maintenance of soil fertility generally requires the application of nitrogen, phosphate, and potash in suitable amounts. It also requires the evaluation of organic matter and natural fertility in the soil, of the yield level desired, of the past management, and of the kind of root zone available for growing plants.

Organic matter affects soil tilth and the amount of nitrogen in the soil. Supplies of nitrogen are generally proportional to the amount of organic matter. Management must provide for an adequate input of organic matter through the utilization of crop residues, green manure, or barnyard manure. Nitrogen fertilizer is used to supplement the nitrogen that the crop can obtain from organic matter. Crop yields and residues are increased through application of nitrogen fertilizer. Crop residues mixed with the soil improve both tilth and fertility. Production of high-quality meadows and large quantities of crop residues in a predetermined sequence will add organic matter to the soil.

Cover crops can provide additional benefits, depending on the weather. In fall, they allow corn harvesting equipment to go over the ground with more traction and less compaction of soil. In spring, cover crops will usually help remove excess moisture from the soil and allow plowing to be done earlier. Cover crops also break up the beating action of rain on bare soil.

Cover crops and green-manure crops should get the same management as the cash crops. When these residue-producing crops are plowed down, nitrogen fertilizer may be needed to facilitate decomposition and to maintain the proper balance of nitrogen.

Drainage of cropland soil is a practice that improves the air-water relationship in the root zone. Surface drains and tile drains should be designed to function properly. Land leveling, to correct natural or manmade irregularities, is desirable in many places to supplement the drainage system. Soil drainage is also improved by maintaining good soil structure and a good supply of organic matter in the soil.

Erosion control is necessary on long sloping fields. The loss of surface soil through erosion generally reduces soil productivity. Erosion is controlled when vegetation or a mechanical practice, or both, reduce the volume and rate of runoff and increase the absorption of water by the soil. The loss of surface soil through water erosion must be reduced to a negligible point. Crop rotations that include meadow, cover crops, and green-manure crops, and provide for the efficient use of crop residues are good. In addition, contour cultivation, stripcropping, and the use of diversion and other terraces are effective in the control of erosion. Suggested crop rotations and the supporting practices to control erosion are given in the section "Descriptions of the Capability Units." Cropping systems and supporting practices that differ from those suggested in the capability unit descriptions are suitable if they control erosion as well or better.

The following management is suitable for all cropland:

1. Return to the soil, except in areas recently seeded, all crop residue, corn stover, and straw. Straw and other residue can injure young seedlings of grass and legumes. Your soil conservationist or county agricultural extension agent can advise you how to seed mulched areas.
2. Apply all available manure; use more on eroded areas than on uneroded areas.
3. Plan for timely plowing, planting, cultivating, and harvesting.
4. Avoid excessive tillage when preparing seedbeds. Do not operate tractors and other machines on soil that is too wet.
5. Plant suitable crops varieties at the recommended rate. The latest bulletins of the Ohio Agricultural Extension Service provide information on crop varieties and hybrids.
6. Inoculate legume seed.
7. Apply fertilizer and lime according to needs determined by soil tests.

The nutrient needs of crops to be grown, the existing fertility of the soil, and the degree of acidity influence the amount of fertilizer and lime soils need. The Ohio Agricultural Extension Service has bulletins on these subjects.

Soil testing service is available, for a small fee, through the Ohio Agricultural Extension Service. Tests determine acidity and the availability of phosphorus and potassium in the soil. Tests for the minor elements can also be obtained.

Proper sampling of a field is very important in obtaining a representative test of the soil and its nutrient elements. The following steps should be followed:

1. Obtain instructions and containers from your County Agricultural Extension Service.
2. Refer to the soil survey map of your farm, and use it as a guide for sampling.
3. Record the soil names or symbols on each sample container and mail sample to soil-testing laboratory.

## COMMERCIAL PRODUCTION OF VEGETABLES

Vegetable crops should be planted and harvested early to have produce ready for the most profitable market. Therefore, soils that warm early in spring are the most desirable. Loamy- and sandy-textured soils having good internal drainage are ideal for most vegetable crops. They warm early in spring and absorb moisture readily.

Vegetables require soil of higher fertility than most other crops. They need soils that can make available at least 90 pounds of phosphorus ($P_2O_5$) and 300 pounds of potassium ($K_2O$) per acre. The soil reaction for most vegetables should be maintained at pH 6.5 to 6.8. For potatoes, the soils should have a lower pH value.

Soils used for vegetables should be high in organic matter. Crop residues, cover crops, green-manure crops, or large amounts of manure should be plowed down each year. Organic matter makes plant nutrients available, increases the moisture-holding capacity, and improves soil tilth. Surface soil in good condition is more suitable for irrigation and will resist compaction when heavy equipment is used for tillage.

In many places, vegetable growers irrigate their crops. This practice is described in the following paragraphs. Information on crop varieties, production methods, control of diseases and insects, and soil requirements are available from the Agricultural Extension Service and the Soil Conservation Service.

#### IRRIGATION

Operators who want to irrigate crops or pasture should find a suitable source of water and determine their legal right to use it. The Ohio Department of Natural Resources has jurisdiction over the use of water in flowing streams. Water from a drilled well can be used for irrigation in whatever quantity is available. Water from a pond can be used for irrigation if the normal flow or supply to a downstream user is not diminished or cut off.

To be suitable for irrigation, the surface soil should be porous, or able to absorb water readily. Surface soil and subsoil should both have a good water-holding capacity. Water and air in the subsoil and underlying material should be able to move freely to prevent waterlogging. A permeable soil allows gravitational water to drain freely, and it warms early in spring.

Irrigation will increase soil productivity in areas where yields are reduced by lack of water. It is most effective if fertility is maintained at a high level and the surface soil is in good physical condition.

The frequency of irrigation will depend on the rainfall, the moisture requirement of the crop, the moisture available to plants, and the rate in which growing crops use water. High crop yields can be expected from irrigation if available moisture in the root zone is not allowed to drop below 50 percent of field capacity.

Devices for measuring soil moisture should be used to determine the level of available moisture in the root zone. Placed in the root zone of the irrigated crop, these devices reliably indicate the amount of available moisture and, thereby, help determine the need for irrigation.

The rate for applying irrigation water depends on the infiltration capacity of the soil and the cover on the soil at the time of irrigation. It should not exceed the maximum infiltration rate of the soil. As a rule, the rate for bare soils that are well or moderately well suited to irrigation should be about one-half inch per hour, or if the vegetative cover is good, 1 inch per hour. The water of each irrigation should be applied at this rate until soil moisture, in the root zone of the crop being grown, has reached field capacity.

The design of an irrigation system depends upon the job to be accomplished. It should take into account the crop or crops to be irrigated, the water-intake rate of the soil, and the size of the area to be irrigated. The system should be tailored to each field by qualified irrigation engineers.

The yields of nearly all cultivated soils in Clinton County can be improved by irrigation in the dry parts of the growing season. However, soil characteristics should be studied carefully before an irrigation system is built. In addition to the soil, supplies of water, types of crops, cost of equipment, and economics of operation should be carefully evaluated. Additional information on irrigation is available from the County Agricultural Extension Service and the Soil Conservation Service.

### *Management of pasture*

Cattle, hogs, and dairy products make up a substantial part of the agricultural sales in Clinton County. Meadows for grazing and pastures are important in the raising and feeding of beef and dairy cattle and hogs. Hogs can be produced more economically on pasture. Meadows in the crop rotation can be used for grazing to supplement the forage from permanent pastures.

The income per acre of many farm enterprises depends largely on the quality and quantity of the forage produced and its efficient use. A well-planned pasture program should provide early pasture and also dependable amounts of forage in the summer months. Livestock needs do not vary appreciably during the pasture season. Consequently, well-planned pastures are needed. Availability of forage throughout the pasture season depends on the type of forage plants, the lime and fertilizers applied, and other management.

The establishment of meadow or pasture requires special care. The band method of seeding should be used whenever possible. This consists of placing bands of fertilizer near the seed. On the stronger slopes, where erosion is a hazard if land is tilled, the trash-mulch method of seeding should be used. Before seeding, a soil reaction of pH 6.5 should be established and fertilizer applied in amounts determined by soil tests. Plants seeded should be suited to the soil drainage conditions and to the expected use and life of the meadow or pasture.

Most meadows and pastures should be seeded to mixtures of grasses and legumes. As a rule, plant mixtures will be different for the soils that are naturally wet, for those that are not as wet, and for those that are well drained or moderately well drained. Legume seed should be inoculated to insure symbiotic fixation of nitrogen. Management ought to include regulation of grazing, timely mowing to control weeds, and regular fertilization to maintain production of forage. Mowing is particularly important to regulate the growth of coarse and unpalatable grasses and to prevent the crowding out of better grasses.

General suggestions for pasture are given in the descriptions of the capability units. In addition, bulletins on establishing and managing pastures and meadows for trash-mulch seeding and band-seeding methods are available from the county agricultural extension agent.

### *Management of woodland*[2]

There are approximately 17,000 acres of woodland in the county, according to the measurement of aerial photographs used in the soil survey. Nearly all of this area is in small farm woodlots, which are scattered throughout the county.

As the county was settled, most of the original forests were cut to make way for cropland. The remaining forests have been repeatedly gleaned for the best timber. Consequently, present forests consist of small or inferior trees, or both. However, they can be improved by good management, and at the same time the owner can derive an income from the sale of poor trees and logging debris for firewood and pulpwood. The gradual improvement of woodlands requires a long time.

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[2] This part of the soil survey report was prepared with the assistance of BYRON KENT, farm forester, Ohio Division of Forestry.

Many woodlands occupy land well suited to cultivation, and additional clearings can be expected. However, steep, eroded soils, now in pasture or used for crops, ought to be reforested. These areas are suited to pine, spruce, or redcedar. Hardwood seedlings will not survive on open, eroded areas until the site has been improved by reforestation with evergreens. The evergreens can be harvested for Christmas trees. Eventually black locust and other hardy deciduous species can be planted.

Suitable management for woodlands in Clinton County is as follows:

1. Protect the trees from fire and livestock to allow seedlings and young trees to grow.
2. Cut or girdle undesirable trees that are likely to crowd young trees or slow their growth. Remove grapevines and other plants that damage good trees. Herbicides should be used to kill undesirable sprouts, grapevines, and trees.
3. Plant desirable species in appropriate locations to hasten reforestation and to improve the composition of the stand. This practice is needed if desirable seed trees are lacking.
4. Harvest good trees when they are mature. Fell and remove them without damage to surrounding trees.
5. Do not plant evergreen seedlings in sweetclover, alfalfa, or other legumes, because they cannot survive the strong competition.
6. Den trees of wild animals should not be cut. A few den trees in the forest will help make the area a wildlife habitat.

Additional information on woodland management can be obtained from the county agricultural extension agent, farm forester, or soil conservationist.

### *Management for wildlife*

The soil survey is useful in determining what kinds of plants and wildlife are most likely to live successfully on these soils. For example, sweetclover is a good nesting cover for wildlife. It will grow only on fairly "sweet" soils—those that have a pH of 6.3 and above. Pheasants, for reasons not yet known, thrive much better on glacial or lacustrine soils than they do on other kinds of soils.

Most farm wildlife needs to have food, water, and cover in close association in numerous places on a farm (*16*). Insect-eating songbirds and other kinds of farm wildlife require a food source close to permanent cover. One area of permanent cover in 20 acres meets this need.

Most of Clinton County land suitable for cultivation can be used intensively for corn, soybeans, small grains, and meadow. These crops provide grain and weed seeds for birds. Intensive land use, however, may not allow enough nesting cover, escape cover, and winter cover. Such cover and ample food can be provided on intensively cropped lands by growing food and cover plants in hedgerows and on the banks of ditches and streams.

Grasses and legumes growing on the banks and berms of drainage ditches help prevent silting in the ditch. They provide excellent nesting cover if the plants are not mowed until late in fall.

Hedgerows of multiflora rose or other shrubs are useful as living fences, windbreaks, and field dividers, and they furnish nesting cover for insect-eating birds and small mammals close to growing crops. Living borders and barriers can be grown in long, narrow strips to supply food and cover for wildlife. They also are used by the praying mantis and other predaceous insects.

Land use must be planned and managed for the production of wildlife. As a rule, management of woodland, cropland, and grazing land improves conditions for wildlife. Such practices as burning crop residues, pastures, and woodlands, overgrazing, and the indiscriminate use of herbicides and insecticides are undesirable.

## *Descriptions of the Soils*

All the soils mapped in Clinton County are described in this section. First the soil series is described and then, very briefly, the soil mapping units. A soil series is a group of soils that have developed from similar parent material and that have, except for texture of the surface soil, similar characteristics. The soil series descriptions tell about the general characteristics of the soil series and the relation of the series to other series. A representative soil profile is described for each series. A soil profile is a vertical section showing all the layers, or horizons, from the surface through the parent material.

The mapping units in a given series have essentially the same characteristics, except texture of the surface layer and external properties, such as slope, erosion, and deposition of new material that particularly affect management of the soils but do not affect their placement in an orderly natural classification. Hence, only a few sentences are given to point out distinctive characteristics of some of the mapping units that follow the series description.

Following the name of each soil, there is a set of symbols in parentheses. These identify the soil on the detailed map in back of the report. The first two letters of the symbol (a capital letter and a small letter) identify the soil series, the second capital letter shows the class of slope, and the Arabic number shows the degree of erosion. A plus sign following these symbols indicates an overwashed soil.

Classes of slope are shown by the following letters:

A--------0 to 2 percent slopes.
B--------2 to 6 percent slopes.
C--------6 to 12 percent slopes.
D--------12 to 18 percent slopes.
E--------18 to 25 percent slopes.
F--------25 to 50 percent slopes.

Degrees of erosion are shown by the following Arabic numbers:

0--------Not eroded.
1--------Slightly eroded.
2--------Moderately eroded.
3--------Severely eroded.

The descriptions of the soils and soil series are somewhat technical. To help the reader, a few of the commonly used terms are discussed in the following paragraphs. See also the Soil Survey Manual (*18*).

In describing the soils, the scientist frequently assigns a letter symbol, for example, "$A_1$" to the various layers. These letter symbols have special meanings that concern scientists and others who desire to make a special study of soils. Most readers will need to remember only that all letter symbols beginning with "A" are surface soil and subsurface soil; those beginning with "B" are subsoil; those beginning with "C" are substratum, or parent material; and those beginning with "D" are underlying, dissimilar materials. All measurements refer to depth from the surface.

Color is denoted by a descriptive term, for example, "grayish brown." Unless otherwise stated, the color given is the color of the soil material when moist.

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural name, such as fine sandy loam. This refers to the texture of the surface layer, or A horizon.

Structure is indicated by the way the individual soil particles, are arranged in larger grains, or aggregates, and the amount of pore space between the grains. The structure of the soil is determined by the strength or grade, the size, and the shape of the aggregates. For example, a horizon may have "weak, fine, blocky structure."

Definitions of other terms used in describing soils are given in the Glossary in the back part of the report. A list of the soils, and the map symbol and capability unit of each, are given in the "Guide to Mapping Units and Capability Units" at the end of the report. The location and distribution of the mapping units are shown on the detailed soil map in the back of the report. The approximate acreage and proportionate extent of the mapping units are given in table 2.

TABLE 2.—*Total acreage and proportionate extent of soils and approximate percentage in various uses*

[Leaders in columns indicate that soil is not in the stated uses]

| Soil | Cropland [1] | Permanent bluegrass pasture | Forest [2] | Idle [3] | Miscellaneous [4] | Total | Percent of county |
|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Acres* | |
| Algiers silt loam | 71. 5 | 23. 5 | 4. 3 | 0. 5 | 0. 1 | 4, 808 | 1. 8 |
| Avonburg silt loam, 0 to 2 percent slopes | 84. 0 | 5. 2 | 6. 1 | 1. 4 | 3. 3 | 17, 184 | 6. 5 |
| Avonburg silt loam, 2 to 6 percent slopes | 81. 8 | 11. 7 | 3. 4 | . 2 | 2. 9 | 2, 033 | . 8 |
| Avonburg silt loam, 2 to 6 percent slopes, moderately eroded | 80. 5 | 16. 0 | . 8 | ---- | 2. 7 | 634 | . 2 |
| Birkbeck silt loam, 0 to 2 percent slopes | 90. 0 | 4. 6 | 2. 0 | ---- | 3. 4 | 957 | . 4 |
| Birkbeck silt loam, 2 to 6 percent slopes | 86. 1 | 6. 9 | 2. 8 | ---- | 4. 2 | 799 | . 3 |
| Birkbeck silt loam, 2 to 6 percent slopes, moderately eroded | 90. 3 | 9. 7 | ---- | ---- | ---- | 31 | (5) |
| Blanchester silt loam | 86. 6 | 1. 6 | 9. 6 | 1. 1 | 1. 1 | 6, 894 | 2. 6 |
| Bonpas silty clay loam | 96. 2 | 1. 2 | 1. 9 | . 2 | . 5 | 2, 332 | . 9 |
| Bonpas silt loam, overwashed | 100. 0 | ---- | ---- | ---- | ---- | 53 | (5) |
| Brookston silty clay loam | 93. 7 | 3. 0 | 2. 8 | . 1 | . 4 | 32, 558 | 12. 3 |
| Brookston silt loam | 95. 1 | 2. 1 | 2. 1 | . 2 | . 5 | 956 | . 4 |
| Brookston silt loam, overwashed | 97. 2 | 1. 1 | 1. 1 | ---- | . 6 | 1, 933 | . 7 |
| Casco and Rodman soils, 25 to 50 percent slopes, moderately eroded | 41. 0 | 24. 4 | 29. 5 | ---- | 5. 1 | 79 | (5) |
| Casco, Rodman, and Fox soils, 18 to 25 percent slopes, moderately eroded | 65. 9 | 29. 8 | 4. 3 | ---- | ---- | 48 | (5) |
| Celina silt loam, 0 to 2 percent slopes | 91. 7 | . 3 | 4. 3 | ---- | 3. 7 | 380 | . 1 |
| Celina silt loam, 2 to 6 percent slopes | 79. 5 | 8. 5 | 5. 8 | . 1 | 6. 1 | 8, 248 | 3. 1 |
| Celina silt loam, 2 to 6 percent slopes, moderately eroded | 93. 2 | 3. 3 | . 4 | . 3 | 2. 8 | 3, 918 | 1. 5 |
| Celina silt loam, 6 to 12 percent slopes, moderately eroded | 73. 4 | 18. 9 | 4. 5 | 1. 0 | 2. 2 | 740 | . 3 |
| Cincinnati silt loam, 2 to 6 percent slopes | 52. 8 | 25. 1 | 13. 9 | 5. 5 | 2. 7 | 36 | (5) |
| Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded | 79. 3 | 6. 9 | ---- | ---- | 13. 8 | 29 | (5) |
| Cincinnati silt loam, 6 to 12 percent slopes | 17. 4 | 17. 4 | 65. 2 | ---- | ---- | 23 | (5) |
| Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded | 51. 9 | 34. 9 | 7. 3 | 1. 8 | 4. 1 | 741 | . 3 |
| Clermont silt loam | 80. 9 | 2. 4 | 14. 4 | . 9 | 1. 4 | 15, 448 | 5. 9 |
| Crosby silt loam, 0 to 2 percent slopes | 93. 3 | 2. 0 | 3. 3 | . 2 | 1. 2 | 3, 618 | 1. 4 |
| Crosby silt loam, 2 to 6 percent slopes | 88. 4 | 5. 8 | 2. 9 | . 2 | 2. 7 | 6, 304 | 2. 4 |
| Crosby silt loam, 2 to 6 percent slopes, moderately eroded | 90. 5 | 7. 5 | ---- | ---- | 2. 0 | 257 | . 1 |
| Delmar silt loam | 68. 7 | 31. 1 | ---- | ---- | ---- | 16 | (5) |
| Edenton silt loam, 2 to 6 percent slopes, moderately eroded | 37. 0 | 24. 7 | 21. 9 | 8. 2 | 8. 2 | 74 | (5) |
| Edenton silt loam, 6 to 12 percent slopes, moderately eroded | 40. 0 | 43. 3 | 9. 2 | 3. 9 | 3. 6 | 909 | . 3 |
| Edenton silt loam, 12 to 18 percent slopes, moderately eroded | 17. 8 | 51. 9 | 23. 3 | 3. 0 | 4. 0 | 1, 577 | . 6 |
| Edenton soils, 6 to 12 percent slopes, severely eroded | 37. 8 | 37. 8 | 6. 4 | 15. 4 | 2. 6 | 158 | . 1 |
| Edenton soils, 12 to 18 percent slopes, severely eroded | 42. 3 | 40. 2 | 5. 1 | 7. 7 | 4. 7 | 197 | . 1 |
| Edenton and Fairmount soils, 18 to 25 percent slopes, moderately eroded | 5. 4 | 38. 5 | 51. 7 | . 9 | 3. 5 | 434 | . 2 |
| Edenton and Fairmount soils, 18 to 25 percent slopes, severely eroded | 2. 8 | 97. 2 | ---- | ---- | ---- | 37 | (5) |
| Edenton and Fairmount soils, 25 to 50 percent slopes, moderately eroded | 5. 2 | 29. 4 | 49. 4 | 9. 4 | 6. 6 | 606 | . 2 |
| Eel loam | 100. 0 | ---- | ---- | ---- | ---- | 23 | (5) |
| Eel silt loam | 52. 6 | 30. 0 | 14. 0 | 2. 7 | . 7 | 2, 344 | . 9 |
| Fincastle silt loam, 0 to 2 percent slopes | 90. 8 | 3. 6 | 2. 9 | . 1 | 2. 6 | 11, 126 | 4. 2 |
| Fincastle silt loam, 2 to 6 percent slopes | 88. 0 | 3. 5 | 5. 3 | . 2 | 3. 0 | 12, 749 | 4. 8 |
| Fincastle silt loam, 2 to 6 percent slopes, moderately eroded | 84. 8 | 10. 3 | 4. 0 | ---- | . 9 | 354 | . 1 |

See footnotes at end of table.

TABLE 2.—*Total acreage and proportionate extent of soils and approximate percentage in various uses*—Continued

[Leaders in columns indicate that soil is not in the stated uses]

| Soil | Cropland [1] | Permanent bluegrass pasture | Forest [2] | Idle [3] | Miscellaneous [4] | Total | Percent of county |
|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Acres* | |
| Fox silt loam, 0 to 2 percent slopes | 56.3 | 24.0 | 0.3 | 1.4 | 18.0 | 288 | 0.1 |
| Fox silt loam, 2 to 6 percent slopes | 59.8 | 27.3 | 2.4 | 4.8 | 5.7 | 339 | .1 |
| Fox silt loam, 2 to 6 percent slopes, moderately eroded | 65.8 | 22.4 | -------- | 10.5 | 1.3 | 77 | [5] |
| Fox silt loam, 6 to 12 percent slopes, moderately eroded | 43.4 | 45.5 | 3.0 | 2.0 | 6.1 | 101 | [5] |
| Fox and Casco soils, 12 to 18 percent slopes, moderately eroded | 42.1 | 44.7 | 5.3 | -------- | 7.9 | 77 | [5] |
| Fox, Casco, and Rodman soils, 12 to 25 percent slopes, severely eroded | 21.9 | 53.1 | 6.3 | 18.7 | -------- | 32 | [5] |
| Genesee loam | 46.7 | 13.1 | 37.5 | 2.3 | .4 | 489 | .2 |
| Genesee loam, sandy substratum | 46.5 | 38.6 | 14.9 | -------- | -------- | 411 | .2 |
| Genesee silt loam | 58.0 | 29.6 | 11.3 | 1.1 | -------- | 1,936 | .7 |
| Genesee silt loam, sandy substratum | 35.2 | 61.0 | -------- | 3.8 | -------- | 107 | [5] |
| Gullied land | -------- | 62.5 | -------- | 37.5 | -------- | 32 | [5] |
| Hennepin and Miami soils, 25 to 50 percent slopes | -------- | 4.0 | 96.0 | | | 77 | [5] |
| Hennepin and Miami soils, 25 to 50 percent slopes, moderately eroded | 6.1 | 80.8 | 13.1 | -------- | -------- | 249 | .1 |
| Hennepin and Miami soils, 25 to 50 percent slopes, severely eroded | 8.5 | 75.6 | 15.9 | -------- | -------- | 83 | [5] |
| Henshaw silt loam | 100.0 | -------- | -------- | -------- | -------- | 44 | [5] |
| Kokomo silt loam, overwashed | 100.0 | -------- | -------- | -------- | -------- | 60 | [5] |
| Medway loam | 72.8 | -------- | 27.2 | -------- | -------- | 254 | .1 |
| Medway silt loam | 70.9 | 29.1 | -------- | -------- | -------- | 80 | [5] |
| Miami silt loam, 2 to 6 percent slopes | 78.8 | 6.1 | 5.3 | -------- | 9.8 | 1,152 | .4 |
| Miami silt loam, 2 to 6 percent slopes, moderately eroded | 90.4 | 5.4 | 1.2 | .2 | 2.8 | 1,553 | .6 |
| Miami silt loam, 6 to 12 percent slopes | 16.1 | 18.8 | 63.8 | -------- | 1.3 | 152 | .1 |
| Miami silt loam, 6 to 12 percent slopes, moderately eroded | 77.1 | 16.3 | 4.9 | .2 | 1.5 | 2,054 | .8 |
| Miami silt loam, 12 to 18 percent slopes | -------- | 64.0 | 36.0 | -------- | -------- | 25 | [5] |
| Miami silt loam, 12 to 18 percent slopes, moderately eroded | 39.5 | 48.0 | 9.0 | -------- | 3.5 | 261 | .1 |
| Miami soils, 2 to 6 percent slopes, severely eroded | 100.0 | -------- | -------- | -------- | -------- | 42 | [5] |
| Miami soils, 6 to 12 percent slopes, severely eroded | 80.0 | 16.1 | 3.2 | -------- | .7 | 416 | .2 |
| Miami soils, 12 to 18 percent slopes, severely eroded | 67.2 | 31.0 | -------- | 1.8 | -------- | 233 | .1 |
| Miami and Hennepin silt loams, 18 to 25 percent slopes | -------- | 29.4 | 66.2 | -------- | 4.4 | 69 | [5] |
| Miami and Hennepin silt loams, 18 to 25 percent slopes, moderately eroded | 10.6 | 51.4 | 36.1 | -------- | 1.9 | 220 | .1 |
| Miami and Hennepin soils, 18 to 25 percent slopes, severely eroded | 13.5 | 86.5 | -------- | -------- | -------- | 38 | [5] |
| Millsdale silty clay loam | 90.0 | 5.0 | 5.0 | -------- | -------- | 18 | [5] |
| Milton silt loam, 0 to 2 percent slopes | 71.2 | 21.8 | -------- | -------- | 7.0 | 117 | [5] |
| Milton silt loam, 2 to 6 percent slopes | 66.6 | 33.4 | -------- | -------- | -------- | 15 | [5] |
| Milton silt loam, 2 to 6 percent slopes, moderately eroded | 85.7 | -------- | -------- | -------- | 14.3 | 28 | [5] |
| Milton silt loam, 6 to 12 percent slopes, moderately eroded | 57.7 | 42.3 | -------- | -------- | -------- | 26 | [5] |
| Milton silt loam, 12 to 18 percent slopes, moderately eroded | 14.3 | 85.7 | -------- | -------- | -------- | 28 | [5] |
| Milton silt loam, shallow, 2 to 6 percent slopes | 93.3 | 6.7 | -------- | -------- | -------- | 15 | [5] |
| Milton silt loam, shallow, 6 to 12 percent slopes, moderately eroded | 63.1 | 36.9 | -------- | -------- | -------- | 19 | [5] |
| Milton silt loam, shallow, 12 to 18 percent slopes, moderately eroded | 65.0 | 15.0 | 20.0 | -------- | -------- | 20 | [5] |
| Milton silt loam, shallow, 18 to 25 percent slopes, moderately eroded | -------- | 86.4 | 4.5 | 9.1 | -------- | 45 | [5] |
| Milton silt loam, shallow, 25 to 50 percent slopes, moderately eroded | -------- | 37.5 | 62.5 | -------- | -------- | 98 | [5] |
| Milton soils, shallow, 12 to 18 percent slopes, severely eroded | 40.0 | 28.0 | 4.0 | 28.0 | -------- | 25 | [5] |
| Milton soils, shallow, 25 to 50 percent slopes, severely eroded | 23.9 | -------- | -------- | 76.1 | -------- | 47 | [5] |
| Ockley silt loam, 0 to 2 percent slopes | 84.7 | 9.3 | -------- | -------- | 6.0 | 207 | .1 |
| Ockley silt loam, 2 to 6 percent slopes | 64.1 | 25.8 | 6.6 | -------- | 3.5 | 292 | .1 |
| Ockley silt loam, 2 to 6 percent slopes, moderately eroded | 96.2 | -------- | -------- | -------- | 3.8 | 54 | [5] |
| Ockley silt loam, 6 to 12 percent slopes, moderately eroded | 87.2 | 5.1 | 7.7 | -------- | -------- | 40 | [5] |
| Ockley silt loam, mixed substratum, 0 to 2 percent slopes | 80.0 | 20.0 | -------- | -------- | -------- | 97 | [5] |
| Ockley silt loam, mixed substratum, 2 to 6 percent slopes | 95.1 | 4.9 | -------- | -------- | -------- | 124 | [5] |
| Ockley silt loam, mixed substratum, 2 to 6 percent slopes, moderately eroded | 100.0 | -------- | -------- | -------- | -------- | 16 | [5] |
| Ockley silt loam, mixed substratum, 6 to 12 percent slopes, moderately eroded | 75.5 | 16.3 | 8.2 | -------- | -------- | 50 | [5] |
| Ragsdale silty clay loam | 94.6 | 1.4 | 3.2 | -------- | .8 | 10,104 | 3.8 |
| Ragsdale silt loam | 92.4 | -------- | 7.6 | -------- | -------- | 148 | .1 |
| Raub silt loam | 95.2 | 2.4 | 2.4 | -------- | -------- | 43 | [5] |
| Reesville silt loam, 0 to 2 percent slopes | 88.6 | 3.0 | 5.8 | .1 | 2.5 | 9,985 | 3.8 |
| Reesville silt loam, 2 to 6 percent slopes | 88.8 | 3.5 | 5.3 | -------- | 2.4 | 1,120 | .4 |

See footnotes at end of table.

TABLE 2.—*Total acreage and proportionate extent of soils and approximate percentage in various uses*—Continued

[Leaders in columns indicate that soil is not in the stated uses]

| Soil | Cropland [1] | Permanent bluegrass pasture | Forest [2] | Idle [3] | Miscellaneous [4] | Total | Percent of county |
|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Acres* | |
| Ross loam | 100.0 | - | - | - | - | 44 | (5) |
| Ross silt loam | 83.4 | 16.6 | - | - | - | 172 | 0.1 |
| Rossmoyne silt loam, 0 to 2 percent slopes | 81.0 | 5.4 | 7.1 | 1.9 | 4.6 | 951 | .4 |
| Rossmoyne silt loam, 2 to 6 percent slopes | 66.5 | 18.6 | 5.0 | 1.4 | 8.5 | 2,772 | 1.1 |
| Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded | 70.4 | 18.4 | 5.3 | 1.3 | 4.6 | 1,791 | .7 |
| Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded | 55.3 | 30.0 | 9.7 | 1.4 | 3.6 | 1,701 | .6 |
| Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded | 31.0 | 45.6 | 20.6 | 1.4 | 1.4 | 69 | (5) |
| Rossmoyne soils, 6 to 12 percent slopes, severely eroded | 53.8 | 38.5 | - | - | 7.7 | 66 | (5) |
| Russell silt loam, 2 to 6 percent slopes | 77.4 | 9.4 | 6.3 | .8 | 6.1 | 1,716 | .7 |
| Russell silt loam, 2 to 6 percent slopes, moderately eroded | 87.2 | 7.7 | 1.9 | .8 | 2.4 | 3,864 | 1.5 |
| Russell silt loam, 6 to 12 percent slopes | 8.5 | 30.0 | 61.5 | - | - | 143 | .1 |
| Russell silt loam, 6 to 12 percent slopes, moderately eroded | 67.9 | 21.5 | 7.3 | 1.4 | 1.9 | 11,303 | 4.3 |
| Russell silt loam, 12 to 18 percent slopes | 5.7 | 8.6 | 85.7 | - | - | 36 | (5) |
| Russell silt loam, 12 to 18 percent slopes, moderately eroded | 38.5 | 40.5 | 16.9 | 2.2 | 1.9 | 2,606 | 1.0 |
| Russell silt loam, 18 to 25 percent slopes | 11.4 | 4.3 | 35.8 | 41.4 | 7.1 | 71 | (5) |
| Russell silt loam, 18 to 25 percent slopes, moderately eroded | 15.1 | 39.9 | 42.0 | 2.2 | .8 | 1,025 | .4 |
| Russell soils, 2 to 6 percent slopes, severely eroded | 30.0 | 70.0 | - | - | - | 20 | (5) |
| Russell soils, 6 to 12 percent slopes, severely eroded | 61.0 | 30.3 | 3.6 | 3.3 | 1.8 | 2,545 | 1.0 |
| Russell soils, 12 to 18 percent slopes, severely eroded | 34.5 | 52.6 | 7.4 | 4.8 | .7 | 1,603 | .6 |
| Russell soils, 18 to 25 percent slopes, severely eroded | 18.5 | 49.9 | 28.4 | 2.6 | .6 | 638 | .2 |
| Russell and Hennepin silt loams, 25 to 50 percent slopes | 2.9 | 14.5 | 82.6 | - | - | 464 | .2 |
| Russell and Hennepin silt loams, 25 to 50 percent slopes, moderately eroded | 7.9 | 40.1 | 45.5 | 6.0 | .5 | 1,594 | .6 |
| Russell and Hennepin soils, 25 to 50 percent slopes, severely eroded | 15.9 | 31.3 | 40.3 | .9 | 11.6 | 546 | .2 |
| Sardinia silt loam, 0 to 2 percent slopes | 96.4 | 2.9 | - | - | .7 | 142 | .1 |
| Sardinia silt loam, 2 to 6 percent slopes | 72.8 | 10.5 | 7.3 | - | 9.4 | 195 | .1 |
| Sardinia silt loam, 2 to 6 percent slopes, moderately eroded | 51.9 | 33.3 | 14.8 | - | - | 27 | (5) |
| Shoals silt loam | 55.4 | 21.2 | 21.4 | .9 | 1.1 | 908 | .3 |
| Sleeth silt loam | 89.5 | 8.8 | - | - | 1.7 | 58 | (5) |
| Sleeth silt loam, mixed substratum, 0 to 2 percent slopes | 94.8 | 1.5 | 2.8 | - | .9 | 330 | .1 |
| Sleeth silt loam, mixed substratum, 2 to 6 percent slopes | 84.0 | 14.0 | 2.0 | - | - | 51 | (5) |
| Sloan silty clay loam | 71.0 | 25.4 | 3.5 | - | .1 | 1,921 | .7 |
| Sloan silt loam | 62.2 | 29.9 | 7.1 | .4 | .4 | 1,367 | .5 |
| Sloan silt loam, overwashed | 91.5 | 2.8 | 5.7 | - | - | 72 | (5) |
| Thackery silt loam, 0 to 2 percent slopes | 94.6 | 5.4 | - | - | - | 96 | (5) |
| Thackery silt loam, 2 to 6 percent slopes | 90.3 | 4.2 | 5.5 | - | - | 73 | (5) |
| Thackery silt loam, mixed substratum, 0 to 2 percent slopes | 100.0 | - | - | - | - | 19 | (5) |
| Thackery silt loam, mixed substratum, 2 to 6 percent slopes | 95.1 | 4.9 | - | - | - | 84 | (5) |
| Uniontown silt loam, 0 to 2 percent slopes | 100.0 | - | - | - | - | 56 | (5) |
| Uniontown silt loam, 2 to 6 percent slopes, moderately eroded | 76.9 | 15.4 | 7.7 | - | - | 26 | (5) |
| Westland silty clay loam | 98.5 | .7 | .7 | - | .1 | 1,978 | .8 |
| Westland silt loam | 97.8 | 2.2 | - | - | - | 47 | (5) |
| Westland silt loam, overwashed | 100.0 | - | - | - | - | 26 | (5) |
| Westland silt loam, mixed substratum, overwashed | 97.0 | .6 | 1.8 | .6 | - | 329 | .1 |
| Westland silty clay loam, mixed substratum | 97.4 | 1.0 | - | 1.1 | .5 | 628 | .2 |
| Williamsburg silt loam, 0 to 2 percent slopes | 100.0 | - | - | - | - | 153 | .1 |
| Williamsburg silt loam, 2 to 6 percent slopes | 63.5 | 17.4 | 7.2 | 2.8 | 9.1 | 438 | .2 |
| Williamsburg silt loam, 2 to 6 percent slopes, moderately eroded | 67.4 | 19.7 | 6.8 | 3.4 | 2.7 | 150 | .1 |
| Williamsburg silt loam, 6 to 12 percent slopes | - | - | 100.0 | - | - | 18 | (5) |
| Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded | 41.5 | 33.0 | 15.0 | 5.9 | 4.6 | 312 | .1 |
| Williamsburg silt loam, 12 to 18 percent slopes, moderately eroded | 14.1 | 73.2 | 2.8 | - | 9.9 | 72 | (5) |
| Williamsburg silt loam, 18 to 25 percent slopes, moderately eroded | - | 69.6 | 26.8 | - | 3.6 | 57 | (5) |
| Xenia silt loam, 0 to 2 percent slopes | 85.4 | 4.4 | 7.2 | .3 | 2.7 | 793 | .3 |
| Xenia silt loam, 2 to 6 percent slopes | 84.0 | 6.0 | 4.2 | .5 | 5.3 | 26,164 | 9.9 |
| Xenia silt loam, 2 to 6 percent slopes, moderately eroded | 87.4 | 7.6 | 1.9 | .7 | 2.4 | 9,259 | 3.5 |
| Xenia silt loam, 6 to 12 percent slopes | 32.0 | 28.8 | 39.2 | - | - | 156 | .1 |
| Xenia silt loam, 6 to 12 percent slopes, moderately eroded | 65.1 | 21.9 | 10.1 | .9 | 2.0 | 3,717 | 1.4 |

See footnotes at end of table.

TABLE 2.—*Total acreage and proportionate extent of soils and approximate percentage in various uses*—Continued

[Leaders in columns indicate that soil is not in the stated uses]

| Soil | Cropland [1] | Permanent bluegrass pasture | Forest [2] | Idle [3] | Miscellaneous [4] | Total | Percent of county |
|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Acres* | |
| Xenia soils, 2 to 6 percent slopes, severely eroded | 27. 6 | | 70. 7 | | 1. 7 | 59 | (5) |
| Xenia soils, 6 to 12 percent slopes, severely eroded | 45. 6 | 46. 1 | 5. 5 | 2. 8 | | 442 | 0. 2 |
| Total area of soil survey | | | | | | 261, 340 | 98. 2 |
| Incorporated areas not covered by soil survey | | | | | | 1, 692 | . 6 |
| Water | | | | | | 648 | . 2 |
| Total | | | | | | 263, 680 | 99. 0 |

[1] All land in cultivation and in rotation meadow or rotation pasture.
[2] Land in trees, which have a crown-canopy closure of 10 percent or more.
[3] Old fields not in productive use.
[4] Includes house and barn lots, cemeteries, church lots, and other small nonagricultural tracts, usually less than 10 acres in size.
[5] Less than one-tenth of 1 percent of the county area.

## Algiers Series

The Algiers soils consist of light-colored, medium to moderately fine textured alluvium overlying darker colored, very poorly drained alluvium. The overlying material is slightly acid to neutral and ranges from 14 to 42 inches in thickness. The alluvium, or parent material, washed from associated soils that formed from calcareous till on the uplands. Algiers soils are in nearly level or depressed areas on bottom lands and are subject to ponding and flooding. The native vegetation was elm, soft maple, sycamore, and other deciduous trees.

In Clinton County the Algiers soils are usually alluvial fans associated with the Sloan soils. Areas where the overlying light-colored overwash is less than 14 inches thick are mapped as Sloan soils. Areas where this layer is more than 42 inches thick are mapped as the well-drained Genesee, or the moderately well drained Eel, or the poorly drained Shoals soils.

Representative profile (Algiers silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 10 inches, grayish-brown, friable silt loam; moderate, medium, granular structure; neutral to slightly acid.

Substratum—
- $C_1$ 10 to 20 inches, yellowish-brown, friable silt loam; weak, medium to fine, subangular blocky structure; neutral to slightly acid.
- $C_2$ 20 to 36 inches, very dark gray to black, firm to friable silty clay loam; moderate to weak, medium to fine, subangular blocky structure; neutral.
- $C_3$ 36 inches +, mottled gray, dark-gray, and yellowish-brown, very friable silt and moderately fine textured soil material; irregularly stratified with sandy material; massive in place; neutral.

There is very little, if any, profile development in the light-colored overlying material and only slight to moderate development of a profile in the underlying dark-colored layer.

The Algiers soils have a deep rooting zone and a high moisture-supplying capacity for growing plants. The surface soil is medium in organic matter. Runoff is slow because the soils are in depressed or nearly level areas. Tile drains work well. If properly managed, the Algiers soils are productive for crops commonly grown on bottom lands in the county.

**Algiers silt loam** (AgA0).—This is the only Algiers soil in the county. The profile of this soil is the one described for the series. Slopes are generally less than 2 percent, and little, if any, erosion has occurred. Included with this soil are a few areas on slopes of 2 to 6 percent and a few alluvial fans that contain stratified sand and gravel. (Capability unit IIw–1; if subject to flooding, Vw–1.)

## Avonburg Series

The Avonburg series consists of light-colored, imperfectly drained soils on uplands that have developed in 20 to 45 inches of loess over moderately fine textured Illinoian till. This till has a weathered appearance. Carbonates are at a depth of 70 to 120 inches.

Approximately 90 percent of the Avonburg acreage is on slopes of less than 2 percent; the rest is on slopes of about 4 percent. The native vegetation consisted of beech, sweetgum, sycamore, ash, soft maple, red oak, and other deciduous trees.

The Avonburg soils are associated with the poorly drained, moderately dark Blanchester, the poorly drained Clermont, the moderately well drained Rossmoyne, and the well drained Cincinnati soils.

The nearly level Avonburg soils are usually adjacent to areas of Clermont soils. The Avonburg soils are better drained than the Clermont soils, which have a grayer surface soil and subsoil.

Representative profile (Avonburg silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 8 inches, dark grayish-brown to grayish-brown, friable silt loam; weak, medium, granular structure; neutral to slightly acid.
- $A_2$ 8 to 11 inches, yellowish-brown, friable silt loam; many, medium and fine, distinct mottles of brownish yellow and light gray; weak, medium, subangular blocky structure; strongly acid.

Subsoil—
$B_1$ 11 to 36 inches, yellowish-brown and strong-brown, firm silty clay loam; common, medium, distinct mottles of light gray and brownish yellow; moderate, medium, subangular blocky structure; lower part has a weak, coarse, prismatic structure that breaks to moderate, medium, subangular blocky peds; strongly acid.
$B_2$ 36 to 100 inches, distinctly mottled yellowish-brown, gray, and light olive-brown, firm clay loam; upper part has a weak, coarse, prismatic structure that breaks to weak, medium, subangular blocky peds; lower part is massive; reaction in upper part is strongly acid, gradually changing to neutral in the lower part.
Substratum—
C 100 inches +, mottled gray and yellowish-brown, firm clay loam till; massive; calcareous.

The underlying till is clay loam in most areas, but in some it is clay, silty clay, and silty clay loam. Loam till occurs in a few places. Limestone and calcareous shale bedrock usually are at a depth that ranges from 7 to 20 feet.

The Avonburg soils have a shallow to moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is low to medium in organic matter. They require drainage, but tile drains are only partly successful. If properly managed, these soils are fairly productive of the crops commonly grown in the county.

**Avonburg silt loam, 0 to 2 percent slopes** (AvA1).—A profile for this soil is described as representative of the Avonburg series. Runoff is slow, and in most places there is slight erosion. Some small areas of Clermont silt loam, too small to map separately, are included. (Capability unit IIIw–1.)

**Avonburg silt loam, 2 to 6 percent slopes** (AvB1).—This soil has been slightly eroded. Runoff is medium, and the risk of erosion is moderate. In many places the soil is mapped adjacent to the moderately well drained Rossmoyne soils. (Capability unit IIIe–3.)

**Avonburg silt loam, 2 to 6 percent slopes, moderately eroded** (AvB2).—Some of the surface soil has been lost through erosion, and the rest has been mixed with the subsurface soil in tillage. Runoff is medium, and the risk of erosion is moderate.

This soil is often mapped adjacent to areas of the moderately well drained Rossmoyne soils. Small severely eroded places in which the plowed layer now consists mainly of silty clay loam upper subsoil are included in this mapping unit. (Capability unit IIIe–3.)

## Birkbeck Series

The Birkbeck series consists of light-colored, moderately well drained soils on uplands. The soils have formed in 40 inches or more of loess over calcareous loamy till of Wisconsin age. The loess in which these soils have developed is calcareous below 24 to 42 inches. The Birkbeck soils are nearly level to gently sloping and are generally in the north-central part of the county. The native vegetation consisted of oak, hickory, elm, maple, and other deciduous trees.

The Birkbeck soils are associated with the very poorly drained Ragsdale and with the imperfectly drained Reesville soils. In appearance they are similar to the moderately well drained Xenia and to the well drained Russell soils. In the Xenia and Russell soils, the overlying loess is somewhat less than 40 inches thick.

Representative profile (Birkbeck silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, grayish-brown, friable silt loam; weak to moderate, medium, granular structure; neutral.
Subsoil—
$B_1$ 8 to 12 inches, yellowish-brown, friable silt loam; common, medium, faint mottles of light brownish gray and pale yellow; weak, fine, subangular blocky structure; medium to slightly acid.
$B_2$ 12 to 36 inches, yellowish-brown, firm silt loam to silty clay loam; lower part has a few, fine, faint mottles of brownish yellow; moderate, medium and coarse, subangular blocky structure; slightly acid to neutral.
$B_3$ 36 to 44 inches, mottled yellowish-brown and light yellowish-brown, friable silt loam; weak, coarse, subangular blocky structure; slightly acid to neutral in upper part, calcareous in lower part.
Substratum—
C 44 to 56 inches, mottled brownish-yellow and light yellowish-brown, friable silt loam; massive; calcareous.
D 56 to 90 inches, yellowish-brown, firm loam; a few, medium mottles of light gray; massive; calcareous; gray, coarse and very coarse, silica sand and limestone make up 2 to 3 percent, by volume, of the total soil material in this horizon. This admixture is characteristic of till.

The loess in which these soils have developed appears to have been deposited on a very irregular till surface.

Birkbeck soils have medium runoff. The risk of erosion is moderate and is related to the length and steepness of slopes and the cover of vegetation or of mulch. The Birkbeck soils have a very deep root zone, a very high moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, Birkbeck soils are productive of the crops commonly grown in the county.

**Birkbeck silt loam, 0 to 2 percent slopes** (BbA1).—A profile of this soil is described as representative of the Birkbeck series. In many places slight erosion has occurred. (Capability unit I–1.)

**Birkbeck silt loam, 2 to 6 percent slopes** (BbB1).—This soil has been slightly eroded, and has about 8 inches of surface soil. A few areas too small to map separately and having better internal drainage and no subsoil mottles are included with this soil. (Capability unit IIe–2.)

**Birkbeck silt loam, 2 to 6 percent slopes, moderately eroded** (BbB2).—The present surface layer is a mixture of the original surface soil and the upper part of the former subsoil. A few areas having better internal drainage and no mottles in the subsoil, but too small to map separately, are included with this soil. (Capability unit IIe–2.)

## Blanchester Series

The Blanchester series consists of moderately dark colored, poorly drained soils on uplands. The soils have developed in 16 to 30 inches of loess over fine to moderately fine textured till of Illinoian age. Carbonates are usually present at a depth of about 80 inches. Blanchester soils occur in nearly level and slightly depressed areas and at the heads of some drainageways. They may be ponded during wet weather. The native vegetation consisted of white elm, swamp white oak, and sour-gum.

The Blanchester soils are associated with the poorly drained Clermont, the imperfectly drained Avonburg, the moderately well drained Rossmoyne, and well drained Cincinnati soils. In scattered areas the Blanchester soils are mapped in association with the Bonpas soils. This occurs where the overlying parent material of the Bonpas soils thins and is intermingled with the soils on the Illinoian till.

Representative profile (Blanchester silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 7 inches, dark-gray, friable silt loam; weak, medium, granular structure; slightly acid.

Subsoil—
$B_{1g}$ 7 to 27 inches, dark-gray to very dark gray, firm clay loam; common, medium, distinct mottles of yellowish brown; moderate, medium to fine, subangular blocky structure; medium to strongly acid.
$B_{2g}$ 27 to 46 inches, gray, firm to very firm clay loam to clay; common, medium, distinct mottles of yellowish brown and dark yellowish brown; moderate to strong, medium, subangular blocky structure; medium acid.
$B_{3g}$ 46 to 80 inches, gray, firm to very firm clay; many, medium, prominent mottles of yellowish brown, brownish yellow, and light olive gray; massive; slightly acid.

Substratum—
C 80 inches +, very firm clay that is mottled light olive gray and light olive brown; massive; calcareous.

The depth to calcareous parent material ranges from 74 to 156 inches. The parent material is mainly clay and clay loam, but it may consist of other moderately fine textured and clayey material. In places Blanchester soils overlie a D horizon of Ordovician calcareous clay shale and limestone. Also, a neutral reaction in the subsoil has been noted occasionally at a depth of about 40 to 48 inches.

The Blanchester soils have a moderately deep rooting zone, medium moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, the Blanchester soils are productive of the crops commonly grown in the county.

**Blanchester silt loam** (BcA0).—This soil has the profile described as representative of the series. Most slopes are 0 to 2 percent. Little or no erosion has occurred. Included with this soil are small slightly eroded areas with slopes of 2 to 6 percent and areas on to which lighter colored, silty material has washed from surrounding higher soils. (Capability unit IIw–3.)

## Bonpas Series

The Bonpas series consists of dark-colored, very poorly drained soils. They have formed in moderately fine to medium textured, neutral to calcareous, water-laid sediment of Wisconsin age. These soils occupy nearly level and slightly depressed areas, which may be ponded in wet weather. The native vegetation consisted of white ash, American elm, red maple, and other deciduous trees in swamps.

The Bonpas soils are associated with the imperfectly drained Henshaw and the moderately well drained Uniontown soils. In the southern and western parts of the county, the Bonpas soils are beyond the outer margin, or south extremity, of the Wisconsin glacial (Cuba) moraine, and they are associated with and apparently overlie the older Illinoian till. In many places in this area, the Bonpas soils are adjacent to areas of the Clermont and Blanchester soils.

Representative profile (Bonpas silty clay loam, in a cultivated field):

Surface layers—
$A_{1p}$ 0 to 8 inches, black, friable silty clay loam; moderate, medium, granular structure; neutral.
$A_{12}$ 8 to 13 inches, black, firm to friable silty clay loam; moderate, medium, subangular blocky structure; neutral.

Subsoil—
$B_{21g}$ 13 to 24 inches, very dark gray, firm silty clay loam; many, medium, distinct mottles of grayish brown; weak, prismatic structure that breaks to moderate, medium, subangular blocky peds; neutral.
$B_{22g}$ 24 to 33 inches, dark-gray, firm silty clay loam; few, fine, faint mottles of yellowish brown; moderate, medium, blocky structure; neutral.
$B_{3g}$ 33 to 64 inches, very dark gray, firm silty clay loam; many, medium, distinct mottles; moderate, coarse, blocky structure; neutral to calcareous.

Substratum—
D 64 inches +, mottled light-gray, light olive-gray, and yellowish-brown, firm clay loam; massive (structureless); calcareous.

The A horizon ranges from 11 to 15 inches in thickness. Texture of the substratum may be silty clay loam, silt loam, or clay loam. Layers of sandy material or clay may occur throughout the profile of Bonpas soils. In some places the water-laid sediment is 10 feet or more in thickness, and it overlies the older Illinoian till.

The Bonpas soils have a deep rooting zone for growing plants, a high moisture-supplying capacity, and a surface soil that is high in organic matter. Tile drainage should work well. Runoff is slow. If properly managed, the Bonpas soils are productive of crops commonly grown in the county.

**Bonpas silty clay loam** (PcA0).—A profile of this soil is described as representative for the Bonpas series. The soil has slopes of 0 to 2 percent and little or no erosion. The plowed layer becomes cloddy if cultivated when too wet.

Included with this soil are a few areas with slopes of 2 to 6 percent and a few areas that are slightly eroded. Also included are small areas of the Montgomery soils (not mapped in this county). The Montgomery soils are similar to the Bonpas soils in most characteristics but have a finer textured subsoil and substratum. (Capability unit IIw–4.)

**Bonpas silt loam, overwashed** (PaA+).—This soil has slopes of 0 to 2 percent. The surface is covered by 8 to 14 inches of lighter colored silty material that washed from surrounding soils.

Small areas of the Montgomery soils (not mapped in this county) are included with this soil. The included soils are similar to the Bonpas soils in most characteristics but have a fined textured subsoil and substratum. (Capability unit IIw–4.)

## Brookston Series

The Brookston series consists of dark-colored, very poorly drained upland soils. These soils have formed in medium-textured, calcareous till of Wisconsin age. In places as much as 40 inches of loess may overlie the till.

The soils occupy nearly level and depressed areas, which are ponded in wet weather.

The native vegetation consisted of a swamp forest that included white ash, American elm, red maple, and other deciduous trees.

The Brookston soils are associated with the well drained Miami, the moderately well drained Celina, and the imperfectly drained Crosby soils. They are also associated with the well drained Russell, the moderately well drained Xenia, the imperfectly drained Fincastle, and the poorly drained Delmar.

Representative profile (Brookston silty clay loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, black, firm to friable silty clay loam; moderate, medium, subangular blocky structure; neutral.

Subsoil—
$B_2$ 8 to 12 inches, very dark gray, firm to friable silty clay loam; moderate, medium, subangular blocky structure; neutral.
$B_{3g}$ 12 to 48 inches, gray, firm silty clay loam; many, medium, distinct mottles of yellowish brown and brownish yellow; moderate, medium, subangular blocky structure becoming massive in lower part; neutral to mildly alkaline.

Substratum—
C 48 inches +, gray silty clay loam till; many, medium, prominent mottles of brownish yellow; massive in place; calcareous.

The texture of the till is dominantly loam, but in some areas it is as fine as clay loam. The overlying mantle of loess is usually more than 18 inches thick in areas of Brookston soils mapped near soils of the Russell catena. This is thicker than in areas of Brookston soils mapped near the Miami catena. The substratum is generally at a depth of 36 to 65 inches, but occasionally it is at a depth of 84 inches.

Brookston soils have a deep rooting zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. Runoff is slow. The lack of drainage limits the use of these soils, but properly installed tile drains should work well. If properly managed, the Brookston soils are productive of crops commonly grown in the county.

**Brookston silty clay loam** (BrAO).—A profile of this soil is described as representative of the Brookston series. This soil is mainly on slopes of 0 to 2 percent, and very little if any erosion has occurred. A few small areas, usually affected by seepage, are included with this soil. Also included are a few small areas of Kokomo silty clay loam (not mapped in Clinton County), generally less than 2 acres in size. These inclusions have a thicker surface soil than Brookston silty clay loam.

The plowed layer of Brookston silty clay loam becomes cloddy if cultivated when too wet. (Capability unit IIw–4.)

**Brookston silt loam** (BsA0).—This soil is in depressed, basinlike areas on slopes of 0 to 2 percent. It has been covered by 6 to 8 inches of silty material that washed from surrounding soils. This silty material is somewhat lighter colored than the underlying soil. In many places the underlying soil has been mixed with the silty material during tillage. The resulting mixture is more friable than Brookston silty clay loam. (Capability unit IIw–4.)

**Brookston silt loam, overwashed** (BsA+).—This soil is in depressed, basinlike areas on slopes of 0 to 2 percent. It has been covered by 8 to 14 inches of silty material that washed from surrounding areas. The silty material is lighter colored than the underlying soil. (Capability unit IIw–4.)

## Casco Series

The Casco series consists of light-colored, excessively drained soils that have developed in 10 to 24 inches of loamy material over stratified sand and gravel. These soils occupy mainly irregularly shaped slopes of dissected outwash terraces, outwash plains, and the remnants of valley trains that are of Wisconsin age. Slopes range from 18 to 50 percent. The native vegetation was oak, hickory, and other deciduous trees.

In Clinton County, the Casco soils occur in small areas closely intermingled with the sloping to steep Rodman and Fox soils. Consequently, they were mapped with the Rodman and Fox soils only as undifferentiated units, some of which are described in this series. The rest are described under the Fox series, elsewhere in this section of the report. Representative profiles of the Fox and of the Rodman soils are given in their respective series descriptions.

Representative profile (Casco loam in a cultivated field):

Surface soil—
$A_p$ 0 to 7 inches, very dark grayish-brown, friable loam; weak, medium and fine, granular structure; neutral.

Subsoil—
$B_2$ 7 to 20 inches, dark-brown, firm clay loam; moderate, medium, subangular blocky structure; neutral in upper part, gradually changing to calcareous in lower part.

Substratum—
C 20 inches +, yellowish-brown and light yellowish-brown sand and gravel; roughly stratified; variably assorted and unassorted; single grain (structureless); calcareous.

The texture and thickness of the soil layers and the kind of material in the substratum vary considerably in short distances.

Runoff from the Casco soils is rapid to very rapid. The risk of erosion is high, depending on the length and steepness of slopes and the cover of plants or of mulch. The Casco soils have a shallow rooting zone, a low to very low moisture-supplying capacity, and a surface soil that is low in organic matter. These soils are not suited to cultivation and should be in pasture or woodland.

**Casco and Rodman soils, 25 to 50 percent slopes, moderately eroded** (CfF2).—Both soils in this undifferentiated group usually occur in each mapped area, but the Casco generally occupies most of the acreage. The pattern of each soil is irregular. The Casco soil has a profile similar to that described for the Casco series. The Rodman soil is mostly gravel and cobblestones and has a profile similar to the one described as representative of the Rodman series.

Some areas of this mapping unit are severely eroded. Slopes are very irregular. (Capability unit VIIe–1.)

**Casco, Rodman, and Fox soils, 18 to 25 percent slopes, moderately eroded** (CgE2).—All of these soils usually occur in each mapped area but in irregular patterns. The Casco soil generally occupies most of the acreage, and the Fox the least. The texture and thickness of soil layers and the material in the substratum vary considerably in short distances in all three components.

Profiles of the Rodman and the Fox soils are given in the descriptions of their series.

Some areas of this mapping unit are severely eroded. Many slopes are irregular. (Capability unit VIe–1.)

## Celina Series

The Celina series consists of light-colored, moderately well drained soils on uplands. These soils have formed in calcareous loamy till of Wisconsin age and a loess mantle as much as 18 inches thick. They are on gently sloping to sloping areas. Carbonates are at depths ranging from 17 to 36 inches. The native vegetation on these soils was oak, maple, hickory, and other deciduous trees.

The Celina soils are associated with the well-drained Miami, the imperfectly drained Crosby, and the very poorly drained Brookston and Kokomo soils. In appearance they are similar to the Xenia soils, but the latter have formed in 18 to 40 inches of loess that overlies calcareous loamy till. They also resemble the Birkbeck soils that have formed in 40 inches or more of loess over calcareous loamy till.

Representative profile (Celina silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark-brown to dark grayish-brown, friable silt loam; weak, fine, granular structure; slightly acid to neutral.

Subsoil—
- $B_1$ 8 to 11 inches, dark grayish-brown, firm clay loam; few, fine, faint mottles of very dark grayish brown; moderate, fine, subangular blocky structure; medium acid.
- $B_2$ 11 to 20 inches, dark-brown, firm clay or clay loam; few, fine, faint mottles of very dark grayish brown; moderate, medium and coarse, subangular blocky structure; slightly acid to medium acid.
- $B_3$ 20 to 25 inches, dark-brown, firm clay loam; few, fine, faint mottles of very dark grayish brown; weak, medium and coarse, subangular blocky structure; slightly acid in upper part, gradually changing to neutral or calcareous in lower part.

Substratum—
- C 25 to 28 inches +, dark yellowish-brown, friable loam till; few, fine, faint mottles of dark grayish brown; weak, coarse, subangular blocky structure; calcareous; many small stones.

The surface soil and upper subsoil are usually free of grit because these layers have developed in the overlying mantle of loess. In a very few areas, this mantle of loess may be completely absent. The lower subsoil of most Celina soils was derived from loamy till, which usually consists of an appreciable amount of gritty material containing pebbles.

The overlying loess varies greatly in thickness within short distances. In areas where it has the maximum thickness, the surface soil and subsoil are thickest.

Runoff from the Celina soils is slow to medium. The risk of erosion is slight to moderate, depending on the length and steepness of slopes and the cover of growing vegetation or of mulch. Celina soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in content of organic matter. If properly managed, Celina soils are productive of crops commonly grown in the area.

**Celina silt loam, 0 to 2 percent slopes** (CeA1).—A profile of this soil is described as representative of the Celina series. Slight erosion has occurred. (Capability unit I–1.)

**Celina silt loam, 2 to 6 percent slopes** (CeB1).—This soil has been slightly eroded. The present surface soil is approximately 8 inches thick.

Included with this soil are a few small areas having a black or very dark gray surface soil. These areas with darker colored surface soil were formed under prairie vegetation. (Capability unit IIe–2.)

**Celina silt loam, 2 to 6 percent slopes, moderately eroded** (CeB2).—About 2 to 4 inches of the original surface layer of this soil remain. The present plow layer is a mixture of the original surface soil and the dark grayish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIe–2.)

**Celina silt loam, 6 to 12 percent slopes, moderately eroded** (CeC2).—Approximately 2 to 4 inches of the original surface soil remain. The original surface soil has been mixed with the dark grayish-brown upper subsoil during tillage. This mixture is finer textured than the original surface soil. The risk of erosion is more severe on this soil than it is on gentler slopes, because runoff is more rapid. (Capability unit IIIe–2.)

## Cincinnati Series

The Cincinnati series consists of light-colored, well-drained soils on uplands. These soils have formed in 16 to 30 inches of loess that overlies moderately fine to fine textured weathered till of Illinoian age. Carbonates usually are at a depth of about 80 inches. The soils generally occupy long narrow, gently sloping to sloping areas usually at the edge of ridges in the southwestern and southern parts of the county. The native vegetation was oak, hickory, tulip-poplar, and other hardwoods.

The Cincinnati soils are associated with the moderately well drained Rossmoyne, the imperfectly drained Avonburg, the poorly drained Clermont, and the poorly drained, moderately dark Blanchester soils.

Representative profile (Cincinnati silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 7 inches, brown, friable silt loam; weak, fine, granular structure; slightly acid to neutral.
- $A_2$ 7 to 14 inches, yellowish-brown, friable silt loam; weak, thin, platy structure; strongly acid.

Subsoil—
- $B_{21}$ 14 to 36 inches, yellowish-brown, friable silty clay loam; weak to moderate, medium, subangular blocky structure; very strongly acid; below 26 inches, layer usually has few to many, fine, faint mottles of gray and pale brown.
- $B_{22}$ 36 to 90 inches, yellowish-brown, firm silty clay loam; moderate, medium, subangular blocky structure; very strongly to strongly acid. This till-like layer contains black manganese concretions.

Substratum—
- C 90 inches +, mottled yellowish-brown and light olive-brown, firm to very firm clay till; massive (structureless); calcareous.

Limestone and calcareous shale bedrock are generally at a depth greater than 7 feet. The depth to carbonates ranges from 66 to 130 inches. Mottles, if present, are farther from the surface than in the associated Rossmoyne soils.

Runoff from the Cincinnati soils is medium. The risk of erosion depends on the length and steepness of slopes and the cover of vegetation and of mulch. Cincinnati soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, these soils are productive of crops commonly grown in the county.

**Cincinnati silt loam, 2 to 6 percent slopes** (CcB1).—This soil has the profile described as representative of the Cincinnati series. Slight erosion has occurred. (Capability unit IIe–2.)

**Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded** (CcB2).—Approximately 2 to 3 inches of the original surface layer of this soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface layer. This mixture has a lighter color than the original surface soil. In some areas, the plowed layer has been mixed with some of the finer textured subsoil. (Capability unit IIe–2.)

**Cincinnati silt loam, 6 to 12 percent slopes** (CcC1).—The profile of this soil is similar to that described for the series. Slight erosion has occurred. Runoff is more rapid and the risk of erosion is greater on this soil than on areas with more gentle slopes. (Capability unit IIIe–2.)

**Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded** (CcC2).—Approximately 2 to 3 inches of the original surface soil remain. During tillage the original surface soil has been mixed with the yellowish-brown subsurface layer and upper subsoil. This mixture is finer textured and lighter colored than the original surface soil. Runoff and the risk of erosion are greater on this soil than in areas with gentler slopes or in areas that are only slightly eroded. (Capability unit IIIe–2.)

## Clermont Series

The Clermont series consists of light-colored, poorly drained soils on uplands. The soils have formed in 16 to 30 inches of loess over moderately fine to fine textured weathered till of Illinoian glacial age. Carbonates are usually at a depth of 79 to 96 inches. Clermont soils are in fairly large areas on the nearly level upland till plains in the southern and southwestern parts of the county. The native vegetation was pin oak, white oak, gum, elm, and other hardwoods.

The Clermont soils are associated with the poorly drained, moderately dark Blanchester, the imperfectly drained Avonburg, the moderately well drained Rossmoyne, and the well drained Cincinnati soils.

Representative profile (Clermont silt loam in a cultivated field):

Surface layers—

$A_p$ 0 to 7 inches, light brownish-gray to light-gray, friable silt loam; common, fine, distinct mottles of brown and yellowish brown; weak, fine, granular structure; neutral.

$A_{2g}$ 7 to 11 inches, gray and light-gray, friable silt loam; common to few, fine, distinct mottles of yellowish brown; weak, medium, subangular blocky structure; strongly acid.

Subsoil—

$B_{1g}$ 11 to 22 inches, light-gray, friable to firm silty clay loam; many, fine, distinct mottles of yellowish brown and brown; weak to moderate, medium, subangular blocky structure; very strongly acid.

$B_{21g}$ 22 to 34 inches, gray, plastic silty clay loam; common, medium, distinct mottles of dark brown and yellowish brown; weak, coarse, prismatic structure that breaks to moderate, medium, subangular blocky; very strongly acid.

$B_{22g}$ 34 to 54 inches, dark-gray to gray, plastic silty clay loam to silty clay; many, medium, distinct mottles of yellowish brown and dark brown; weak, coarse to very coarse, prismatic structure that breaks to weak, medium, subangular blocky peds; very strongly acid.

$B_{23g}$ 54 to 80 inches, mottled gray and yellowish-brown, plastic silty clay loam to silty clay; massive (structureless); strongly acid in upper part, becoming slightly acid in lower part.

Substratum—

C 80 inches +, mottled gray and yellowish-brown, plastic clay loam till; massive (structureless); calcareous.

The texture of the subsoil ranges from silty clay loam to clay. Occasionally the depth to carbonates is greater than 96 inches, and it may be as much as 120 inches or more. The depth to underlying limestone and calcareous shale bedrock usually ranges from 7 to 20 feet.

The Clermont soils have slow runoff. Drainage is a problem, and tile drains will not work well (fig. 9).

*Figure 9.*—**Surface ditches are used in Clermont silt loam, which is difficult to drain by tile.**

Clermont soils have a shallow root zone, a low to fair moisture-supplying capacity, and a surface soil that is low in organic matter. Even if properly managed, these soils have limited productivity for the crops commonly grown in the county.

**Clermont silt loam** (CtA1).—A profile of this soil is described for the Clermont series. This soil has slopes of 0 to 2 percent and is slightly eroded. Some small areas that have a darker surface layer containing more organic matter are included because it was impractical to map them separately. (Capability unit IIIw–1.)

## Crosby Series

The Crosby series consists of light-colored, imperfectly drained soils on nearly level to gently sloping uplands. The soils have formed in calcareous loamy till of Wisconsin glacial age and a loess mantle up to 18 inches in thickness. The till usually is calcareous at depths of 18 to 30 inches. The native vegetation consisted of maple, beech, elm, ash, hickory, and oak.

The Crosby soils are associated with the very poorly drained Brookston and Kokomo, the moderately well drained Celina, and the well drained Miami soils.

Occasionally, the Crosby soils are adjacent to areas of the imperfectly drained Fincastle and Reesville soils. The Fincastle soils have formed in loess that is 18 to 36 inches thick over calcareous till of Wisconsin glacial age. The Reesville soils have formed in calcareous loess that is more than 40 inches thick.

Representative profile (Crosby silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 9 inches, dark grayish-brown, friable silt loam; medium, granular structure; slightly acid.

Subsoil—
$B_2$ 9 to 23 inches, distinctly mottled dark grayish-brown and yellowish-brown, firm silty clay loam to silty clay; mottles many and medium; a minor amount of grayish brown and dark yellowish-brown mottles; moderate to strong, medium to coarse, subangular blocky structure; medium acid in upper part, changing to slightly acid or neutral in lower part.

Substratum—
C 23 inches +, olive-brown, friable loam; few to many, medium to fine, distinct mottles of yellowish brown; massive in place; calcareous.

The loess mantle varies in thickness from almost zero to as much as 18 inches. Crosby soils that have a loess mantle approaching the maximum thickness generally have a subsoil of silty clay or silty clay loam. Those with a thinner mantle of loess generally have a clay-textured subsoil.

Runoff is slow to medium from the nearly level Crosby soils and medium from the gently sloping soils. Tile drains work well. The Crosby soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, these soils are productive of the crops commonly grown in the county.

**Crosby silt loam, 0 to 2 percent slopes** (CrA1).—This soil has the profile described as representative of the Crosby series. Slight erosion has occurred. Included with this soil are a few small uneroded, wooded areas with a very dark grayish-brown surface soil that contains slightly more organic matter. A few small areas of Brookston soils are also included because it was impractical to map them separately. (Capability unit IIw–2.)

**Crosby silt loam, 2 to 6 percent slopes** (CrB1).—This soil has been slightly eroded. Included with it are a few small uneroded, wooded areas that have a very dark grayish-brown surface soil. This darker colored surface soil is slightly higher in organic matter. A few small areas of Brookston soils were also included because it was impractical to map them separately. (Capability unit IIe–3.)

**Crosby silt loam, 2 to 6 percent slopes, moderately eroded** (CrB2).—The surface layer of this soil is predominantly silt loam. Erosion has removed a moderate amount of the original surface soil. What remained has been mixed with the moderately fine textured subsoil. This mixture is finer textured than the original surface soil. A few small, severely eroded areas that have lost all the original surface soil are included with this soil. (Capability unit IIe–3.)

## Delmar Series

The Delmar series consists of light-colored, poorly drained soils on uplands. These soils have formed in loess that is 18 to 40 inches thick and the underlying medium-textured calcareous till of Wisconsin glacial age. Calcareous till is at a depth of 36 to 48 inches.

Delmar soils are usually in small, nearly level areas surrounded by the Fincastle soils. The native vegetation was mainly beech and maple, with lesser amounts of ash, elm, and pin oak.

The Delmar soils are associated with the very poorly drained Brookston, the imperfectly drained Fincastle, the moderately well drained Xenia, and the well drained Russell soils. Delmar soils, in contrast to the Fincastle soils, have more gray in the A and B horizons and less yellowish brown in the subsoil. This indicates poorer internal drainage in the Delmar soils.

Representative profile (Delmar silt loam in a cultivated field):

Surface layers—
$A_p$ 0 to 7 inches, grayish-brown, friable silt loam; weak, fine, granular structure; slightly acid to medium acid.
$A_2$ 7 to 14 inches, light brownish-gray, friable silt loam; few, fine, distinct mottles of yellowish brown and dark brown; weak, medium, subangular blocky structure; medium to very strongly acid.

Subsoil—
$B_{2g}$ 14 to 38 inches, light brownish-gray and yellowish-brown, firm silty clay loam; common, medium, distinct mottles of grayish brown and dark yellowish brown; moderate, medium, prismatic structure breaking into moderate, medium, subangular blocky peds; strongly acid in upper part and changing to slightly acid or neutral in lower part.

Substratum—
C 38 inches +, mottled brownish-yellow, yellowish-brown, and light brownish-gray, friable loam till; massive in place; calcareous.

Textures of the underlying till include loam, silt loam, and clay loam.

Runoff from the Delmar soils is slow. Drainage is a problem, but tile drains do not work well. The Delmar soils have a shallow to deep root zone for growing plants, a fair to medium moisture-supplying capacity, and a surface soil that is low in organic matter. Even when drained and properly managed, these soils have only limited productivity for crops commonly grown in the county.

**Delmar silt loam** (DeA1).—This soil has the profile described for the series. Slopes are 0 to 2 percent. Little to slight erosion has occurred. (Capability unit IIIw–1.)

## Edenton Series

The Edenton series consists of light-colored, well-drained soils on uplands. These soils formed from shallow, medium to moderately fine textured till of Illinoian glacial age, underlain by bedrock consisting of thinly bedded limestone and calcareous shale. They are generally on sloping to very steep areas adjacent to stream valleys. The native vegetation was beech, maple, and other hardwood trees.

The Edenton soils are associated with the Fairmount soils. These two soils are mapped together on steep and very steep slopes because they occur in such a complex pattern that it was not practical to map them separately. The Fairmount soils usually have a finer textured subsoil. They are residual soils that weathered from thin-bedded limestone and calcareous clay shale.

Representative profile (Edenton silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 7 inches, yellowish-brown to dark-brown, friable silt loam; moderate, fine to medium, granular structure; slightly to medium acid.

Subsoil—
- $B_1$ 7 to 18 inches, yellowish-brown, firm silty clay loam; moderate, medium, subangular blocky structure; strongly acid to medium acid.
- $B_2$ 18 to 38 inches, yellowish-brown, firm silty clay loam; few, fine, faint mottles of pale brown; moderate, medium, subangular blocky structure; medium acid in upper part and gradually changing to neutral in lower part.

Substratum—
- C 38 to 45 inches, brown to yellowish-brown, firm silty clay loam till; few, fine to medium, faint mottles of pale brown; massive (structureless); neutral in upper part and gradually changing to calcareous in lower part.
- D 45 inches +, bedrock consisting of thinly bedded limestone and calcareous shale.

The texture of the surface soil is predominantly silt loam, but in local areas it is often finer or more clayey. This is caused mainly by variation in the thickness and texture of till, local downhill slumping, and mixing of material of the subsoil and substratum.

Runoff from the Edenton soils is medium to rapid. The risk of erosion depends on the length and steepness of slopes and the cover of vegetation and of mulch. The moderately eroded Edenton soils have a shallow root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. These properties are less favorable for agriculture on the severely eroded areas of these soils. If properly managed, the Edenton soils are moderately productive of crops commonly grown in the county.

**Edenton silt loam, 2 to 6 percent slopes, moderately eroded** (EdB2).—A profile of this soil is described as representative of the Edenton series. The plowed layer is a mixture of the original surface soil and the upper part of the subsoil. A few small severely eroded areas have been included because they were too small to map separately. (Capability unit IIe–1.)

**Edenton silt loam, 6 to 12 percent slopes, moderately eroded** (EdC2).—This soil has a profile like the one described as representative for the series. On this soil, however, runoff is more rapid, the risk of erosion is more severe, and the moisture-holding capacity is slightly lower. A few small severely eroded areas are included because they were too small to map separately. (Capability unit IIIe–1.)

**Edenton silt loam, 12 to 18 percent slopes, moderately eroded** (EdD2).—This soil has a profile like the one described as representative of the series. The surface soil and subsoil, however, are not quite so thick. As a result, the root zone and the moisture-holding capacity are less. Because of the steeper slopes and more rapid runoff, the risk of erosion is greater on this soil than on the less sloping Edenton soils. (Capability unit IVe–1.)

**Edenton soils, 6 to 12 percent slopes, severely eroded** (EsC3).—About 2 inches or less of the original surface soil remain in the plowed layer of this soil. This material has been mixed with some of the yellowish-brown upper subsoil in tillage, and the resulting mixture is finer textured than the original surface layer. In a few areas the subsoil has been lost and the underlying parent material is exposed. Some areas are gullied. Control of erosion is necessary to keep this soil in cultivation. (Capability unit IVe–3.)

**Edenton soils, 12 to 18 percent slopes, severely eroded** (EsD3).—The profile of these soils is not so thick as that of the representative series profile. About 2 inches or less of the original surface soil remain and has been mixed in tillage with some of the yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. Runoff is rapid, and the risk of erosion is severe. Many areas are gullied. The moisture-supplying capacity is low. (Capability unit VIe–2.)

**Edenton and Fairmount soils, 18 to 25 percent slopes, moderately eroded** (EfE2).—Both soils in this undifferentiated group are usually in each mapped area, but the Edenton soil occupies most of the acreage. The area of each soil is irregular and does not have a definite pattern. The surface soil of the Fairmount contains more clay than that of the Edenton soil.

Some areas of this mapping unit are severely eroded. In many areas the slopes are very irregular. (Capability unit VIe–1.)

**Edenton and Fairmount soils, 18 to 25 percent slopes, severely eroded** (EfE3).—All or nearly all of the original surface soil has been lost through erosion from most areas. As a result the lighter colored and finer textured subsoil is exposed. The severe risk of erosion makes these soils unsuitable for cultivation. (Capability unit VIIe–2.)

**Edenton and Fairmount soils, 25 to 50 percent slopes, moderately eroded** (EfF2).—These soils have been mapped together as an undifferentiated unit. Both generally occur in each mapped area, but the Edenton occupies most of the acreage. The area of each soil is irregular and does not have a definite pattern.

The risk of erosion is severe, and the soils in this unit are not suited to cultivation. Slopes are very irregular in many places. A representative profile of the Fairmount soils is described under the Fairmount series. (Capability unit VIIe-1.)

## Eel Series

The Eel series consists of light-colored, moderately well drained soils on bottom lands. These soils are forming in medium-textured, neutral to calcareous alluvium that washed from calcareous till soils on uplands. They are subject to flooding. The native vegetation was elm, ash, soft maple, sycamore, and other deciduous trees.

The Eel soils are associated with the well drained Genesee, the imperfectly drained Shoals, and the very poorly drained Sloan soils.

Representative profile (Eel silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; weak, medium, granular structure; neutral.

Substratum—
$C_1$ 8 to 36 inches, dark grayish-brown, friable silt loam; few, fine, faint mottles of light brownish gray, pale brown, and yellowish brown; lower part of layer has distinct, coarse mottles; upper part of layer has weak, medium, granular structure, the lower part is massive; some slight stratification; neutral.
$C_2$ 36 to 48 inches, brown to dark-brown, firm to friable silt loam and loam; few to many, coarse, distinct mottles of grayish brown and gray; roughly assorted, coarser textured layer is present; massive (structureless); neutral to calcareous.

Although the alluvium, or parent material, is medium textured, it usually contains roughly stratified layers of coarser textured material. The proportion of this material usually increases with depth. Occasionally there are layers of well-sorted sand at various depths. In places, Eel soils are underlain by limestone bedrock at depths of more than 36 inches.

These soils may be occasionally flooded. They have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, the Eel soils are productive of the crops commonly grown in the county.

**Eel loam** (EmA0).—This soil is on slopes of 0 to 2 percent. Little or no erosion has occurred. The soil is forming in loamy alluvium. The profile of this soil has coarser textured layers than those described in the representative profile. (Capability unit I-2; if subject to flooding, Vw-1.)

**Eel silt loam** (EeA0).—A profile of this soil is described as representative of the Eel series. The soil is on slopes of 0 to 2 percent. Little or no erosion has occurred. (Capability unit I-2; if subject to flooding, Vw-1.)

## Fairmount Series

The Fairmount series consists of dark-colored, well-drained, residual soils on uplands. These soils have formed in material that weathered from thinly bedded limestone and calcareous clay shale. They have a fine-textured subsoil. They occur on steep and very steep slopes adjacent to stream valleys. The native vegetation was beech, maple, and other deciduous trees.

Representative profile (Fairmount silty clay loam in a pasture area):

Surface layers—
$A_{11}$ 0 to 2 inches, very dark grayish-brown, friable silty clay loam; moderate, fine, granular structure; neutral to slightly alkaline.
$A_{12}$ 2 to 8 inches, dark grayish-brown, friable silty clay loam; moderate, coarse, granular structure to fine, subangular blocky; neutral to slightly alkaline.

Subsoil—
$B_1$ 8 to 12 inches, pale-yellow or light yellowish-brown, very firm silty clay loam; strong, fine to medium, subangular blocky structure; neutral to mildly alkaline.
$B_2$ 12 to 20 inches, olive-yellow to olive, very firm clay; strong, coarse, subangular blocky structure; mildly to strongly alkaline.

Substratum—
D 20 inches +, bedrock consisting of thinly bedded limestone and calcareous shale.

In Clinton County the Fairmount soils are so closely associated with the Edenton soils on steep and very steep slopes that they are mapped with them as undifferentiated units. These units are described under the Edenton series.

## Fincastle Series

The Fincastle series consists of light-colored, imperfectly drained soils on nearly level to gently sloping uplands. These soils have formed in 18 to 40 inches of loess, over medium-textured, calcareous till of Wisconsin glacial age. Carbonates are at a depth of 30 to 48 inches. The native vegetation consisted of ash, elm, maple, and other deciduous trees.

The Fincastle soils are associated with the very poorly drained Brookston, the moderately well drained Xenia, and the well drained Russell soils.

In places the Fincastle soils may be adjacent to areas of the imperfectly drained Crosby and Reesville soils. The Crosby soils have formed in loamy till with a loess mantle as much as 18 inches in thickness; the Reesville, in 40 inches or more of loess.

Representative profile (Fincastle silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; moderate, fine, granular structure; medium to slightly acid.

Subsoil—
$B_1$ 8 to 14 inches, yellowish-brown, firm silt loam; many, medium to fine, distinct mottles of brown and grayish brown; moderate, medium, subangular blocky structure; medium acid.
$B_2$ 14 to 36 inches, brown and dark yellowish-brown, firm silty clay loam; many, medium, distinct mottles of yellowish brown; moderate, medium, subangular blocky structure; medium to slightly acid in upper part, grading to neutral in lower part; small weathered pebbles of glacial till in lower part.

Substratum—
C 36 inches +, mottled light brownish-gray and dark yellowish-brown, friable loam till; massive in place; calcareous.

The underlying till consists of loam and silt loam. It is seldom leached of carbonates where the overlying loess is 36 inches or more in thickness. In contrast, the soil may be leached to a depth of 48 inches where the overlying loess is less than 36 inches thick. On the terminal moraine, carbonates may be as far from the surface as 72 inches. This extreme variation can occur in short horizontal distances.

Runoff from Fincastle soils is slow to medium in nearly level areas and medium on gentle slopes. These soils have moderately deep root zones, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. Drainage is a problem, but tile drains can be expected to work well. If properly managed, Fincastle soils are productive of the crops commonly grown in the county.

**Fincastle silt loam, 0 to 2 percent slopes** (FnA1).—A profile of this soil is described as representative of the Fincastle series. The soil has been slightly eroded. A few small areas of Brookston soils are included because it was impractical to map them separately. (Capability unit IIw–2.)

**Fincastle silt loam, 2 to 6 percent slopes** (FnB1).—This soil has been slightly eroded. The major problem, however, is drainage. In places a few small areas of the Brookston soils have been included. It was not feasible to map these areas separately. (Capability unit IIe–3.)

**Fincastle silt loam, 2 to 6 percent slopes, moderately eroded** (FnB2).—This soil has lost some of the surface layer through erosion. As a result the original surface layer has been mixed with some of the upper subsoil. A few small severely eroded areas that have lost all the original surface layer are included with this soil. In addition, small areas of the Brookston soils that were too small to map separately are included. (Capability unit IIe–3.)

## Fox Series

The Fox series consists of light-colored, somewhat excessively drained soils. They have formed from a medium-textured mantle of material 24 to 42 inches thick that overlies stratified, calcareous sand and gravel of Wisconsin age. The depth to carbonates coincides with the depth to the unweathered sand and gravel. Most of the Fox soils are nearly level except on terrace edges. These soils occur on outwash plains in the valleys of the larger streams and also on the remnants of valley trains. A few areas are subject to flooding because they are at a relatively low elevation on the flood plains. The native vegetation consisted of oak, maple, walnut, hickory, and other deciduous trees.

Most Fox soils occupy slopes of 1 to 12 percent. Some areas, however, are on steeper slopes and are intermingled with the Casco and the Rodman soils. These steeper Fox soils are mapped with their associates as undifferentiated groups.

Fox soils differ from the Casco in that the latter have developed in loamy material that is 10 to 24 inches deep over stratified sand and gravel. The Rodman soils have developed entirely from sandy material and gravel.

Representative profile (Fox silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark-brown, friable silt loam; weak, medium, granular structure; neutral.

Subsoil—
- $B_1$ 8 to 16 inches, brown, friable silty clay loam or clay loam; weak, medium, subangular blocky structure; slightly acid.
- $B_{21}$ 16 to 23 inches, brown, firm clay to clay loam; strong, medium, subangular blocky structure; slightly acid to medium acid; roughly stratified units of sand and gravel are distributed throughout the matrix of clay to clay loam.
- $B_{22}$ 23 to 27 inches, brown, firm clay loam; strong, medium, subangular blocky structure; slightly acid in upper part, gradually changing to neutral or calcareous in lower part; roughly stratified units of sand and gravel are distributed throughout the matrix of clay loam.

Substratum—
- D 27 inches +, gray and light-yellow, stratified sand and gravel; layers usually well sorted; single grain (structureless); calcareous.

In places the depth to the calcareous sand and gravel may be greater than 42 inches. Pendants or tongues of the finer textured, overlying material have penetrated, through weathering, as much as 6 feet into the underlying calcareous sand and gravel.

In places the surface soil and upper subsoil are free of grit and were derived from a thin mantle of loess or from grit-free, alluvial silt. The lower layers of the subsoil contain, throughout the matrix, varying amounts of roughly stratified sand and gravel. The amount of this sand and gravel usually increases with depth.

Runoff from Fox soils is slow to medium. The risk of erosion depends on the length and steepness of slopes and the cover of growing plants or of mulch. The Fox soils have a shallow rooting zone, a low to medium moisture-holding capacity, and a surface soil that is medium in content of organic matter. The gravelly and sandy substratum is excessively drained. If management is good, these soils are productive of the crops commonly grown in the county.

**Fox silt loam, 0 to 2 percent slopes** (FxA1).—A profile of this soil is described as representative of the Fox series. A slight amount of erosion has occurred. In some places this soil is droughty. A few areas with a gravelly surface layer are included with this soil. (Capability unit IIs–1.)

**Fox silt loam, 2 to 6 percent slopes** (FxB1).—This soil has a profile similar to that described as representative of the series. A slight amount of erosion has occurred. Erosion control is important in the management of this soil. Additional loss of soil will reduce the moisture-supplying capacity and the depth of the root zone. (Capability unit IIe–1.)

**Fox silt loam, 2 to 6 percent slopes, moderately eroded** (FxB2).—About 2 to 4 inches of the original surface soil remain. The rest has been lost through erosion. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface layer. Erosion control is important in the management of this soil because additional loss of soil will reduce the depth of the root zone, as well as the moisture-supplying capacity. (Capability unit IIe–1.)

**Fox silt loam, 6 to 12 percent slopes, moderately eroded** (FxC2).—Approximately 2 to 4 inches of the original surface soil remain. During tillage the plow layer has been mixed with some of the brown upper subsoil. This mixture is finer textured than the original surface soil. This soil has a shallower root zone and a lower moisture-supplying capacity than the uneroded or slightly eroded Fox soils. Additional loss of soil will make the soil more droughty. (Capability unit IIIe–1.)

**Fox and Casco soils, 12 to 18 percent slopes, moderately eroded** (FcD2).—These soils have been mapped together as an undifferentiated unit. Usually, both soils occur in each mapped area, but the Fox soils occupy most of the acreage.

The soils occupy areas that have no definite pattern. Within short distances, they may vary considerably in texture, in thickness of soil layers, and in the kind of underlying material. A profile of the Casco soil is described under the Casco series.

These soils are droughty, and the risk of erosion is severe. They are therefore not suited to cultivation. (Capability unit VIe–1.)

**Fox, Casco, and Rodman soils, 12 to 25 percent slopes, severely eroded** (FdD3).—All three soils in this undifferentiated unit generally occur in each mapped area. They occur in areas that have no definite pattern. Within short distances, they may vary considerably in texture, in thickness of layers, and in kind of underlying material. The Fox soils occupy most of the acreage, and the Rodman the least. Profiles of the Casco and of the Rodman soils are described under their respective series elsewhere in this section of the report.

Because of droughtiness and the severe risk of erosion, the soils in this mapping unit are not suited to cultivation. (Capability unit VIIe–2.)

## Genesee Series

The Genesee series consists of light-colored, well-drained soils on nearly level bottom lands. These soils are forming in 36 inches or more of medium-textured, neutral to calcareous alluvium that washed from calcareous soils on uplands. They are subject to flooding. The native vegetation consisted of elm, sycamore, ash, and other deciduous trees.

The Genesee soils are associated with the well drained Ross, the moderately well drained Eel, the imperfectly drained Shoals, and the very poorly drained Sloan soils. The associated Ross soils have a darker colored surface soil and in places have developed a structure in the profile. Many areas of Genesee soils are adjacent to the Fox and Ockley soils on low elevations.

Representative profile (Genesee silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark-brown, friable silt loam; moderate to weak, medium, granular structure; neutral.

Substratum—
- $C_1$ 8 to 42 inches, brown, friable silt loam; very weak, fine and medium, granular and subangular blocky structure; neutral; strata of loam and sandy loam may occur.
- $C_2$ 42 to 54 inches, dark-brown, friable loam and sandy loam; loam is massive (structureless); sandy loam is single grain (structureless); neutral.
- $C_3$ 54 inches +, brown, loose sandy loam with roughly assorted layers of sandy and gravelly material; calcareous.

The alluvium, or parent material, has a medium texture but usually contains roughly stratified layers of coarser textured material. The proportion of this stratified material usually increases with depth. In some places layers of well-sorted sand are at various depths, and in others, limestone bedrock is at a depth of 36 inches or more. In the sandy substratum phases of the Genesee soils, sandy and gravelly layers occur at a depth of 20 to 36 inches.

These soils may occasionally be flooded. They have a deep root zone, a high moisture-supplying capacity, and a medium amount of organic matter. If properly managed, they are productive of crops generally grown in the county.

**Genesee loam** (GnA0).—This soil is on slopes of 0 to 2 percent. Little or no erosion has occurred. The soil has formed from loamy alluvium of coarser texture than the various layers described in the representative profile. (Capability unit I–2; if subject to flooding, Vw–1.)

**Genesee loam, sandy substratum** (GmA0).—This soil is on slopes of 0 to 2 percent. Little or no erosion has occurred. The parent material consisted of loamy alluvium, 20 to 36 inches deep, over sandy and gravelly layers. (Capability unit I–2; if subject to flooding, Vw–1.)

**Genesee silt loam** (GeA0)—The profile of this soil is described as representative of the Genesee series. Slopes are 0 to 2 percent. Little or no erosion has occurred. (Capability unit I–2; if subject to flooding, Vw–1.)

**Genesee silt loam, sandy substratum** (GsA0).—This soil is on slopes of 0 to 2 percent. Little or no erosion has occurred. The soil formed in silt loam alluvium that is underlain at a depth of 20 to 36 inches by sandy and gravelly layers. (Capability unit I–2; if subject to flooding, Vw–1.)

## Gullied Land

**Gullied land** (Gu).—This miscellaneous land type consists of numerous, deep, V-shaped valleys or gullies that have no vegetation. Gullies in this mapping unit occur at least every 100 feet apart and usually are 3 to 6 feet deep. The gullies have cut into the substratum. This substratum is friable, medium-textured, calcareous till of Wisconsin glacial age. It is unstable material from which the soil particles are readily removed by flowing water. Moderately eroded Miami, Russell, and Hennepin soils are in the areas between gullies. These soils are similar to comparable soils described in other portions of this report.

Gullied land was caused by large quantities of runoff from higher elevations that concentrated into fast-flowing, intermittent rivulets. Such erosion can be prevented by use of diversion ditches and by planting trees. Trees should be able to tolerate calcareous soil and the poor physical condition and moisture relationship that exist in bare gullying soil. Some gullies can be leveled by earth-moving equipment. Then, if management is good, a vegetative cover can be reestablished. (Capability unit VIIe–2.)

## Hennepin Series

The Hennepin series consists of light-colored, well-drained soils on uplands. These soils have developed in loamy calcareous till of Wisconsin glacial age. They occupy the steep sides of valleys. Carbonates usually are at depths of 4 to 15 inches. The native vegetation consisted of oak, hickory, maple, elm, and other deciduous trees.

The Hennepin soils are associated with the Miami or Russell soils but have thinner surface soil and subsoil. In addition, the depth to carbonates is correspondingly less.

In Clinton County the Hennepin soils are so closely intermingled with the Miami or Russell soils that they were mapped together as undifferentiated units. Hennepin silt loams on 18 to 25 percent slopes, closely intermingled with the Miami soils, are described with the Miami series elsewhere in this report.

The Hennepin silt loams on steep slopes that are closely intermingled with the Russell soils are described with the Russell series elsewhere in this report.

Representative profile (Hennepin loam in a pasture area):

Surface soil—
- $A_1$ 0 to 4 inches, dark-brown, friable loam; moderate, medium to fine, crumb structure; neutral; fine gravel present.

Subsoil—
- B 4 to 9 inches, dark yellowish-brown, friable silty clay loam or clay loam; fine and very fine, subangular blocky structure; neutral; fine gravel present.

Substratum—
- C 9 inches +, yellowish-brown, friable loam till; massive (structureless); calcareous.

The surface soil is predominantly loam and silt loam. However, where erosion has exposed the subsoil, the surface layer is silty clay loam or clay loam. Loams or sandy loams occur where the surface soil was formed mainly from till.

Runoff is rapid. Most Hennepin soils are slightly and moderately eroded. The risk of erosion depends on the length and steepness of slopes and the cover of vegetation or of mulch. The Hennepin soils have a shallow to moderately deep root zone, a low to medium moisture-supplying capacity, and a surface soil that is medium in organic matter. These properties are less favorable for agriculture in the severely eroded soils. Hennepin soils are suited to forestry and pasture.

**Hennepin and Miami soils, 25 to 50 percent slopes** (HeF1).—The soils in this undifferentiated unit have been slightly eroded. The Miami component is deeper than the Hennepin, but its profile is not so deep as that described under the Miami series. Usually both components are in each mapped area, but the Hennepin soils occupy most of the acreage. The soils of this unit are not suited to cultivation. (Capability unit VIIe–1.)

**Hennepin and Miami soils, 25 to 50 percent slopes, moderately eroded** (HeF2).—The Miami component of this undifferentiated unit is deeper than the Hennepin, but its profile is not so deep as that described under the Miami series. Usually both components are in each mapped area, but the Hennepin soils occupy most of the acreage. The soils of this unit are not suited to cultivation. (Capability unit VIIe–1.)

**Hennepin and Miami soils, 25 to 50 percent slopes, severely eroded** (HeF3).—Most areas of these soils have lost all or nearly all of the original surface soil through erosion. As a result, the lighter colored loam, sandy loam, clay loam, or silty clay loam subsoil and substrata are exposed at the surface. Usually both components occur in each mapped area, but the Hennepin soils occupy most of the acreage. The soils of this unit are not suited to cultivation. (Capability unit VIIe–2.)

## Henshaw Series

The Henshaw series consists of light-colored, imperfectly drained soils that have formed in medium-textured, water-laid sediment of Wisconsin glacial age. Carbonates are at depths of 36 to 60 inches. Henshaw soils occupy nearly level areas in the west-central part of the county. The native vegetation consisted of oak, hickory, and other deciduous trees.

The Henshaw soils are associated with the very poorly drained Bonpas and the moderately well drained Uniontown soils.

Representative profile (Henshaw silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; weak, fine, granular structure; slightly acid.
- $A_2$ 8 to 14 inches, yellowish-brown, friable silt loam; common, fine and medium, faint mottles of light grayish brown; weak, thin, platy and weak, medium, granular structure; slightly acid to neutral.

Subsoil—
- $B_{21}$ 14 to 26 inches, yellowish-brown and grayish-brown, firm silty clay loam; common, fine, faint mottles of light brown; moderate, medium and coarse, angular blocky structure; slightly acid to neutral.
- $B_{22}$ 26 to 34 inches, pale-brown and brownish-yellow, firm silty clay loam; common, fine to medium, faint mottles of light grayish brown and olive brown; moderate, medium to coarse, angular blocky structure; slightly acid to neutral in upper part, neutral in lower part.
- $B_3$ 34 to 40 inches, light brownish-gray and brownish-yellow, firm silty clay loam to silt loam; common, fine and medium, faint to distinct mottles of yellowish brown; moderate, medium to coarse, prismatic structure in upper part to massive in lower part; neutral in upper part and gradually becoming calcareous in lower part.

Substratum—
- C 40 inches +, mottled light brownish-gray and brownish-yellow, firm silty clay loam; massive (structureless); calcareous.

In places, the texture of the substratum varies between silty clay loam or silt loam and clay loam. Some fairly thin, discontinuous bands, or layers, of sandy material occur in the substratum.

Runoff is slow from the Henshaw soils. Drainage is a problem, but tile drains should work well. The Henshaw soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. If well managed, these soils are productive for crops commonly grown in the county.

**Henshaw silt loam** (HnA1).—A profile of this soil is described for the Henshaw series. The soil is on slopes of 0 to 2 percent. Slight erosion has occurred. (Capability unit IIw–3.)

## Kokomo Series

The Kokomo series consists of very dark colored, very poorly drained soils on uplands. These soils formed from calcareous, loamy till of Wisconsin glacial age. In places up to 36 inches of loess overlies the till. Carbonates are at depths of 36 to 60 inches. The soils are in nearly level and basinlike areas where water is ponded and silty material is deposited. The native vegetation consisted of white ash, American elm, red maple, and other trees commonly growing in a swamp forest.

The Kokomo soils are associated with the very poorly drained Brookston, the imperfectly drained Crosby, the moderately well drained Celina, and the well drained Miami soils. The Kokomo soils have a thicker surface soil and are usually darker colored than the Brookston soils.

Representative profile (Kokomo silt loam, overwashed, in a cultivated field):

Surface layers—
$A_{1p}$ 0 to 8 inches, very dark brown, friable silt loam; moderate, medium, granular structure; slightly acid to neutral.
$A_{12}$ 8 to 17 inches, black or very dark gray, firm to friable silty clay loam; moderate, fine, subangular blocky structure; slightly acid to neutral.

Subsoil—
$B_{21g}$ 17 to 28 inches, dark-gray, very firm silty clay loam; moderate, coarse, prismatic structure that breaks to coarse, angular blocky peds; slightly acid.
$B_{22g}$ 28 to 54 inches, dark-gray, very firm silty clay loam mottled with yellowish brown and dark yellowish brown; coarse and very coarse, angular blocky structure; neutral.

Substratum—
$C_g$ 54 inches+, grayish-brown, friable loam; many, medium, distinct mottles of yellowish brown and dark yellowish brown; massive in place; calcareous.

Most areas of Kokomo soils have been covered by 8 to 14 inches of alluvial overwash. This light-colored silt loam material has been mixed with the original black, silty clay loam surface soil. The resulting surface soil is very dark brown silt loam. The silt loam overwashed phase is the only Kokomo soil mapped in Clinton County, but small areas that have a silty clay loam surface soil are included. Where the overwash accumulated at a fairly slow rate, it was thoroughly mixed with the original soil. This dark grayish-brown mixture grades into the original soil. Where the overwash accumulated at a rapid rate, it is usually grayish brown and has an abrupt boundary with the original black or very dark gray silty clay loam surface soil.

Runoff is slow from the Kokomo soils because they are usually in nearly level and depressed areas. Drainage is a problem, but tile drains should work well. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. If adequately drained, the Kokomo soils are productive of crops commonly grown in the county and are especially good for corn.

**Kokomo silt loam, overwashed** (KoA+).—A profile of this soil is described for the Kokomo series. This soil is on slopes of 0 to 2 percent. Soil material from surrounding areas covers the original soil surface. (Capability unit IIw–4.)

## Medway Series

The Medway series consists of dark-colored, moderately well drained soils on bottom lands. These soils are forming in medium-textured, neutral to calcareous alluvium that washed from uplands. Medway soils are at higher elevations than most other soils on the bottom lands, and they are subject to less flooding. The native vegetation consisted of elm, ash, soft maple, sycamore, and other deciduous trees.

The Medway soils are associated with the well drained Ross soils and with the moderately well drained Eel soils. They have darker colored layers in the upper profile and, at comparable depths, a stronger grade of structure than the Eel soils.

Representative profile (Medway loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, very dark brown to very dark grayish-brown, friable loam; moderate to weak, fine and medium, granular structure; neutral.

Substratum—
$C_1$ 8 to 13 inches, dark-gray to black, friable loam; moderate to weak, fine and medium, subangular blocky structure; neutral.
$C_2$ 13 to 22 inches, very dark brown, friable loam; common, medium to fine, faint mottles of dark grayish brown and brown; moderate to weak, medium to coarse, subangular blocky structure; neutral.
$C_3$ 22 to 36 inches +, yellowish-brown loam or fine sandy loam; many, medium to fine, distinct mottles of light yellowish brown and brown; moderate to weak, medium, subangular blocky structure in upper part to massive in lower part; neutral.

The alluvium is generally medium textured, but some of it is moderately fine and moderately coarse. In the lower parts of these soils there are thin, roughly stratified, sandy layers. The proportion of these layers usually increases with depth. In a few places, there are layers of well-sorted, or clean, sand at various depths in these soils. In some places the Medway soils are underlain by limestone at a depth greater than 24 to 48 inches.

These soils have a slight drainage problem. They have a deep root zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. If properly managed, the Medway soils are productive of crops commonly grown on bottom lands of the county.

**Medway loam** (MwA0).—A profile for this soil is described as representative of the Medway series. The soil has slopes of 0 to 2 percent. Little or no erosion has occurred. (Capability unit I–2; if subject to flooding, Vw–1.)

**Medway silt loam** (MyA0).—This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. The parent material of this soil was a finer textured (silt loam) alluvium than that of Medway loam. (Capability unit I–2; if subject to flooding, Vw–1.)

## Miami Series

The Miami series consists of light-colored, well-drained, sloping to gently sloping soils on uplands. These soils have developed in calcareous loamy till of Wisconsin glacial age. In many places a mantle of loess, up to 18 inches thick, covered the till. Carbonates generally occur at depths of 15 to 30 inches in Clinton County.

The native vegetation was a mixture of white and red oaks, maple, elm, ash, hickory, and other hardwoods.

The Miami soils are associated with the moderately well drained Celina, the imperfectly drained Crosby, and the very poorly drained Brookston and Kokomo soils. Miami soils resemble the Russell and Xenia soils, which have formed in 18 to 40 inches of loess over calcareous loamy till. They also resemble the Birkbeck soils, which have formed in 40 inches or more of loess over calcareous loamy till.

Representative profile (Miami silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; moderate, fine, granular structure; neutral reaction.

Subsoil—
- $B_1$ 8 to 11 inches, dark yellowish-brown, firm silt loam; moderate, medium, granular structure; slightly acid.
- $B_2$ 11 to 24 inches, yellowish-brown to dark yellowish-brown, firm to very firm silty clay loam; strong to moderate, medium, subangular blocky structure; slightly acid in upper part, gradually becoming neutral in lower part.
- $B_3$ 24 to 28 inches, dark-brown to dark yellowish-brown, firm to friable clay loam; moderate, medium, subangular blocky structure, massive in lower part; calcareous.

Substratum—
- C 28 inches +, dark-brown to light yellowish-brown, friable loam till; massive (structureless); calcareous.

The slopes of the Miami soils range mainly from 2 to 12 percent; some are as strong as 25 percent. The surface soil and upper subsoil are generally free of grit if these layers have formed from loess. The loess overlying the till is thickest on gentle slopes, but it thins considerably on stronger slopes. In many places it is absent on slopes greater than 18 percent. The surface soil and subsoil also are thinner on stronger slopes.

Runoff from Miami soils is medium to rapid. The risk of erosion is moderate to high, depending on the length and steepness of slopes and the cover of growing plants or of mulch. Most Miami soils are slightly or moderately eroded. Generally, they have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. In the severely eroded Miami soils, these properties are less favorable for agriculture. If properly managed, the Miami soils are productive of the crops commonly grown in the county.

**Miami silt loam, 2 to 6 percent slopes** (MmB1).—The profile of this soil has been described as representative of the series. In some places slight erosion has occurred. (Capability unit IIe–2.)

**Miami silt loam, 2 to 6 percent slopes, moderately eroded** (MmB2).—In this soil about 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the dark yellowish-brown subsoil. The mixture is finer textured than the original surface soil. (Capability unit IIe–2.)

**Miami silt loam, 6 to 12 percent slopes** (MmC1).—This soil is slightly eroded. The remaining surface soil is about 8 inches thick. (Capability unit IIIe–2.)

**Miami silt loam, 6 to 12 percent slopes, moderately eroded** (MmC2).—In this soil about 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the dark yellowish-brown upper subsoil. The mixture is finer textured than the original surface soil. (Capability unit IIIe–2.)

**Miami silt loam, 12 to 18 percent slopes** (MmD1).—This soil has been slightly eroded. Approximately 8 inches of the original surface soil remain. (Capability unit IVe–2.)

**Miami silt loam, 12 to 18 percent slopes, moderately eroded** (MmD2).—In this soil about 2 to 4 inches of the original surface soil remain in the plow layer. This has been mixed with the dark yellowish-brown subsoil. The mixture is finer textured than the original surface soil. (Capability unit IVe–2.)

**Miami soils, 2 to 6 percent slopes, severely eroded** (MeB3).—In this mapping unit about 2 inches or less of the original surface soil remain in the plow layer. This has been mixed with the yellowish-brown to dark yellowish-brown silty clay loam subsoil. The mixture is finer textured than the original surface soil. (Capability unit IIIe–2.)

**Miami soils, 6 to 12 percent slopes, severely eroded** (MeC3).—In this mapping unit about 2 inches or less of the original surface soil remain in the plow layer. This has been mixed with the yellowish-brown to dark yellowish-brown silty clay loam subsoil. The mixture is finer textured than the original surface soil. (Capability unit IVe–3.)

**Miami soils, 12 to 18 percent slopes, severely eroded** (MeD3).—In this mapping unit about 2 inches or less of the original surface soil remain in the plow layer. This has been mixed with the yellowish-brown to dark yellowish-brown silty clay loam subsoil. The mixture is finer textured than the original surface soil. (Capability unit VIe–2.)

**Miami and Hennepin silt loams, 18 to 25 percent slopes** (MhE1).—The profile of the Miami component of this undifferentiated unit is like the one described as representative of the Miami series. That for the Hennepin component is like the one described for the Hennepin series.

Both soils are usually in each mapped area of this unit. Miami silt loam, which is deeper than Hennepin silt loam, covers most of the area. The soils in this mapping unit are not suited to cultivation. (Capability unit VIe–1.)

**Miami and Hennepin silt loams, 18 to 25 percent slopes, moderately eroded** (MhE2).—These soils have been mapped as an undifferentiated unit. The texture of the surface layer in these soils is finer than that described in the representative series profiles. This is because some of the original surface soil has been lost through erosion and part of the subsoil has been mixed in the plow layer by tillage.

The Miami soil covers most of this mapping unit, but both soils are generally present. The soils in this unit are not suitable for cultivation. (Capability unit VIe–1.)

**Miami and Hennepin soils, 18 to 25 percent slopes, severely eroded** (MpE3).—In most areas of this undifferentiated unit, all or nearly all of the original surface soil has been lost through erosion. As a result, the lighter colored loam, clay loam, sandy loam, and silty clay loam of the subsoil and substratum are now exposed at the surface. (Capability unit VIIe–2.)

## Millsdale Series

The Millsdale series consists of dark-colored, very poorly drained soils on uplands. They have formed in 20 to 48 inches of medium-textured till of Wisconsin age that lies over limestone. These soils occur in small, shallow, level to nearly level areas at the heads of upland draws. Runoff water and seepage accumulate in these areas. The native vegetation consisted of oak, maple, hickory, and other deciduous trees.

The Millsdale soils are associated with the well-drained Milton soils. They resemble Brookston soils, which have an overlying mantle of till that is greater than 48 inches in thickness.

Representative profile (Millsdale silty clay loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, very dark grayish-brown, firm silty clay loam; moderate, medium and fine, granular structure; neutral.

Subsoil—
$B_1$ 8 to 20 inches, dark-gray, very firm silty clay loam; few, fine, distinct mottles of yellowish brown and pale brown; moderate, medium and fine, subangular blocky structure; neutral.
$B_2$ 20 to 34 inches, olive-gray, very firm clay loam; many, medium, distinct mottles of light olive brown and yellowish brown; moderate, medium, subangular blocky structure; neutral in upper part, changing gradually to calcareous in lower part.

Substratum—
C 34 to 38 inches, mottled gray, olive-gray and grayish-brown, very firm clay loam till; massive (structureless); calcareous.
D 38 inches +, gray bedrock consisting of thinly bedded limestone and clay shale; calcareous.

The mantle of till varies in texture and in composition. Texture ranges from moderately fine to moderately coarse. In some areas the mantle appears to consist of alluvial material or of roughly stratified, finer textured outwash material. Where the mantle is fairly thin, most of the subsoil is residuum that has weathered from thin-bedded limestone and calcareous clay shale.

The Millsdale soils have a high content of organic matter in the surface soil. Where the limestone bedrock is at greater depth, they have a deep root zone and a high moisture-supplying capacity. Drainage is a problem in the Millsdale soils, but tile drains work well if bedrock is deep enough not to interfere with installation. If properly managed, these soils are productive for crops commonly grown in the county.

**Millsdale silty clay loam** (MdA0).—A profile of this soil is described as representative of the Millsdale series. Slopes range from 0 to 2 percent. Little or no erosion has taken place. (Capability unit IIw–4.)

## Milton Series

The Milton series consists of light-colored, well-drained soils that have generally formed in 20 to 60 inches of medium-textured till of Wisconsin age that lies over limestone. The shallow phases, however, have formed in till that is only 10 to 20 inches thick over limestone. The Milton soils are on valley slopes that have gradients of 1 to 50 percent and are adjacent to large streams. The native vegetation consisted of sugar maple, oak, hickory, black walnut, and other deciduous trees.

The level or nearly level to gently sloping Milton soils are associated with the very poorly drained Millsdale soils.

Representative profile (Milton silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 7 inches, dark grayish-brown, friable silt loam; moderate, medium and fine, granular structure; slightly acid.

Subsoil—
$B_1$ 7 to 19 inches, brown to dark yellowish-brown, firm silty clay loam or clay loam; moderate, medium, subangular blocky structure; medium acid.
$B_2$ 19 to 33 inches, yellowish-brown to dark-brown, firm clay loam; moderate, medium, subangular blocky structure; medium acid in upper part, gradually changing to neutral in lower part.

Substratum—
C 33 to 37 inches, dark-brown and dark yellowish-brown, firm clay loam and silty clay loam till; weak, medium, subangular blocky structure; neutral to calcareous.
D 37 inches +, bedrock consisting of thinly bedded limestone and calcareous shale.

Where the overlying till was less than 20 inches thick, the lower subsoil has developed in residuum derived from limestone. The residuum in these places is usually dark-brown to dark reddish-brown clay or silty clay loam; it is sticky when wet. In some places a 1- to 2-inch layer of very pale brown, calcareous sandy material lies directly on the residuum. This gritty material remained in place during the weathering of the upper part of the limestone.

The surface soil and subsoil are thinner as slope gradients increase. In some places on the less steep slopes where limestone bedrock is relatively deep, the Milton soils are covered by 8 to 24 inches of loess. They are thus free of grit to these depths. Some of the Milton soils are moderately well drained and have mottled subsoil, which indicates restricted internal drainage.

Milton soils have medium to rapid runoff. Most of them are slightly and moderately eroded. The risk of erosion depends on the length and steepness of slopes and the cover of vegetation or of mulch. These soils have a moderately deep root zone, a medium moisture-holding capacity, and a surface soil that has a medium amount of organic matter. The root zone, moisture-holding capacity, and amount of organic matter are less favorable for agriculture in the shallow Milton soils.

The deeper soils on gentle slopes are cultivated, and when properly managed they are productive of crops commonly grown in the county. The shallow, steeper soils should be used only for pasture or forestry.

**Milton silt loam, 0 to 2 percent slopes** (MnA1).—A profile of this soil is described as representative of the Milton series. Slight erosion has occurred. (Capability unit I–1.)

**Milton silt loam, 2 to 6 percent slopes** (MnB1).—This soil has been slightly eroded. The surface soil is approximately 7 inches thick. (Capability unit IIe–1.)

**Milton silt loam, 2 to 6 percent slopes, moderately eroded** (MnB2).—This soil has only about 2 to 3 inches of the original surface soil. The present plow layer is a mixture of original surface soil and part of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIe–1.)

**Milton silt loam, 6 to 12 percent slopes, moderately eroded** (MnC2).—This soil has about 2 to 3 inches of the original surface soil left. The present plow layer is a mixture of the original surface soil and part of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIIe–1.)

**Milton silt loam, 12 to 18 percent slopes, moderately eroded** (MnD2).—This soil has about 2 to 3 inches of the original surface soil left in the plow layer. This material has been mixed with some of the brown to dark yellowish-brown upper subsoil in tillage. This mixture is finer textured than the original surface soil. (Capability unit IVe–1.)

**Milton silt loam, shallow, 2 to 6 percent slopes** (MtB1).—This soil has been slightly eroded. Its depth to limestone ranges from 10 to 20 inches. (Capability unit IVe–1.)

**Milton silt loam, shallow, 6 to 12 percent slopes, moderately eroded** (MtC2).—This soil is only 10 to 20 inches deep to limestone bedrock. Only about 2 to 3 inches of the original surface soil are left. The remaining surface soil has been mixed with some of the brown to dark yellowish-brown upper subsoil in tillage. This mixture is finer textured than the original surface soil. (Capability unit IVe–1.)

**Milton silt loam, shallow, 12 to 18 percent slopes, moderately eroded** (MtD2).—This soil is about 10 to 20 inches deep. All but 2 to 3 inches of the original surface soil has been lost through erosion. The present plow layer is a mixture of original surface soil and part of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IVe–1.)

**Milton silt loam, shallow, 18 to 25 percent slopes, moderately eroded** (MtE2).—This soil is about 10 to 20 inches deep. All but 2 or 3 inches of the original surface soil has been lost through erosion. The present plow layer is a mixture of original surface soil and part of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit VIe–1.)

**Milton silt loam, shallow, 25 to 50 percent slopes, moderately eroded** (MtF2).—This soil is 10 to 20 inches deep to limestone bedrock. All but 2 or 3 inches of the original surface soil has been lost through erosion. The present plow layer is a mixture of original surface soil and part of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit VIIe–1.)

**Milton soils, shallow, 12 to 18 percent slopes, severely eroded** (MsD3).—This soil is about 10 to 20 inches deep over bedrock. All but 1 inch or less of the original surface soil has been lost through erosion. The present plow layer is a mixture of original surface soil and part of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured (silty clay loam or clay loam) than the original surface soil. (Capability unit VIe–2.)

**Milton soils, shallow, 25 to 50 percent slopes, severely eroded** (MsF3).—This soil is about 10 to 20 inches deep over bedrock. Only about 1 inch or less of the original surface soil is left. The plow layer, as a result of tillage, now consists of the remaining surface soil and some of the brown to dark yellowish-brown upper subsoil. This mixture is finer textured (silty clay loam or clay loam) than the original surface soil. (Capability unit VIIe–2.)

## Ockley Series

The Ockley series consists of light-colored, well-drained soils that have developed from a mantle of medium-textured material, 42 to 60 inches thick. Under this mantle are well-sorted, stratified layers of calcareous sand and gravel outwash of Wisconsin age. The depth to carbonates corresponds to the depth to the sand and gravel.

These soils have slopes of 1 to 12 percent. They occur along the valleys of the larger streams, on outwash plains, and on the remnants of valley trains. A very few areas of the mixed substratum phase of Ockley silt loam are subject to flooding. The native vegetation was oak, hickory, maple, and other deciduous trees.

The Ockley soils are associated with the moderately well drained Thackery, the imperfectly drained Sleeth, and the very poorly drained Westland soils.

Representative profile (Ockley silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 8 inches, dark-brown, friable silt loam; weak, medium, granular structure; neutral.
- $A_3$ 8 to 12 inches, dark-brown, friable silt loam; moderate, fine to medium, subangular and angular blocky structure; neutral.

Subsoil—
- $B_1$ 12 to 26 inches, dark-brown, friable silty clay loam; strong, medium and coarse, subangular and angular blocky structure; medium acid.
- $B_2$ 26 to 36 inches, dark-brown, firm clay loam; strong, medium and coarse, subangular blocky structure; medium acid.
- $B_3$ 36 to 49 inches, dark-brown to strong-brown, firm sandy clay loam; moderate, medium and coarse, subangular blocky structure; medium acid in upper part, with gradual change to neutral or calcareous in lower part; roughly stratified layers of sand and gravel throughout the sandy clay loam matrix.

Substratum—
- D 49 inches +, pale-brown and light brownish-gray, stratified sand and gravel; each layer usually well sorted; single grain (structureless); calcareous.

The upper 12 to 36 inches of these soils, which includes the surface soil and upper subsoil, are usually free of grit. The upper layers have developed in a thick mantle of either loess or a grit-free alluvial silt. The lower subsoil contains layers of roughly stratified sand and gravel that are part of the matrix. The amount of sand and gravel increases with depth.

In the mixed substratum phase of Ockley silt loam, the underlying layers of sand and gravel are roughly stratified and poorly assorted. Each poorly assorted sand and gravel layer contains a considerable amount of loamy and clayey material.

Runoff from the Ockley soils is slow to medium. The risk of erosion is slight to moderate. It depends on the length and steepness of slopes, the cover of vegetation or of mulch, and the infiltration and percolation rates. The Ockley soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, these soils are productive of the crops commonly grown in the county.

**Ockley silt loam, 0 to 2 percent slopes** (OcA1).—A profile of this soil is described as representative of the Ockley series. Slight erosion has occurred. (Capability unit I–1.)

**Ockley silt loam, 2 to 6 percent slopes** (OcB1).—This soil has been slightly eroded. Approximately 8 inches of the original surface soil remain. (Capability unit IIe–1.)

**Ockley silt loam, 2 to 6 percent slopes, moderately eroded** (OcB2).—Because of erosion, this soil has only 2 to 4 inches of the original surface soil left. The present plow layer is a mixture of the original surface soil and part of the dark-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IIe–1.)

**Ockley silt loam, 6 to 12 percent slopes, moderately eroded** (OcC2).—As a result of erosion, only 2 to 4 inches of the original surface soil are left. The plow layer is a mixture of the original surface soil and part of the dark-brown subsurface layer. This mixture is finer textured than the original surface soil. (Capability unit IIIe–1.)

**Ockley silt loam, mixed substratum, 0 to 2 percent slopes** (OmA1).—This soil has been slightly eroded. It is characterized by poorly assorted underlying material. (Capability unit I–1.)

**Ockley silt loam, mixed substratum, 2 to 6 percent slopes** (OmB1).—This soil has been slightly eroded. It is underlain by poorly assorted material. (Capability unit IIe–1.)

**Ockley silt loam, mixed substratum, 2 to 6 percent slopes, moderately eroded** (OmB2).—This soil has only 2 to 4 inches of the original surface soil left as the result of erosion. The present plow layer is a mixture of the original surface soil and part of the subsoil. This mixture is finer textured than the original surface soil. The substratum consists of poorly assorted material. (Capability unit IIe–1.)

**Ockley silt loam, mixed substratum, 6 to 12 percent slopes, moderately eroded** (OmC2).—The present plow layer is a mixture of the original surface soil and the subsoil. This mixture is finer textured than the original surface soil. The substratum consists of poorly assorted material. (Capability unit IIIe–1.)

## Ragsdale Series

The Ragsdale series consists of dark-colored, very poorly drained soils of the uplands. They have developed in neutral to calcareous loess. The depth to carbonates is usually between 30 to 48 inches. The soils are on nearly level and slightly depressed areas that are ponded in wet weather. They are mostly in the north-central part of the county.

The natural vegetation consisted of swamp forest. It included white ash, American elm, red maple, other swamp forest trees, and many herbaceous plants and marsh grasses.

The Ragsdale soils are associated with the imperfectly drained Reesville and the moderately well drained Birkbeck soils. They are similar to the very poorly drained Brookston soils but have a siltier subsoil and substratum.

Representative profile (Ragsdale silty clay loam in a cultivated field):

Surface soil—

$A_p$ 0 to 8 inches, black to very dark grayish-brown, friable silty clay loam; moderate, medium, granular structure; slightly acid.

Subsoil—

$B_{21g}$ 8 to 15 inches, very dark gray, firm silty clay loam mottled with dark grayish brown; moderate, fine, subangular blocky structure; slightly acid.

$B_{22g}$ 15 to 19 inches, very dark gray, firm silty clay loam; many, fine, faint mottles of dark grayish brown; moderate, medium, subangular blocky structure; neutral.

$B_{23g}$ 19 to 36 inches, grayish-brown, firm silty clay loam; many, medium, prominent mottles of yellowish brown; moderate, subangular blocky structure; neutral.

Substratum—

C 36 inches +, brownish-yellow, firm silt loam; many, medium, prominent mottles of grayish brown; massive in place; calcareous.

In some places, carbonates are at a depth ranging from 24 to 70 inches. Most of the Ragsdale soils have slopes of 0 to 2 percent, but a few have slopes as much as 4 percent.

Runoff from the Ragsdale soils is slow. Tile drains work well. The soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. If properly managed, the soils are productive for crops commonly grown in the county.

**Ragsdale silty clay loam** (RgA0).—A profile for this soil is described as representative of the Ragsdale series. The soil has slopes of 0 to 2 percent. Little or no erosion has occurred. The plow layer forms clods if cultivated when too wet. (Capability unit IIw–4.)

**Ragsdale silt loam** (RaA0).—This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. Silty material washed from surrounding areas has been mixed with the original surface soil. As a result the present surface soil is silt loam. (Capability unit IIw–4.)

## Raub Series

The Raub series consists of dark-colored, imperfectly drained soils on level to nearly level uplands. These soils have developed in 18 to 40 inches of loess over calcareous loamy till of Wisconsin age. Carbonates are at depths of 30 to 48 inches. The native vegetation was prairie grasses.

The Raub soils are associated with the Fincastle soils but differ in having a dark-colored surface soil.

Representative profile (Raub silt loam in a cultivated field):

Surface layers—

$A_p$ 0 to 8 inches, very dark brown, friable silt loam; moderate, medium, granular to crumb structure; slightly acid.

$A_1$ 8 to 13 inches, very dark grayish-brown, friable silt loam; few, fine, faint mottles of brown; moderate, medium, granular to crumb structure; medium acid.

Subsoil—

$B_{21}$ 13 to 22 inches, yellowish-brown, firm silty clay loam; common, medium and fine, distinct mottles of brown and grayish brown; moderate, medium, subangular blocky structure; medium acid.

$B_{22}$ 22 to 38 inches, grayish-brown, firm silty clay loam; many, medium, distinct mottles of yellowish brown and brown; moderate, medium, subangular blocky structure; slightly acid to neutral in upper part, gradually changing to calcareous in lower part.

Substratum—

C 38 inches +, mottled light brownish-gray, yellowish-brown, and dark yellowish-brown, friable loam till; massive (structureless); calcareous.

The underlying till consists of loam and silt loam. It is seldom leached when the overlying loess is about 36 inches thick. If the loess is less than 36 inches thick, however, it may be leached to a depth as much as 48 inches.

Runoff from the Raub series is slow to medium. Drainage is a problem, but tile drains work well. The Raub soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is high in organic matter. If properly managed, they are productive for crops commonly grown in the county.

**Raub silt loam** (RbA1).—A profile for this soil is described as representative of the Raub soils. This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. Small areas of Brookston soils that were too small to map separately are included. (Capability unit IIw–2.)

## Reesville Series

The Reesville series consists of light-colored, imperfectly drained soils of the uplands. These soils have formed from 40 to 78 inches of loess. This material is underlain by loamy calcareous till. Carbonates are at a depth ranging from 24 to 72 inches but are generally at a depth of 30 to 48 inches. Reesville soils are on nearly level to gently sloping areas in the north-central part of the county. The natural vegetation consisted of beech, hickory, maple, and other hardwood trees.

The Reesville soils are associated with the very poorly drained Ragsdale and Brookston soils and with the moderately well drained Birkbeck soils. In places the Reesville soils are adjacent to the imperfectly drained Fincastle and Crosby soils. The Fincastle soils have developed in 18 to 40 inches of loess over glacial till; the Crosby soils have developed in loamy till covered by a loess mantle less than 18 inches in thickness.

Representative profile (Reesville silt loam in a cultivated field):

Surface layers—

$A_p$ 0 to 9 inches, dark grayish-brown, friable silt loam; very weak, fine to medium, granular structure; slightly acid.

$A_2$ 9 to 13 inches, pale-brown, friable silt loam; common, fine, distinct mottles of yellowish brown; weak, medium, platy structure; strongly acid to medium acid.

Subsoil—

$B_1$ 13 to 17 inches, yellowish-brown, friable silt loam; many, medium, distinct mottles of pale brown; moderate, fine and medium, subangular blocky structure; medium to strongly acid.

$B_2$ 17 to 38 inches, brownish-yellow and yellowish-brown, friable to firm silty clay loam; many, medium, distinct mottles of pale brown, grayish brown, and light yellowish brown; moderate, medium, subangular blocky structure; medium to strongly acid in upper part changing to slightly acid or neutral in lower part.

Substratum—

C 38 to 50 inches, pale-brown, friable silt loam; many, medium, distinct mottles of brownish yellow and strong brown; massive (structureless); calcareous.

Runoff from the Reesville soils is slow to medium. Drainage is a problem, but tile drains work well. The Reesville soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. If well managed, these soils are productive of the crops generally grown in the county.

**Reesville silt loam, 0 to 2 percent slopes** (ReA1).—A profile of this soil is described as representative of the Reesville series. Slight erosion has occurred. Small areas of the Fincastle, Xenia, and Crosby soils are included because it was impractical to map them separately. (Capability unit IIw–2.)

**Reesville silt loam, 2 to 6 percent slopes** (ReB1).—This soil has been slightly eroded. Small areas of the Fincastle, Xenia, and Crosby soils are included because it was impractical to map them separately. (Capability unit IIe–3.)

## Rodman Series

The Rodman series consists of light-colored, excessively drained soils formed from calcareous sandy and gravelly material. These soils occupy mainly the irregular slopes of dissected outwash terraces, outwash plains, and remnants of valley trains of Wisconsin age. The native vegetation was oak and hickory.

In Clinton County, the Rodman soils are so closely intermingled with the Casco and with the Fox soils that they could not be mapped separately. Consequently, they are mapped with these soils as undifferentiated units, which are described under the Casco and under the Fox series elsewhere in this section of the report.

Representative profile (Rodman gravelly loam in a pasture):

Surface soil—

A 0 to 4 inches, very dark brown to dark grayish-brown, friable, gravelly loam; weak, medium and fine, granular structure; neutral to mildly alkaline.

Substratum—

$C_1$ 4 to 12 inches, brown to dark-brown, loose gravelly loam; single grain (structureless); neutral.

$C_2$ 12 inches +, light brownish-gray, loose sand and gravel; single grain (structureless); calcareous.

The typical surface soil is a coarse, gravelly loam that is very low in organic matter. The Rodman soils have a very shallow root zone and are droughty in summer.

## Ross Series

The Ross series consists of dark-colored, well-drained soils on bottom lands. These soils have formed from medium-textured, neutral or calcareous alluvium that has washed from calcareous till soils of the uplands. They occupy the higher parts of flood plains and are less subject to flooding than other bottom-land soils. The native vegetation consisted of sycamore, elm, ash, and other deciduous trees.

The Ross soils are associated with the moderately well drained Medway soils. They are similar to the Genesee soils but have darker colored, upper soil layers. In addition, the Ross soils, at comparable depths, have more strongly developed structure.

Representative profile (Ross silt loam in a cultivated field):

Surface soil—
$A_p$ 0 to 8 inches, very dark brown, friable silt loam; moderate, fine and medium, granular structure; neutral to mildly alkaline.

Substratum—
$C_1$ 8 to 26 inches, very dark grayish-brown to dark-brown, friable silt loam; moderate to weak, medium, subangular blocky structure; neutral to mildly alkaline.
$C_2$ 26 to 42 inches, dark-brown, friable loam; moderate to weak, medium to coarse, subangular blocky structure, gradually changing to massive in lower part; mildly alkaline to calcareous.
$C_3$ 42 inches +, dark yellowish-brown, friable loam and loose sandy loam; single grain (structureless); calcareous.

In some places, the alluvium is moderately fine textured to moderately coarse textured. The lower layers of the Ross soils have fairly thin, roughly stratified, sandy layers. The number of these layers generally increases with depth. In places layers of well-sorted sand are at various depths. Some areas of Ross soils are underlain by limestone at depths of more than 36 to 48 inches.

The Ross soils are flooded part of the time, and drainage is a slight problem. They have a deep root zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. Properly managed, Ross soils are productive of the crops generally grown on the bottom lands of the county.

**Ross loam** (RoA0).—This soil was formed from coarser textured (loam) alluvium than the soil described as typical of the series. It has slopes of 0 to 2 percent and has little or no erosion. (Capability unit I–2; if subject to flooding, Vw–1.)

**Ross silt loam** (RsA0).—A profile for this soil is described as representative of the Ross series. The soil has slopes of 0 to 2 percent. Little or no erosion has occurred. (Capability unit I–2; if subject to flooding, Vw–1.)

## Rossmoyne Series

The Rossmoyne series consists of light-colored, moderately well drained soils on uplands. These soils have formed from 16 to 30 inches of loess over weathered clay to clay loam till of Illinoian age. Carbonates are at depths ranging from 80 to 120 inches. Most of the Rossmoyne soils have slopes ranging from 0 to 18 percent. Generally they are in the southern and southwestern parts of the county. The native vegetation consisted of beech, white and red oaks, maple, hickory, tulip-poplar, and other deciduous trees.

The Rossmoyne soils are associated with the well-drained Cincinnati, the imperfectly drained Avonburg, the poorly drained Clermont, and the poorly drained, moderately dark Blanchester soils.

Representative profile (Rossmoyne silt loam in a cultivated field):

Surface layers—
$A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; weak, fine, granular structure; slightly acid.
$A_2$ 8 to 11 inches, yellowish-brown, friable silt loam; few, fine, faint mottles of yellowish brown; weak, medium, subangular blocky structure; very strongly acid.

Subsoil—
$B_1$ 11 to 16 inches, yellowish-brown, friable silty clay loam; few, fine to medium, faint mottles of light grayish brown; weak, medium, subangular blocky structure; very strongly acid.
$B_2$ 16 to 42 inches, strong-brown and yellowish-brown, firm silty clay loam; many, medium, faint to distinct mottles of light gray and pale yellow; moderate to strong, medium to coarse, subangular blocky structure; ped surfaces coated light gray to gray; very strongly acid in the upper part, gradually becoming slightly acid in lower part.
$B_3$ 42 to 85 inches, mottled yellowish-brown, gray, and grayish-brown, firm clay; massive (structureless); neutral.

Substratum—
C 85 inches +, mottled yellowish-brown, light olive-brown, and grayish-brown, very firm clay till; massive (structureless); calcareous.

The Rossmoyne soils are underlain by limestone and calcareous shale, which generally are at depths of more than 7 feet. In a few places, the underlying till has the texture of loam.

Runoff from the Rossmoyne soils is slow to rapid. The risk of erosion depends on the length and steepness of slopes and the cover of vegetation or of mulch. Most of these soils are slightly or moderately eroded. The Rossmoyne soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. In the severely eroded areas, these properties are less favorable for agriculture. If properly managed, these soils are productive of crops commonly grown in the county.

**Rossmoyne silt loam, 0 to 2 percent slopes** (RmA1).—This soil has been slightly eroded. Approximately 8 inches of the original surface soil remain. (Capability unit I–1.)

**Rossmoyne silt loam, 2 to 6 percent slopes** (RmB1).—A profile for this soil is described as representative of the Rossmoyne series. This soil has been slightly eroded. (Capability unit IIe–2.)

**Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded** (RmB2).—About 2 to 4 inches of original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IIe–2.)

**Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded** (RmC2).—About 2 to 4 inches of original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IIIe–2.)

**Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded** (RmD2).—About 2 to 4 inches of original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IVe–2.)

**Rossmoyne soils, 6 to 12 percent slopes, severely eroded** (RnC3).—Approximately 2 inches or less of the original surface soil remain. The present plow layer is a mixture of the original surface soil and the yellowish-brown subsurface and upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IVe-3.)

## Russell Series

The Russell series consists of light-colored, well-drained soils on uplands. These soils have formed from 18 to 40 inches of loess over medium-textured, calcareous till of Wisconsin age. Carbonates usually are at depths of 30 to 42 inches. The soils range from gently sloping to steep. The native vegetation consisted of oak, hard maple, hickory, and other deciduous trees.

The Russell soils are associated with the moderately well drained Xenia, the imperfectly drained Fincastle, the poorly drained Delmar, and the very poorly drained Brookston soils.

They are similar to the Birkbeck and Reesville soils, which have developed in loess more than 40 inches thick. They also resemble the Miami and Celina soils, which have formed in calcareous, loamy till and a loess mantle up to 18 inches thick.

Representative profile (Russell silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; moderate, medium, granular structure; slightly to medium acid.

Subsoil—
- $B_1$ 8 to 15 inches, brown, friable silt loam; moderate, medium, subangular blocky structure; medium to strongly acid.
- $B_{21}$ 15 to 27 inches, dark yellowish-brown, firm silty clay loam; moderate, medium, subangular blocky structure; medium to strongly acid.
- $B_{22}$ 27 to 34 inches, dark yellowish-brown, firm clay loam; moderate, medium, subangular blocky structure; slightly acid to medium acid.
- $B_3$ 34 to 42 inches, dark-brown, friable loam; weak, coarse, subangular blocky structure that has overall massive characteristics; slightly acid to medium acid in upper part, gradually changing to calcareous in lower part.

Substratum—
- C 42 inches +, mottled yellowish-brown and dark-brown, firm loam till; massive (structureless); calcareous.

The Russell soils are mainly on slopes of 6 to 12 percent. The surface soil and subsoil become progressively thinner as slopes become steeper. Depth to carbonates ranges from 24 to 84 inches. The greater depth of leaching usually occurs in isolated spots near the terminal Wisconsin-age moraine. The loess mantle may also be thicker in areas in which the depth to carbonates approaches the maximum.

Runoff from the Russell soils is medium to rapid. The risk of erosion depends on the steepness and length of slopes. Most of the soils are slightly or moderately eroded. Russell soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. These characteristics, in the severely eroded areas, are less favorable for agriculture. If management is good, the Russell soils are productive of crops commonly grown in the county.

**Russell silt loam, 2 to 6 percent slopes** (RuB1).—A profile of this soil is described as representative of the Russell series. Slight erosion has occurred. (Capability unit IIe-2.)

**Russell silt loam, 2 to 6 percent slopes, moderately eroded** (RuB2).—Approximately 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIe-2.)

**Russell silt loam, 6 to 12 percent slopes** (RuC1).—This soil has been slightly eroded. Approximately 8 inches of the original surface layer remain. (Capability unit IIIe-2.)

**Russell silt loam, 6 to 12 percent slopes, moderately eroded** (RuC2).—Approximately 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIIe-2.)

**Russell silt loam, 12 to 18 percent slopes** (RuD1).—This soil has been slightly eroded. Approximately 8 inches of the original surface layer remain. (Capability unit IVe-2.)

**Russell silt loam, 12 to 18 percent slopes, moderately eroded** (RuD2).—About 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IVe-2.)

**Russell silt loam, 18 to 25 percent slopes** (RuE1).—This soil has been slightly eroded. Approximately 8 inches of the original surface layer remain. (Capability unit VIe-1.)

**Russell silt loam, 18 to 25 percent slopes, moderately eroded** (RuE2).—Approximately 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and most of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit VIe-1.)

**Russell soils, 2 to 6 percent slopes, severely eroded** (RvB3).—Approximately 2 inches or less of the original surface layer remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIIe-2.)

**Russell soils, 6 to 12 percent slopes, severely eroded** (RvC3).—Approximately 2 inches or less of the original surface layer remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IVe-3.)

**Russell soils, 12 to 18 percent slopes, severely eroded** (RvD3).—Approximately 2 inches or less of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit VIe-2.)

**Russell soils, 18 to 25 percent slopes, severely eroded** (RvE3).—Approximately 2 inches or less of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit VIIe-2.)

**Russell and Hennepin silt loams, 25 to 50 percent slopes** (RhF1).—The soils in this mapping unit have been slightly eroded. Usually both soils are in each delineation, but the Russell occupies most of the acreage. The Russell component in this unit is deeper than the Hennepin, but it is not so deep as is shown in the profile described as representative of the Russell series. Neither soil in this mapping unit is suitable for cultivation. (Capability unit VIIe–1.)

**Russell and Hennepin silt loams, 25 to 50 percent slopes, moderately eroded** (RhF2).—Generally both soils in this unit are in each delineation, but the Russell occupies most of the acreage. The Russell component is deeper than the Hennepin, but it is not so deep as shown in the profile described as representative of the Russell series. Neither soil in this unit is suitable for cultivation. (Capability unit VIIe–1.)

**Russell and Hennepin soils, 25 to 50 percent slopes, severely eroded** (RxF3).—Through erosion, all or nearly all of the original surface layer has been lost from most of this mapping unit. Generally both soils are in each delineation, but the Russell occupies most of the acreage. The Russell component is deeper than the Hennepin, but it is not so deep as shown in the profile described as representative of the Russell series. Neither soil is suitable for cultivation. (Capability unit VIIe–2.)

## Sardinia Series

The Sardinia series consists of light-colored, moderately well drained soils. These soils have formed in from 30 to 42 inches of medium-textured material over roughly stratified sandy clay loam and gravelly clay loam outwash of Wisconsin glacial age. Carbonates are generally at depths of 60 to 90 inches.

These nearly level to gently sloping soils are along Todd Fork and the East Fork of the Little Miami River, which flow through the Illinoian glacial area of the county. They occupy positions near the flood plains, but only a few areas are subject to flooding. Slopes range from 0 to 6 percent. The native vegetation consists of hard maple, white oak, walnut, tulip-poplar, and other deciduous trees.

The Sardinia soils are associated with the well-drained Williamsburg soils. They are similar to the Thackery soils but are more acid in the subsoil and have a substratum that is comprised of roughly stratified sandy clay loam and gravelly clay loam. The substratum of the Thackery soils is stratified sand and gravel.

Representative profile (Sardinia silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 7 inches, dark-brown, friable silt loam; weak, fine and medium, granular structure; medium acid.
- $A_2$ 7 to 13 inches, brown to yellowish-brown, friable silt loam; weak, fine, subangular blocky structure; medium acid.

Subsoil—
- $B_{21}$ 13 to 24 inches, yellowish-brown, friable silty clay loam; few, fine, faint to distinct mottles of brown and light yellowish brown; moderate, medium and fine, subangular blocky structure; strongly acid.
- $B_{22}$ 24 to 36 inches, dark yellowish-brown, firm silty clay loam; many, medium to fine, distinct to faint mottles of yellowish brown and brown; moderate, medium and coarse, subangular blocky structure; strongly acid.
- $B_3$ 36 to 50 inches, brown to dark yellowish-brown, friable to slightly firm silty clay loam or clay loam; weak, medium, subangular blocky structure; medium acid.

Substratum—
- C 50 to 72 inches, mottled dark-brown and yellowish-brown, friable to loose gravelly sandy clay loam and gravelly clay loam; single grain (structureless); medium acid in upper part, gradually changing to neutral or calcareous in lower part; 50 to 60 percent of the total volume is roughly stratified sand and gravel.
- D 72 inches +, dark-brown, loose gravelly sandy loam and gravelly clay loam; single grain (structureless); calcareous; 50 to 60 percent of the volume is roughly stratified sand and gravel.

The upper 12 to 36 inches, which include the surface soil and upper subsoil, are usually free of grit. The lack of grit indicates that these layers have developed in loess or in grit-free, alluvial silt. In places, the lower subsoil contains roughly stratified sand and gravel, the quantity of which increases with depth.

A few areas of Sardinia soils along the Little East Fork have fairly continuous layers of lacustrine silt and clay in the substratum. These layers are from 2 to 12 inches thick. They indicate that the substratum material was deposited as sediment in temporary lakes.

Runoff from the Sardinia soils is medium to slow. The risk of erosion is slight to moderate and depends on the steepness and length of slopes and on the cover of vegetation or of mulch. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in content of organic matter. If properly managed, the soils are productive of crops commonly grown in the county.

**Sardinia silt loam, 0 to 2 percent slopes** (SaA1).—This soil has been slightly eroded. It has a profile similar to that described for the Sardinia series. (Capability unit I–1.)

**Sardinia silt loam, 2 to 6 percent slopes** (SaB1).—This soil has been slightly eroded. A profile of this soil is described as representative of the Sardinia series. (Capability unit IIe–2.)

**Sardinia silt loam, 2 to 6 percent slopes, moderately eroded** (SaB2).—Approximately 2 to 3 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the brown to yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IIe–2.)

## Shoals Series

The Shoals series consists of light-colored, imperfectly drained soils on bottom lands. These soils have formed in medium-textured, calcareous alluvium, 36 to 48 inches deep. This alluvium washed from calcareous till. Shoals soils are in nearly level and depressed areas that are subject to ponding and flooding.

The natural vegetation consisted of sycamore, poplar, maple, elm, and other hardwood trees.

The Shoals soils are associated with the very poorly drained Sloan, the moderately well drained Eel, and the well drained Genesee soils.

Representative profile (Shoals silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, light brownish-gray to light-gray, friable silt loam; moderate, medium, granular structure; neutral.

Substratum—
- $C_1$ 8 to 42 inches, light brownish-gray and gray, friable silt loam; many, medium, faint and distinct mottles of pale brown and light yellowish brown; massive (structureless); neutral.
- $C_2$ 42 inches +, mottled light brownish-gray to yellowish-brown, friable silt loam; massive (structureless); neutral.

In places the alluvium, or parent material, is moderately fine or moderately coarse. Intermittent layers of well-sorted sand may occur at variable depths in the profile. Intermingled with these sandy layers is roughly stratified, moderately fine and fine textured soil material. In a few places the alluvium is underlain by limestone at depths of more than 36 inches. In a few small areas along tributaries of West Fork in Jefferson Township, a slightly to medium acid layer is under the plow layer. This layer has weak structure.

Runoff from the Shoals soils is slow. Drainage is a problem, and tile drains are only partly effective. These soils have a moderately deep root zone, a medium moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, the Shoals soils are productive of crops commonly grown on bottom lands in Clinton County.

**Shoals silt loam** (ShA0).—This soil has slopes of 0 to 2 percent. A profile of this soil is described as representative of the Shoals series. (Capability unit IIw–1; if subject to flooding, Vw–1.)

## Sleeth Series

The Sleeth series consists of light-colored, imperfectly drained soils that have developed in 12 to 36 inches of medium to moderately fine textured material. This material overlies stratified, sandy and gravelly material derived from outwash of Wisconsin glacial age. Depth to carbonates is more than 42 inches. The Sleeth soils are on nearly level areas adjacent to the major stream valleys, on outwash plains, and on remnants of valley trains. These positions are slightly higher than the flood plains. The natural vegetation consisted of maple, beech, elm, hickory, and oak.

The Sleeth soils are associated with the very poorly drained Westland, the moderately well drained Thackery, and the well drained Ockley soils. Adjacent soils developed from recent alluvium in slightly lower topographic positions than the Sleeth soils are those of the Genesee, Sloan, and Eel series.

Representative profile (Sleeth silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 8 inches, grayish-brown, friable silt loam; weak, fine and medium, granular structure; slightly acid.
- $A_2$ 8 to 13 inches, light brownish-gray, friable silt loam; weak, thin, platy and weak, medium and fine, subangular blocky structure; medium acid.

Subsoil—
- $B_1$ 13 to 26 inches, pale-brown, firm silty clay loam; medium, distinct mottles of brown and yellowish brown; moderate, medium to coarse, subangular blocky structure; medium to strongly acid.
- $B_2$ 26 to 45 inches, mottled grayish-brown, brown, and yellowish-brown, firm clay loam; weak, medium, subangular blocky structure; medium acid in upper part, gradually changing to neutral in lower part; quantity of sand and gravel increases in lower part of layer.

Substratum—
- D 45 inches +, gray and brown, well-stratified, well-sorted layers of loose sand and gravel; single grain (structureless); calcareous.

The upper 12 to 36 inches, which comprise the surface soil and upper subsoil, are generally free of grit. The lack of grit indicates that these layers have developed in loess or in grit-free, alluvial silt. Below this mantle, the subsoil and substratum usually contain roughly stratified sand and gravel, the quantity of which increases with depth.

In the mixed substratum phases of Sleeth soils, the underlying formation is different, in that the layers of sand and gravel are roughly stratified and poorly assorted. Each poorly sorted layer of sand and gravel is mixed considerably with loamy and clayey material.

Runoff is medium to slow from the nearly level areas and medium from the gently sloping areas. Drainage is a problem, but tile drains are effective. These soils have a moderately deep root zone, a medium moisture-holding capacity, and a surface soil that is medium in organic matter. If properly managed, the Sleeth soils are productive of crops commonly grown in the county.

**Sleeth silt loam** (StA1).—This soil is on slopes of 0 to 2 percent. A profile of it is described as representative of the Sleeth series. A slight amount of erosion has occurred. (Capability unit IIw–2.)

**Sleeth silt loam, mixed substratum, 0 to 2 percent slopes** (SmA1).—This soil has been slightly eroded. It is characterized by the poorly assorted material in the underlying formation. (Capability unit IIw–2.)

**Sleeth silt loam, mixed substratum, 2 to 6 percent slopes** (SmB1).—This soil has been slightly eroded. It is characterized by the poorly assorted material in the underlying formation. (Capability unit IIe–3.)

## Sloan Series

The Sloan series consists of dark-colored, very poorly drained soils. These soils are on nearly level to depressed bottom lands that are subject to ponding and flooding. They have formed from 36 to 48 inches of medium to moderately fine textured and usually neutral to calcareous alluvium that washed from till-derived soils in the uplands. The natural vegetation consists of maple, elm, and other deciduous trees.

The Sloan soils are associated with the very poorly drained Algiers, the imperfectly drained Shoals, the moderately well drained Eel, and the well drained Genesee soils.

Sloan soils, which consist of alluvium, are mixed with areas of Westland, Bonpas, and Brookston soils. They also adjoin areas of Algiers soils, which consist of more than 14 inches of light-colored overwash on dark alluvial soil. Where the overwash is less than 14 inches thick, the soil is an overwashed phase of the Sloan series.

Representative profile (Sloan silty clay loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark grayish-brown, friable silty clay loam; moderate, medium to fine, granular structure; neutral.

Substratum—
- $C_1$ 8 to 30 inches, dark grayish-brown, friable silty clay loam; many, medium, distinct mottles of gray and pale brown; massive (structureless) in place, breaking easily to weak, medium, subangular blocky peds; neutral to mildly alkaline.
- $C_2$ 30 to 42 inches, firm to friable silt loam and silty clay loam that is mottled grayish brown, pale brown, and gray; massive (structureless) in place; neutral to mildly alkaline.
- $C_3$ 42 inches +, mottled gray and brownish-yellow, irregularly stratified, very friable sandy, loamy, and clayey soil layers; massive (structureless) in place; neutral to calcareous.

In many places the alluvium is underlain by irregular layers of sand and gravel at depths ranging from 40 to 60 inches. Below this depth, the material ranges from moderately fine textured to sandy; it is more sandy as the depth increases.

A weak grade of structure has developed in the upper substratum of some areas of Sloan soils. Normally, no structure is evident, and the layers of sediment are clearly visible. In other places a thin layer of fresh, medium to moderately fine textured alluvium is deposited on the surface by each flood. During tillage this material is mixed with the older alluvium.

Runoff from the Sloan soils is slow. Tile drains are effective in removing excess water. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. If properly managed, the Sloan soils are productive of crops commonly grown on bottom lands in the county.

**Sloan silty clay loam** (SyA0).—A profile for this soil is described as representative of the Sloan series. Slopes range from 0 to 2 percent. Little or no erosion has occurred. The plow layer becomes cloddy if cultivated when too wet. (Capability unit IIw–1; if subject to flooding, Vw–1.)

**Sloan silt loam** (SnA0).—This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. The upper 8 inches of the surface soil has a silt loam texture. The underlying soil is similar to that described for Sloan silty clay loam. (Capability unit IIw–1; if subject to flooding, Vw–1.)

**Sloan silt loam, overwashed** (SnA+).—This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. Floods have deposited 8 to 14 inches of brown and grayish-brown silty material on the surface. This material is lighter colored than the underlying soil. (Capability unit IIw–1; if subject to flooding, Vw–1.)

## Thackery Series

The Thackery series consists of light-colored, moderately well drained soils. These soils have formed from 42 to 60 inches of medium-textured material over well-sorted, stratified layers of calcareous sand and gravel outwash of Wisconsin glacial age. The depth to carbonates is generally the same as the depth to underlying sand and gravel. Thackery soils have slopes ranging from 1 to 6 percent. They occur along the valleys of the larger streams, on outwash plains, and on the remnants of valley trains. Only very few areas of these soils are subject to flooding.

The native vegetation consisted of maple, beech, oak, hickory, and other deciduous trees. The Thackery soils are associated with the well drained Ockley, the imperfectly drained Sleeth, and the very poorly drained Westland soils.

Representative profile (Thackery silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; weak, medium and fine, granular structure; neutral to slightly acid.
- $A_2$ 8 to 12 inches, dark-brown, friable silt loam; weak, thin, platy and weak, fine, subangular blocky structure; medium acid.

Subsoil—
- $B_{21}$ 12 to 20 inches, dark-brown, firm silty clay loam; fine, faint mottles of pale brown in lower part; moderate, medium and coarse, subangular blocky structure; medium acid.
- $B_{22}$ 20 to 36 inches, dark yellowish-brown, firm silty clay loam; common, fine, faint mottles of brown and yellowish brown; strong, medium, subangular blocky structure; slightly acid.
- $B_3$ 36 to 45 inches, mottled dark grayish-brown, gray, light-gray, and brownish-yellow, very firm clay loam and sandy clay loam; weak, coarse and medium, subangular blocky structure; slightly acid in upper part, gradually changing to neutral or calcareous in lower part; roughly stratified sand and gravel distributed throughout the clay loam and sandy clay loam matrix.

Substratum—
- D 45 inches +, pale-brown and light brownish-gray, stratified sand and gravel; each layer well sorted; single grain (structureless); calcareous.

Usually the upper 12 to 36 inches, comprising the surface soil and upper subsoil, are free of grit—an indication that these layers have developed in loess or in grit-free alluvial silt. The lower subsoil layer contains various amounts of roughly stratified sand and gravel. The percentage of sand and gravel increases with depth.

In the mixed substratum phases of Thackery soils, the underlying sand and gravel are roughly stratified and poorly assorted, and each layer of sand and gravel contains a considerable amount of loamy and clayey material.

Runoff from the Thackery soils is slow to medium. The risk of erosion is related to steepness and length of slope and the cover of vegetation or of mulch. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed the Thackery soils are productive of crops commonly grown in the county.

**Thackery silt loam, 0 to 2 percent slopes** (ThA1).—A profile of this soil is described as representative of the Thackery series. Slight erosion has occurred. (Capability unit I–1.)

**Thackery silt loam, 2 to 6 percent slopes** (ThB1).—This soil has been slightly eroded. It has a profile similar to that described for the series. (Capability unit IIe–2.)

**Thackery silt loam, mixed substratum, 0 to 2 percent slopes** (TmA1).—This soil has been slightly eroded. The underlying material is roughly stratified and poorly assorted. (Capability unit I–1.)

**Thackery silt loam, mixed substratum, 2 to 6 percent slopes** (TmB1).—This soil has been slightly eroded. The underlying material is roughly stratified and poorly assorted. (Capability unit IIe–2.)

## Uniontown Series

The Uniontown series consists of light-colored, well drained and moderately well drained soils. These soils have formed from medium and moderately fine textured water-laid sediment of Wisconsin age. Carbonates usually are at depths of 30 to 36 inches. These soils have nearly level to gentle slopes. In the southwestern and southern parts of the county, they are beyond the margin of the Wisconsin age glacial (Cuba) moraine. The native vegetation consisted of oak, beech, maple, gum, elm, and other deciduous trees.

The Uniontown soils are associated with the imperfectly drained Henshaw and the very poorly drained Bonpas soils.

Representative profile (Uniontown silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark yellowish-brown, friable silt loam; moderate, medium and fine, granular structure; neutral.

Subsoil—
- $B_1$ 8 to 14 inches, yellowish-brown, friable silt loam; weak, fine and medium, subangular blocky structure; slightly acid.
- $B_{21}$ 14 to 20 inches, yellowish-brown, firm silty clay loam; few, fine, faint mottles of light yellowish brown and pale brown; moderate, medium, subangular blocky structure; slightly acid.
- $B_{22}$ 20 to 36 inches, yellowish-brown and brownish-yellow, very firm silty clay loam; common, fine and medium, faint mottles of light yellowish brown and light brownish gray; weak to moderate, medium, subangular blocky structure; slightly acid to neutral in the upper part, changing to calcareous in the lower part.

Substratum—
- C 36 inches +, yellowish-brown, friable silty clay loam; common, medium, faint mottles of light brownish gray and yellowish brown; weak, fine and medium angular blocky structure in upper part, changing to massive in lower part; calcareous.

The texture of the substratum ranges from silty clay loam to silt loam or clay loam. In a few exceptional places, the substratum may have a silty clay or clay texture similar to that of the well-drained Markland soils (not mapped in Clinton County). In addition, fairly thin, discontinuous bands or layers of sandy material are in the substratum.

The depth and intensity of mottling vary considerably in these soils. The better drained areas have a few, faint mottles, or the mottling is relatively deep in the subsoil. In some places, water-laid sediment in the substratum extends to a depth of 10 to 12 feet and is underlain by old Illinoian till.

Runoff from the Uniontown soils is slow to medium. The risk of erosion is slight to moderate depending on the steepness and length of slope and the cover of vegetation or of mulch. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed, they are productive of crops commonly grown in the county.

**Uniontown silt loam, 0 to 2 percent slopes** (UnA1).—A profile of this soil is described as representative of the Uniontown series. Slight erosion has occurred. (Capability unit I–1.)

**Uniontown silt loam, 2 to 6 percent slopes, moderately eroded** (UnB2).—About 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown upper subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIIe–2.)

## Westland Series

The Westland series consists of dark-colored, very poorly drained soils that have formed in 42 to 60 inches of medium and moderately fine textured material. This material is underlain by well-stratified, well-sorted layers of outwash consisting of calcareous sand and gravel of Wisconsin age. The Westland soils occupy nearly level and depressed areas on terraces, on outwash plains, and on valley trains. The native vegetation consisted of white ash, American elm, red maple, and other swamp forest trees and marsh grasses.

The Westland soils are associated with the imperfectly drained Sleeth, the moderately well drained Thackery, and the well drained Ockley soils. They differ from Bonpas soils in substratum. They are underlain by sandy and gravelly material and the Bonpas by finer textured material.

The Westland and Sloan soils are intermingled in some places, but the Sloan soils differ in having formed from recent alluvium.

Representative profile (Westland silty clay loam in a cultivated field):

Surface layers—
- $A_{1p}$ 0 to 6 inches, very dark-gray to black, firm silty clay loam; moderate, medium, granular structure; neutral.
- $A_{12}$ 6 to 14 inches dark-gray, firm silty clay loam; weak, coarse, subangular blocky structure; neutral.

Subsoil—
- $B_{21g}$ 14 to 30 inches, dark-gray, firm silty clay loam; many, medium, distinct mottles of yellowish brown and dark brown; weak, coarse, prismatic structure that breaks to very coarse, subangular blocky peds; neutral.
- $B_{22g}$ 30 to 45 inches, mottled grayish-brown, gray, and brown, firm clay loam grading to firm sandy clay loam in lower part; weak, coarse, prismatic structure that breaks to very coarse, subangular blocky peds; neutral to calcareous.

Substratum—
- D 45 inches +, gray, well-stratified, loose sand and gravel; few, fine, distinct mottles of yellowish brown; each layer of sand and gravel is well sorted; massive (structureless); calcareous.

Below a depth of about 12 to 36 inches, the soil frequently contains more sand and gravel. Calcareous material is at a depth of about 42 to 60 inches.

In the mixed substratum phases of Westland soils, the underlying formation differs in that the layers of sand and gravel are poorly assorted and roughly stratified. Each poorly sorted layer is mixed with considerable amounts of loamy and clayey material.

Runoff from the Westland soils is slow. Tile drains are effective in reducing wetness. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is high in organic matter. If properly managed, the Westland soils are productive of crops commonly grown in the county.

**Westland silty clay loam** (WtA0).—A profile of this soil is described as representative of the Westland series. Slopes range from 0 to 2 percent. Little or no erosion has occurred. The plow layer becomes cloddy if cultivated when too wet. (Capability unit IIw-4.)

**Westland silt loam** (WeA0).—This soil is on slopes of 0 to 2 percent. Little or no erosion has occurred. Silty material that washed from surrounding soils has mixed with the original surface soil. As a result the plow layer has a texture of silt loam. (Capability unit IIw-4.)

**Westland silt loam, overwashed** (WeA+).—This soil has slopes of 0 to 2 percent. Silty material that washed from surrounding soils has covered the original surface soil with a lighter colored layer, 8 to 14 inches thick. (Capability unit IIw-4.)

**Westland silt loam, mixed substratum, overwashed** (WmA+).—This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. This soil is underlain by a poorly assorted, roughly stratified formation. In addition, silty material that washed from surrounding areas covers the original surface soil with a lighter colored layer, 8 to 14 inches thick. (Capability unit IIw-4.)

**Westland silty clay loam, mixed substratum** (WnA0).—This soil has slopes of 0 to 2 percent. Little or no erosion has occurred. The surface soil and subsoil are similar to those described in the representative profile. However, a poorly assorted, roughly stratified underlying formation is characteristic of this soil.

The plow layer becomes cloddy if cultivated when too wet. (Capability unit IIw-4.)

## Williamsburg Series

The Williamsburg series consists of light-colored, well-drained soils on terraces. These soils have formed from medium-textured material over roughly stratified, sandy and gravelly outwash of Wisconsin glacial age. Carbonates are at depths ranging from 70 to 90 inches. The soils occupy slopes of 1 to 25 percent on dissected terrace remnants along Todd Fork and East Fork of the Little Miami River. These streams flow through parts of the county covered by the Illinoian glaciation. The native vegetation consisted of hard maple, white ash, walnut, tulip-poplar, and other deciduous trees.

The Williamsburg soils are associated with the moderately well drained Sardinia soils. They resemble the Ockley soils but have a more acid subsoil and less calcareous sand and gravel in the substratum.

Representative profile (Williamsburg silt loam in a cultivated field):

Surface layers—
- $A_p$ 0 to 8 inches, yellowish-brown, friable silt loam; moderate, fine and medium, granular structure; medium acid.
- $A_2$ 8 to 12 inches, yellowish-brown, friable silt loam; moderate, fine to medium, subangular blocky structure; strongly acid.

Subsoil—
- $B_{21}$ 12 to 37 inches, yellowish-brown, friable silt loam to firm silty clay loam; moderate to strong, medium, subangular blocky structure; very strongly acid.
- $B_{22}$ 37 to 50 inches, light yellowish-brown, friable loam to light clay loam; common, medium, distinct mottles of grayish brown and brownish yellow; strong, coarse, subangular blocky structure; very strongly acid in upper part, gradually changing to medium acid in lower part.

Substratum—
- C 50 to 84 inches, brown to dark-brown, firm clay loam and sandy clay loam; common, fine to medium, distinct mottles of dark grayish brown and yellowish brown; massive (structureless); medium acid in upper part, changing to neutral in lower part.
- D 84 inches +, yellowish-brown, grayish-brown, and brown, stratified, loose sand and gravel; single grain (structureless); neutral and calcareous; coarse sand and gravel considerably mixed with loamy and clayey material.

The upper 30 to 42 inches, which include the surface soil and upper subsoil, are free of gritty material. The lack of grit indicates that these layers have developed in a fairly thick mantle of loess or of grit-free alluvial silt. The thickness of this grit-free material decreases on the steeper slopes. In places, the lower subsoil contains a few roughly stratified layers of sand and gravel. As a rule, the amount of sand and gravel increases with depth. The substratum consists of roughly stratified layers of sandy and gravelly material, considerably mixed with silt and clay.

Runoff is slow to rapid from the Williamsburg soils. The risk of erosion is slight to high and is related to the steepness and length of slopes and to the cover of vegetation or of mulch. These soils have a deep root zone, a high moisture-supplying capacity, and a surface soil that is medium in organic matter. If properly managed they are productive of crops commonly grown in the county.

**Williamsburg silt loam, 0 to 2 percent slopes** (WbA1).—A profile of this soil is described as representative of the Williamsburg series. Slight erosion has occurred. (Capability unit I-1.)

**Williamsburg silt loam, 2 to 6 percent slopes** (WbB1).—This soil has been slightly eroded. It has a profile similar to that described for the series. (Capability unit IIe-2.)

**Williamsburg silt loam, 2 to 6 percent slopes, moderately eroded** (WbB2).—About 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IIe-2.)

**Williamsburg silt loam, 6 to 12 percent slopes** (WbC1).—This soil has been slightly eroded. It has a profile similar to that described for the series. (Capability unit IIIe-2.)

**Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded** (WbC2).—Approximately 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IIIe-2.)

**Williamsburg silt loam, 12 to 18 percent slopes, moderately eroded** (WbD2).—Approximately 2 to 4 inches of the original surface soil remain. The present layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. (Capability unit IVe-2.)

**Williamsburg silt loam, 18 to 25 percent slopes, moderately eroded** (WbE2).—Approximately 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the yellowish-brown subsurface soil. This mixture is finer textured than the original surface soil. A few severely eroded areas have been included with this soil. (Capability unit VIe–1.)

## Xenia Series

The Xenia series consists of light-colored, moderately well drained, nearly level to sloping soils on uplands. These soils have developed in 18 to 40 inches of loess that overlies medium-textured, calcareous till of Wisconsin age. Carbonates occur at depths of 24 to 42 inches; the loess mantle generally does not contain carbonates. The native vegetation was a mixture of oak, hickory, maple, and other deciduous hardwoods.

The Xenia soils are associated with the well-drained Russell, the imperfectly drained Fincastle, the poorly drained Delmar, and the very poorly drained Brookston soils.

The Xenia soils resemble, in many ways, the Birkbeck soils that have developed in loess more than 40 inches thick, and the Celina soils that are also moderately well drained but have developed in loamy calcareous till and a loess mantle that was as much as 18 inches thick.

Representative profile (Xenia silt loam in a cultivated field):

Surface soil—
- $A_p$ 0 to 8 inches, dark grayish-brown, friable silt loam; moderate, medium and fine, granular structure; medium acid.

Subsoil—
- $B_1$ 8 to 11 inches, dark yellowish-brown, friable silty clay loam; weak, fine, subangular blocky structure; strongly acid.
- $B_{21}$ 11 to 19 inches, dark-brown to yellowish-brown, firm silty clay loam; moderate, fine to medium, subangular blocky structure; strongly acid.
- $B_{22}$ 19 to 24 inches, yellowish-brown, firm silty clay loam; many, medium to fine, distinct mottles of brown and grayish brown; moderate, medium to coarse, subangular blocky structure; medium acid.
- $B_{23}$ 24 to 34 inches, yellowish-brown, friable clay loam; many, fine, faint mottles of brown and dark yellowish brown; weak, medium, subangular blocky structure to massive; medium acid in upper part, gradually changing to neutral or alkaline in lower part.

Substratum—
- C 34 inches +, mottled yellowish-brown to grayish-brown loam till; massive (structureless); calcareous.

In areas near the terminal moraine of the Wisconsin glacier, the soil may be free from carbonates to a depth as much as 84 inches. The till under loess is generally loam, but in local areas it may be silt loam, silty clay loam, or clay loam.

Runoff from the Xenia soils is slow to rapid. The risk of erosion is moderate to high, depending on steepness and length of slopes and the cover of vegetation or mulch. Most of the Xenia soils are slightly or moderately eroded. They have a deep root zone, a medium moisture-supplying capacity, and a surface soil medium in organic matter. In the severely eroded Xenia soils, these properties are less favorable for agriculture. If properly managed, the Xenia soils are productive of the crops commonly grown in the county.

**Xenia silt loam, 0 to 2 percent slopes** (XeA1).—The profile of this soil is described as representative of the Xenia series. These soils are slightly eroded. (Capability unit I–1.)

**Xenia silt loam, 2 to 6 percent slopes** (XeB1).—The profile of this soil is like the one described as representative of the series. These soils are slightly eroded. (Capability unit IIe–2.)

**Xenia silt loam, 2 to 6 percent slopes, moderately eroded** (XeB2).—About 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the dark yellowish-brown subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIe–2.)

**Xenia silt loam, 6 to 12 percent slopes** (XeC1).—This soil has been slightly eroded. It has a profile similar to that described for the series. (Capability unit IIIe–2.)

**Xenia silt loam, 6 to 12 percent slopes, moderately eroded** (XeC2).—About 2 to 4 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and the dark yellowish-brown subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIIe–2.)

**Xenia soils, 2 to 6 percent slopes, severely eroded** (XnB3).—About 2 inches or less of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the dark yellowish-brown subsoil. This mixture is finer textured than the original surface soil. (Capability unit IIIe–2.)

**Xenia soils, 6 to 12 percent slopes, severely eroded** (XnC3).—About 2 inches of the original surface soil remain. The present plow layer is a mixture of the original surface soil and part of the dark yellowish-brown subsoil. This mixture is finer textured than the original surface soil. (Capability unit IVe–3.)

# *Genesis, Classification, and Morphology of the Soils*[3]

This section discusses the formation of soils, their classification into soil orders and great soil groups, and their physical and chemical characteristics.

## Genesis of the Soils

Soils are formed by the processes of weathering and soil development acting upon parent materials that have been deposited or accumulated by geological activity. The characteristics of the soil at any given point depend upon the interrelationships of (1) the physical and mineralogical composition of the parent material; (2) the climate under which the material has accumulated and existed; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted upon the soil material. These are termed the soil-forming factors. Because different factors dominate from place to place, many kinds of soil have been formed.

Climate and vegetation are the active factors in soil genesis. Less is known about the effects of the micro-organisms, earthworms, and other plants and animals living in the soil, but they probably have an influence on

[3] This section was prepared by GEORGE M. SCHAFER, Soil Conservation Service, and N. HOLOWAYCHUK, Ohio Agricultural Experiment Station.

soil composition and the supply of organic matter that is equal to that of the vegetation. The vegetation and animal and microbial life, influenced by the climate, act upon parent material and slowly change it into a natural body with genetically related horizons. Soils differ on a regional basis largely because of the influences of climate and vegetation.

The effects of climate and vegetation upon soil development are modified by the parent material and by the relief, which, in turn, influences drainage. The parent material and the relief influence the kind of soil profile that can be formed and in some cases dominate the soil profile entirely.

Finally, time is required before the parent material can be transformed into a soil. The weathering, leaching, translocation of soil particles, formation of soil structure, erosion, and other soil-forming processes require time to differentiate horizons in the soil parent materials.

## *Parent material*

Parent material is the unconsolidated mass of rock material from which the soil profile develops. This section discusses the various kinds of parent material from which the soils of Clinton County have developed.

### BEDROCK (*19*)

The bedrock under glacial and other surface deposits consists of limestone and, to some extent, of calcareous shale of Silurian and Ordovician ages. Water-laid and glacial material was deposited on the uneven surface of the bedrock. Scouring ice removed some of the bedrock and mixed it with material left as glacial deposits.

The bedrock, west of a somewhat irregular line extending from the northwestern corner of the county to Martinsville and beyond in the southeastern part of the county, is thinly bedded limestone and calcareous shale of the Richmond formation of Ordovician age. The northeastern two-thirds of the county is underlain by dolomite and shale of the Niagara group of Silurian age. A narrow, irregular strip from the northwestern to southeastern part of the county is underlain by the highly crystalline Brassfield limestone, also of Silurian age. This limestone lies between the Richmond and Niagara groups.

### GLACIAL MATERIAL

Several glaciations have passed over or entered the area that is now Clinton County. Ice advanced generally from the north or northeast. The transported material therefore came from this direction. Some material came from as far away as northern Canada.

Drift of both the Wisconsin and the Illinoian glacial ages and postglacial alluvium cover the entire county with very few exceptions. Bedrock is exposed only along some of the stream channels.

The Illinoian drift in Clinton County was deposited as an extensive, nearly level or very gently undulating till plain that lies south of the Cuba moraine. This till is generally 10 to 15 feet thick (*20*). Its shallowness and the depths to which it is leached of carbonates, often to 10 feet or more, have made it difficult to obtain enough unaltered samples to characterize adequately the Illinoian till. Clayey material from the weathered residues of the underlying bedrock has tended to make the lower parts of some of the soil profiles appreciably finer textured than would be expected from a loamy till. Examinations of remnants that have not been noticeably altered show that the till is generally freely effervescent, firm loam.

Deposits laid down during Wisconsin glaciation cover a large area and consist of moraines, till plains, outwash, and lacustrine material. Moraines and till plains are the most extensive and cover approximately the northern two-thirds of the county. The outer Wisconsin moraine, known as the Cuba moraine, occurs as a crescent-shaped belt of rolling topography that stretches from the northwestern corner of the county to beyond New Vienna in the southeastern part. The other Wisconsin moraine, the Reesville, is also crescent shaped, and it crosses the northeastern part of the county. The towns of Bloomington and Reesville are on this moraine. Gently undulating till plains occupy the area between these moraines and the area northeast of the Reesville moraine.

The thickness of the till of Wisconsin age is appreciably greater than that of Illinoian age. It may be more than 100 feet in the moraines, but it is commonly 20 to 40 feet in the till plains. The Wisconsin till is heterogeneous. A large percentage of it came from glacier-eroded bedrock, immediately to the north and northeast. It consists of finely ground limestone and shale and rock fragments up to boulder size. In addition, crystalline material from as far as northern Canada was transported by the glacier and mixed with material of more local origin. The composition of the till material that passes through a 2-millimeter sieve is of special significance in soil formation. Material this size weathers more rapidly, and, consequently, it is an important source of the soil minerals. Some measure of the composition of the till is shown by analysis of this finer material. The analysis of eight samples of Wisconsin-age till, showing the percentage of sand, silt, and clay, and of the calcium carbonate equivalent, is given in table 3.

TABLE 3.—*Analysis of 8 samples of Wisconsin-age till in Clinton County*

| Analyzed for— | Percentage in each sample | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sand | 35. 2 | 18. 2 | 32. 7 | 27. 8 | 30. 7 | 34. 9 | 26. 2 | 39. 1 |
| Silt | 45. 1 | 64. 8 | 45. 7 | 52. 9 | 47. 6 | 45. 3 | 48. 1 | 39. 4 |
| Clay | 19. 7 | 17. 0 | 21. 6 | 19. 3 | 21. 7 | 19. 8 | 25. 7 | 21. 5 |
| Calcium carbonate equivalent | 31. 4 | 31. 8 | 40. 8 | 33. 6 | 37. 6 | 37. 9 | 31. 6 | 31. 8 |

The data in table 3 indicate that the fine material in Wisconsin-age till is mainly loam or silt loam, and that the calcium carbonate equivalent ranges from about 30 to 40 percent.

Outwash from the Wisconsin glacier occurs along most of the major streams in the county. It generally consists of sand and gravel overlain by loamy or silty material; a large part of it is calcareous. Pebbles of crystalline rocks are also numerous. Thickness of the layers and the degree of sorting vary considerably. The most extensive deposits of these materials are along Todd Fork.

#### LACUSTRINE MATERIAL

Finer textured slack water, or lacustrine, material occurs in several small areas along the outer edges of both major moraines. The position of the deposits suggests they were laid down by ponding at the time the moraines were formed.

#### LOESS

Loess, originating during Wisconsin glaciation or in the postglacial period, has covered most of the county that lies outside of the Reesville moraine. It is as much as 100 inches thick in some places, but generally it is appreciably less. The deeper and more extensive areas of this mantle of loess are in the north-central part of the county. In this part, it is generally 40 to 60 inches thick. In most of the other parts of the county, the loess mantle is less thick and generally uneven. Crests of knolls and steeper slopes may have little or none of the loess mantle. On the smoother terrain, however, the loess is more prevalent and thicker because removal occurs at a slower rate.

#### ALLUVIUM

Alluvium occurs along all the major streams in the county. It consists of material washed from the surrounding glacial till that is high in lime. It is 3 to 8 feet or more in thickness. Thin alluvial overwash occurs along small intermittent streams. The alluvial deposits in the county are generally silt loam to loam in texture and have lenses of sandier material in them.

The alluvial soils in the eastern half of the county are generally somewhat poorly drained, and those in the western half are mostly well drained.

### *Climate*

The climate under which the soil material has accumulated and existed since deposition is an active factor in soil genesis. The area in which Clinton County is located has a temperate, humid, continental climate. A detailed discussion of the climate of Clinton County is given in the section "Additional Facts About Clinton County."

Climatic factors that are important in soil formation are precipitation, temperature, and the evapo-transpiration ratio. These factors are interrelated with the vegetation types, and on a regional basis, determine the kinds of soil which have developed. In an area the size of a county, the climate is fairly uniform and soil differences are determined more by local differences in vegetation, parent material, relief and drainage, and the age of the soil materials.

### *Vegetation*

Clinton County is in the extensive deciduous forest area of the eastern United States. At the time of settlement, nearly all the county was covered by a dense forest of hardwood trees. The only exceptions were a few small grassy or marshy areas in the vicinity of Anderson Fork in the north-central part of the county.[4] At present only 4.7 percent of the county is classified as woodland (*14*).

The distribution of tree species in the original forest was not uniform. Soil moisture appears to have been one of the more important factors that caused the species composition to vary. Because of soil moisture and probably other factors, the original forest cover consisted of associations, or groups, of trees dominated by one or more species. Several tree associations in the original forests [5] have been recognized by scientists working in adjoining counties (*2*).

A woodland survey of Clinton County in 1942 (*14*) lists a large number of species and several forest types. In the northern two-thirds of the county on the better drained locations, white and red oaks, beeches, sugar maples, and hickories were common. In addition, American and slippery elm, white ash, wild black cherry, soft maple, black walnut, honeylocust, blackgum, and several other species occurred in a number of upland associations. In the depressed or flat areas, where excessive moisture prevails, the association consisted mainly of elm, ash, and soft maple. These species and sycamore, boxelder, hackberry, willow, and cottonwood were generally more common in the bottom-land forests.

The extensive, nearly level areas of Illinoian till with slowly permeable soils create wet conditions for long periods that determine the kinds of trees that grow under these conditions. Forest types in which pin oak predominates are in most wooded areas in the southern part of the county. Other species mixed with pin oak are soft maple, American and slippery elms, ashes, beeches, and swamp and white oaks. Purple three-awn grass, poison ivy, and wet sedges invade idle land.

Before the area was settled, elm, ash, soft maple, and pin oak were the main tree species in the swamp forest on the extensive, nearly level till plains (*2*). Sweetgum and beech may have been the more common associated species. A somewhat different association of trees was common on the flats of the divides and headwaters in this part of the county. While the association may be referred to as the swamp white oak—hickory association, it included pin, swamp white, bur, red, and white oaks; big shellbark, mockernut, and shagbark hickories; sourgum, American elm, white ash, and soft maple. Beech grew in this association on the somewhat better drained spots. On the well-drained slopes of the valleys, beech, sugar maple, and white oak, with some yellow-poplar, were the more prevalent species.

### *Physiography, relief, and drainage*

Clinton County lies in the Till Plains of the Central Lowland (*4*). Most of the county has very gently undulating or nearly level topography. The latter is especially extensive in the southwestern one-third of the county. Rolling terrain and somewhat greater relief are characteristic of the two moraines traversing the county from northwest to southeast. Steeper slopes are also common along the more prominent valleys. Caesar Creek and its tributaries in the northwestern corner of the county are bordered by steeply sloping land that has considerable relief.

A large part of the county is in the drainage system of the Little Miami River. Anderson Fork, Todd Fork,

[4] DOBBINS, RAYMOND ANSON. VEGETATION OF THE NORTHERN "VIRGINIA MILITARY LANDS" OF OHIO. 1937. [Unpublished dissertation for the degree doctor of philosophy. Copy on file in the library of the Ohio State University, Columbus, Ohio.]

[5] NORRIS, FREDERICK H. PRIMARY FORESTS TYPES OF HIGHLAND COUNTY, OHIO. 1948. [Unpublished dissertation for the degree doctor of philosophy. Copy on file in the library of the Ohio State University, Columbus, Ohio.]

Cowan Creek, and East Fork are the more prominent tributaries of the Little Miami River in this county. All of these streams flow in a general westerly or southwesterly direction. A small part of the county, generally along the eastern border, is drained by a branch of Rattlesnake Creek, which is part of the Scioto River system. All of this county appears to be fairly well drained by the several streams, but a number of shallow swales on the till plain and small, deep depressions on the moraines are not drained by surface outlets.

### *Time*

The length of time that the land surface has been exposed to soil-forming processes is an important factor in the development of the soil profiles. All soils require time for the differentiation of distinct soil horizons. The influence of time, however, may be greatly modified by various soil-forming processes, particularly by erosion, by the deposit of material on the soil surface, by the relief, and by the type of parent material.

The parent materials of the soils in Clinton County may be separated into three general age groups—those of Illinoian age, those of Wisconsin age, and those formed in deposits on the flood plains. The oldest materials are those deposited by the Illinoian glaciation, which geologists say occurred about 100,000 to 200,000 years ago. The surface of the Illinoian till has been modified, however, by a subsequent thin cover of loess, part of which was deposited in the Wisconsin age. Younger land surfaces in the area of the Illinoian glaciation may have been produced by erosion on stronger slopes.

The Wisconsin materials have been separated into Early and Late Wisconsin (*7*), (*9*). By the use of radiocarbon dating (*5*), scientists have learned the Early Wisconsin material was laid down more than 34,000 years ago. Early Wisconsin material in Clinton County occurs only as outwash and is the material in which soils of the Williamsburg catena have developed. Radiocarbon dating of the Late Wisconsin material in the Cuba moraine of Clinton County and in the outer Wisconsin moraines in other Ohio counties shows this material to be about 18,000 years old. The Late Wisconsin materials in Clinton County consist of moraines, till plains, and outwash.

The present flood plains are subject to deposition, and the soils show little or no differentiation of soil horizons. They are young soils compared with other soils in the county.

The age of soils on the steeper slopes is intermediate between that of soils on the level uplands and those on the recent flood plains. Geological erosion on slopes has removed part of the soil as it formed and has prevented the full expression of the other factors of soil formation.

## Classification of the Soils

Soils can be classified in a number of ways, depending upon the purpose. They are placed in narrow classes for the organization and application of knowledge about soil behavior on farms and fields. Soils are placed in broad classes, however, for the study and comparison of large areas such as counties, States, or continents over the world.

Soils are placed in six different categories, one below the other, in the classification system now used in the United States (*22*). Beginning at the top, the six categories are: order, suborder, great soil group, family, series, and type.

Each of these categories consists of a number of classes at the same level. The classes are few and broad in the highest category, whereas they are many and narrow in the lowest category. In the highest category of the classification system, the soils of the United States are placed into three orders, whereas thousands of soil types are recognized in the lowest category.

Among the six categories, those of order, great soil group, series, and type have been used most. The suborder and family categories have never been fully developed and therefore are seldom used. Attention has been given largely to the classification of soils by soil types and soil series within counties and to the subsequent grouping of the series into great soil groups and orders for States or for the country as a whole.

The classes in the highest category of the classification system are the zonal, intrazonal, and azonal orders (*22*). Each of these orders is represented in Clinton County by one or more great soil groups, which in turn, represents one or more soil series. The soil series of Clinton County are classified into the following orders and great soil groups.

| | *Soil series* |
|---|---|
| ZONAL ORDER: | |
| Gray-Brown Podzolic soils: | |
| Well drained and moderately well drained | Birkbeck |
| | Casco |
| | Celina |
| | Edenton |
| | Fox |
| | Miami |
| | Milton |
| | Ockley |
| | Russell |
| | Sardinia |
| | Thackery |
| | Uniontown |
| | Williamsburg |
| | Xenia |
| Imperfectly drained | Crosby |
| | Fincastle |
| | Henshaw |
| | Reesville |
| | Sleeth |
| Gray-Brown Podzolic intergrading to Red-Yellow Podzolic soils | Cincinnati |
| | Rossmoyne |
| Brunizem soils | Raub |
| INTRAZONAL ORDER: | |
| Humic Gley soils | Bonpas |
| | Brookston |
| | Kokomo |
| | Millsdale |
| | Ragsdale |
| | Sloan |
| | Westland |
| Low-Humic Gley soils | Blanchester |
| Planosols | Avonburg |
| | Clermont |
| | Delmar |
| Rendzina soils | Fairmount |
| | Rodman |
| AZONAL ORDER: | |
| Alluvial soils | Algiers |
| | Eel |
| | Genesee |
| | Medway |
| | Ross |
| | Shoals |
| Regosols intergrading to Gray-Brown Podzolic soils | Hennepin |

Some of the characteristics of soils in each group are described in the following pages. Technical descriptions of soil profiles and the results of laboratory analyses are provided in the section "Morphology and Composition of the Soils." Definitions of the great soil groups are similar to those used in the 1938 Yearbook of Agriculture (*22*), or as modified by Thorpe and Smith (*21*).

### Zonal order

Zonal soils have characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms. Their profiles have well-differentiated horizons. The soils are forming in materials that have been in place a long time, are intermediate in physical and chemical compositions, and are not subject to extremes in drainage or topography.

In Clinton County the great soil groups in the zonal order are: Gray-Brown Podzolic, Gray-Brown Podzolic intergrading to Red-Yellow Podzolic, and Brunizem.

#### GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils have developed under a deciduous forest in the humid, temperate region. They have well-developed profiles and are well drained to imperfectly drained. Soils classified in this great soil group have a larger total acreage than the soils in any other great soil group in Clinton County.

The Gray-Brown Podzolic soils, under virgin conditions, have thin, dark-colored $A_1$ horizons and generally gray, grayish-brown, or pale-brown eluviated $A_2$ horizons. In cultivated fields all or part of the $A_2$ horizon may be in the plow layer. The Gray-Brown Podzolic soils have textural B horizons, which are higher in clay than the $A_1$ or $A_2$ horizons or the parent material. The accumulation of clay in the B horizons has resulted from the eluviation of clay from the surface horizon and possibly also by development of clay in place. It also may have resulted from the concentration of clay due to the leaching of calcareous materials. The B horizons also have higher chroma values in which brown, yellowish brown, or strong brown are the most common. The B horizon has moderately to strongly developed subangular to angular blocky structure.

The Gray-Brown Podzolic soils also have characteristic reaction and base saturation patterns in the profile. They are more acid in the lower A and upper B horizons than in the lower B horizon. The reaction is usually strongly acid to slightly acid in the upper horizon and medium acid to neutral in the lower B horizon. There is a similar pattern in base saturation. Saturation values in the lower A and upper B horizons are as low as 30 percent, whereas those in the lower B horizon are seldom below 50 percent.

All of the Gray-Brown Podzolic soils in Clinton County have developed in parent materials that were originally calcareous. The carbonates have leached from this material in the process of soil development. The parent material for Gray-Brown Podzolic soils, except the Edenton, consists of till, silt-mantled till, loess, outwash, or slack-water material of Wisconsin age. The Edenton soils developed from Illinoian till.

The classification of soils in the Gray-Brown Podzolic group is based on parent material, drainage, and profile characteristics. These criteria consist of texture of profile, the degree of development and texture of the B horizon, thickness of solum, and depth of leaching. The depth to carbonates is, to a large degree, related to the texture and character of the parent material, but it may also be affected by the length of time the profile has been developing.

The Gray-Brown Podzolic soils are discussed in this section in relation to catenas occurring in the county. In the catenas in which Gray-Brown Podzolic soils occur, this group may include well drained, moderately well drained, and imperfectly drained members. Series with each of these drainage characteristics, however, do not necessarily occur in each of the catenas.

##### Russell, Xenia, and Fincastle Series

The well drained Russell, the moderately well drained Xenia, and the imperfectly drained Fincastle soils have developed in 18 to 40 inches of loess over weathered till of Wisconsin age. The lower part of the B horizon is derived from till. The solum is underlain by highly calcareous, medium-textured till. The depth to carbonates for the series ranges from about 34 to 72 inches. However, in Clinton County, carbonates generally occur at a depth of 42 inches or less for the Gray-Brown Podzolic soils of this catena.

Two profiles of Russell silt loam (CT–29, CT–30) [6] have been analyzed and are described in detail. The thickness of the silty mantle is about 27 inches and 30 inches in these two profiles. Maximum content of clay is in the $B_2$ horizon, which has a medium silty clay loam texture and moderate subangular to angular blocky structure. These profiles of Russell silt loam show that the upper or middle B horizons have the lowest pH, and that the pH is higher in the lower B horizon. Carbonates are at depths of 40 to 42 inches.

A profile of Xenia silt loam (CT–55) has mottles in the lower B horizon, which indicate that drainage is restricted. The low sand content of the upper horizons indicates that the silty mantle is 24 inches thick. The B horizon has about the same texture as that in the Russell soil—medium silty clay loam. The lower B horizon was derived from till. Carbonates are at a depth of about 34 inches. The pH minimum is in the upper B horizon.

Fincastle silt loam (CT–24, CT–27) has mottles immediately below the plow layer. The textural profile for CT–27 is about like that described for the Russell and Xenia soils, whereas the $B_2$ horizon of profile CT–24 is somewhat finer. The texture of the $B_2$ horizon of profile CT–24 is near the silty clay loam-silty clay boundary. The loess mantle of the two Fincastle profiles that were sampled is about 28 to 30 inches thick. The pH minimum of these Fincastle profiles is in the upper B horizon, but the profile of sample CT–24 is somewhat less acid than the other profiles sampled in this catena.

##### Miami, Celina, and Crosby Series

The well drained Miami, the moderately well drained Celina, and the imperfectly drained Crosby soils are extensive in the northern and northeastern parts of the county. They are mainly on the Reesville moraine and

[6] Letters and numbers in parentheses refer to profile identification in the section "Morphology and Composition of the Soils."

on the ground moraine behind it. These soils have developed in the medium-textured till of Wisconsin glacial age that is covered by little or no mantle of loess. These soils are also associated in local areas in the northern part of the county with soils of the Russell catena but on slopes where no more than 18 inches of loess has accumulated.

The Miami, Celina, and Crosby soils in many counties have textural B horizons of silty clay loam or clay loam, but in some areas, the texture ranges to light clay or silty clay. In Clinton County, however, these soils have B horizons, which are generally within the clay or silty clay textural class. The depth to carbonates generally ranges from 20 to about 42 inches for these series. In Clinton County the depth to the carbonates is at the lower limit of the range for these series, and in many places carbonates occur at a depth of less than 20 inches. All of the profiles that were subjected to mechanical analyses are relatively high in sand throughout the solum, and except that the texture of the surface soil is a silt loam, they show little evidence of a silty mantle.

Two samples of Miami silt loam (CT–13, CT–37) have textural profiles typical of the Miami series in the northeastern part of Clinton County. In both profiles, the $B_2$ horizons are clay; carbonates are at depths of less than 20 inches. Profile CT–13 was sampled only into the $B_3$ $C_1$ horizon, which has clay skins and coatings along structure surfaces. The material under the solum, where this profile was sampled, is medium-textured, highly calcareous till. Profile CT–37 has higher pH values than typical of the Miami series.

The Celina silt loam profiles (CT–12, CT–40) have clayey $B_2$ horizons. However, the clay in horizons with a maximum accumulation of clay is somewhat less than in these horizons in the Miami profiles. Carbonates in the Celina profiles are at depths of 17 to 20 inches. The underlying till is medium textured and highly calcareous. In both profiles the pH minimum is in the $B_1$ horizon. Profile CT–12, sampled in a wooded area, has an $A_2$ horizon which, in cultivation, is generally incorporated in the plow layer. There is more organic matter in the surface layers of this profile than in the plow layer of cultivated soils in this catena. Mottles in the B horizon of the Celina profiles indicate that drainage is somewhat restricted.

The representative Crosby silt loam profiles (CT–14, CT–38) have textural profiles that correspond to those of the Miami and Celina series According to the analysis, the $B_2$ horizons, which contain the greatest accumulation of clay, are silty clay rather than clay. The pH minimum in these profiles is in the $B_1$ horizon. Carbonates are at a depth of less than 20 inches. The solum is underlain by highly calcareous, loam-textured till. The imperfect drainage of the Crosby soils is indicated by the grayer profile colors and the prominent mottles in all horizons below the plow layer.

### Milton Series

The Milton series consists of well-drained soils that have developed in Wisconsin-age till over limestone. Bedrock is generally at depths of 8 to about 40 inches, but occasionally it is as much as 60 inches deep. The characteristics of the Milton soil profiles are, in general, similar to those of the Miami soils, except that the Milton is underlain abruptly by limestone. The Milton soils have a textural B horizon that has a subangular or angular blocky structure, as is typical of Gray-Brown Podzolic soils. A detailed technical description of a Milton soil profile is provided, but samples for laboratory testing were not obtained. In this profile, a 3-inch layer of pale-olive clay just above the bedrock appears to have been derived from the limestone rather than from glacial till.

### Birkbeck and Reesville Series

The moderately well drained Birkbeck and the imperfectly drained Reesville soils have developed in 40 to 65 inches or more of neutral or calcareous loess over calcareous Wisconsin till. These soils are in the same general area as the Russell, Xenia, and Fincastle soils. The Birkbeck and the Reesville soils have textural profiles similar to the profiles of these soils but lack the till material in the lower part of the solum. Well-drained soils developed in this silty parent material have not been classified in Clinton County.

Birkbeck silt loam profiles (CT–5 and CT–S9) are representative of this series. The low sand content in the sola of these two profiles is apparent, although there is more sand than in many samples of loess. The thickness of the silty material is 100 inches for profile CT–5, and 56 inches for profile CT–S9. Clay content in the $B_2$ horizon of profile CT–S9 is less than typical for the Birkbeck series, but the sand content is fairly high. The pH minimum for these profiles is in the $B_1$ or upper $B_2$ horizon. The lowest base saturation percentage in profile CT–5 is also in the $B_1$ horizon, but the base saturation is higher in this profile than in many Gray-Brown Podzolic soils. Profile CT–S9 was sampled in a woodland area and has a 2½-inch $A_1$ horizon high in organic matter.

Two profiles of Reesville silt loam (CT–6, CT–8) were analyzed and are described in detail. The solum in both profiles has developed entirely from silty material. The silty material is 42 inches thick in profile CT–6 and is between 50 and 72 inches thick in profile CT–8. The textural B horizons in these profiles are medium to fine silty clay loam and have a moderate to strong subangular blocky structure. The pH minimum and the lowest base-saturation percentage for profile CT–6 are in the $B_1$ horizon. The pH values then increase with depth to calcareous material. The base-saturation percentage for profile CT–6 is typical for Gray-Brown Podzolic soils. Profile CT–6, sampled in a wooded area, has a 4-inch $A_1$ horizon that is high in organic matter. Mottles below the surface horizon indicate these profiles are imperfectly drained.

### Edenton Series

The well-drained Edenton soils have developed in Illinoian till. They have a moderate to well-developed textural B horizon. The solum is moderately deep to calcareous till, compared to that of other soils derived from Illinoian till. The Edenton soils are associated with the more acid Cincinnati and Rossmoyne soils, which are leached to greater depths and are classified as Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils. The pH values and probably also the base-saturation percentages of the Edenton soils appear to be within the range of Gray-Brown Podzolic soils. The base-exchange characteristics of an Edenton profile have not been determined. Profile samples of the Edenton series were not obtained in Clinton County for laboratory analysis.

Fox and Casco Series

The somewhat excessively drained Fox and the excessively drained Casco soils have developed in outwash material of Wisconsin age. The Fox soils have well-developed textural B horizons consisting of clay loam, gravelly or sandy clay loam, or clay. Calcareous sand and gravel are at depths of 24 to 42 inches. The Casco soils differ from the Fox soils in having a thin $B_2$ horizon and a thin solum overlying calcareous sand and gravel at depths of less than 24 inches.

Ockley, Thackery, and Sleeth Series

The well drained Ockley, the moderately well drained Thackery, and the imperfectly drained Sleeth soils are underlain by calcareous sand and gravel at depths of more than 42 inches. These soils have developed in outwash of Wisconsin age. Depth to carbonates is greater than in the Fox and Casco series. This greater depth to carbonates may be due, in part, to a thin mantle of silty material deposited on the surface of the outwash and in which the upper part of the sola of these soils have developed. These soils have moderately developed to well developed textural B horizons. Mixed substratum phases of these soils were also mapped in Clinton County. In these phases the underlying outwash material is poorly sorted and contains considerable silt and clay with sand and gravel. A detailed technical description of only the Ockley profile is provided. Samples for laboratory analyses were not collected for any of the soils in this catena.

Williamsburg and Sardinia Series

The well drained Williamsburg and the moderately well drained Sardinia soils have developed in 30 inches or more of loess or silty alluvium over stratified loam, clay loam, or sandy clay loam outwash or terrace material located mainly in the Illinoian till area. They differ from the Fox and Ockley soils in having more strongly weathered profiles, greater depth of leaching, stronger maximum acidity in the profile, and possibly lower base status. For these reasons, they are discussed separately from the other soils that have developed in outwash material. Carbonates are generally at depths of more than 60 inches. Degradation of clay on the ped surfaces in the $B_2$ horizons is apparent. The maximum clay content of the $B_2$ horizon of the Williamsburg soils is considerably less than for the corresponding horizons in the Fox and Ockley soils.

Williamsburg and Sardinia soils are on terraces in the Illinoian till area, but the depth of leaching is much less than for soils derived from Illinoian material. They are more acid and have a greater depth to carbonates than soils derived from similar materials of Late Wisconsin age. It is possible that soils in the Williamsburg and Sardinia catena have developed in Early Wisconsin outwash material, as discussed by Kempton and Goldthwait (*7*), and defined by LaRocque and Forsyth (*9*). Considerable additional study of the relationships of this terrace material is needed in Clinton or adjacent counties.

Williamsburg silt loam (CT–72) has been selected for laboratory analysis and detailed profile description. This profile is very strongly acid in the $B_2$ horizon. Below the depth of 64 inches, the soil material is neutral in reaction, but carbonates do not occur until a depth of 84 inches. The stratified nature of the underlying material is apparent. The percentage of clay in the horizon of maximum clay accumulation is barely within range of a silty clay loam. The $B_{22}$ and $B_{23}$ horizons are so designated because they have a subangular blocky structure, even though they have developed in stratified material and have a variable content of clay. Degradation of the ped surfaces is evident from the brownish-yellow, dark yellowish-brown, dark grayish-brown, and light-gray streaks and mottles in the $B_{21}$ and $B_{22}$ horizons.

Uniontown and Henshaw Series

The moderately well drained Uniontown and the imperfectly drained Henshaw soils have developed in silty and loamy or silty clay loam, lacustrine or slack-water deposits. They are of limited extent in Clinton County and occur in association with the Bonpas soils. The Bonpas soils, the Humic-Gley member of this catena, are the predominant soils developed from this type of parent material in Clinton County. Henshaw silt loam (CT–1) was sampled as the representative soil for detailed description and laboratory analysis. The textural B horizon in this soil has a strong, angular blocky structure. The underlying parent material is calcareous, but it was not sampled. Mottles below the plow layer in the profile indicate that drainage is imperfect.

## GRAY-BROWN PODZOLIC SOILS INTERGRADING TO RED-YELLOW PODZOLIC SOILS

The Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils have developed under a deciduous forest in a warm, humid, temperate climate. The soils have strongly developed profiles that are deeper and generally more acid to a greater depth and have somewhat stronger chromas in the lower B horizon than the Gray-Brown Podzolic soils derived from comparable material.

Soils in this group have a thin, dark-colored $A_1$ horizon under virgin conditions and a light-colored, generally gray, pale-brown, or light yellowish-brown, eluviated $A_2$ horizon. They have a textural B horizon that is higher in clay than the $A_1$ and $A_2$ horizons, and higher in clay than the parent material. Eluviation of clay from the A horizon and possibly clayey residue, derived from the weathering of minerals in place, have contributed to this clay enrichment. The B horizon also has a greater chroma in which strong-brown and yellowish-brown colors are the most common. Grayish coatings of coarser texture are commonly found on the more prominent ped faces in the upper part of the B horizon. This horizon generally has moderately or strongly developed, subangular blocky structure in the upper part and medium or coarse, prismatic structure in the lower part. The lower part of this horizon is usually firm or very firm in place.

Soils in this group are usually strongly or very strongly acid in the lower A and well into the B horizon. The lower part of the B horizon is generally slightly acid. Base saturation in the lower A and in an appreciable part of the B horizon is between 20 and 35 percent, but it increases to 50 percent or more in the lower B. Such base saturation data is not shown in table 4 as it has not been determined for any of these soils in Clinton County. However, such information is available from determinations made on soils of the same series from Brown County, the adjacent county to the south.

#### Cincinnati and Rossmoyne Series

The well drained Cincinnati and the moderately well drained Rossmoyne are Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils. They are in a catena that includes soils of the Edenton, Avonburg, Clermont, and Blanchester series. All soils in this catena have developed in medium-texured, calcareous, Illinoian till overlain by a thin mantle of loess.

In Clinton County the Cincinnati and Rossmoyne soils are of limited extent, and only one profile of each series was analyzed. Cincinnati silt loam (CT–61) and Rossmoyne silt loam (CT–65) are representative of this great soil group. Profile descriptions and laboratory analyses are given in the section "Morphology and Composition of the Soils."

Evidence of the loess mantle that covers the Illinoian till is shown by sand content to a depth of about 30 to 32 inches. The pH values for these profiles show that they are strongly or very strongly acid well into the B horizon. The Rossmoyne soils have a fragipan in the lower part of the loess and in the upper part of the till.

### BRUNIZEM SOILS

Brunizem soils, formerly called Prairie soils, have developed under grass vegetation. They are dark colored and well drained to imperfectly drained. In these soils, the dark-colored surface horizon is more than 6 inches thick and relatively high in organic matter. The subsoil is brown or yellowish brown and is frequently mottled or incipiently gleyed in moderately well drained to imperfectly drained profiles. The horizons are not sharply separated; they have gradual or diffuse boundaries. The transitional horizons are usually several inches thick. Brunizem soils lack the $A_2$ horizon that is typical of the Gray-Brown Podzolic and Planosol great soil groups. Base saturation is generally above 50 percent. Smith, Allaway, and Riecken have described the Brunizem great soil group (*17*).

#### Raub Series

The imperfectly drained Raub soils are classified as Brunizems. Their extent is very limited in Clinton County. They are associated with and formed from the same parent material as the Russell, Xenia, and Fincastle soils. Soils of the Raub series are the Brunizem analog of the Gray-Brown Podzolic soils of the Fincastle series. The Raub soils have developed in medium-textured, calcareous till that is capped by more than 18 inches of silt, and they occur in the area of the Wisconsin glaciation. The dark-colored surface horizon has developed in the silt mantle, and the B horizon has developed in the silt and partly in the till. In Clinton County carbonates in the till are at depths generally less than 42 inches.

Limited areas of dark-colored Brunizem soils, in addition to the Raub soils, occur as inclusions in other mapping units. These areas were too small to delineate on the soil map and were included with the Celina, Crosby, and Xenia soils in mapping. If they had been larger, they would have been mapped as the Corwin, Odell, and Dana soils. Because of the small acreage of Brunizem soils in Clinton County, samples were not collected for laboratory analysis.

## *Intrazonal order*

Intrazonal soils have genetically related horizons that reflect a dominating influence of some local factor of relief or of parent material over the normal influences of the climate and the vegetation. Like the zonal soils, these soils also formed from materials that have been in place a long time. The materials, however, may be extreme in nature, as, for example, very fine textured or highly calcareous. Or the soils may develop where parent materials are not extreme but drainage is restricted by level topography. In Clinton County there are many nearly level areas where internal and external drainage are restricted and where geologic erosion is very slow. In addition, there are limited areas where the soils were derived from highly calcareous parent materials.

In Clinton County the great soil groups in the intrazonal order are Humic Gley, Low-Humic Gley, Planosol, and Rendzina.

### HUMIC GLEY SOILS

The Humic Gley soils are dark colored and have developed under conditions of a periodically high water table. They occupy nearly level or depressed areas, and they are the poorly or very poorly drained members of soil catenas. The native vegetation was swamp forest or marsh grasses, or both. Surface horizons are high to moderately high in organic matter. The subsoils show the effects of gleying and have mottled, drab horizons as the result of poor drainage. Humic Gley soils are less acid than the adjacent better drained soils. In most profiles, the surface horizons are neutral or slightly acid, and the lower parts of the solum are generally neutral or mildly alkaline. The base-saturation percentage is high, and it increases with depth. It is generally above 70 percent in the surface layer, and it is as low as 50 percent in only a few soils. The exchange capacity of Humic Gley soils is also higher than in associated Gray-Brown Podzolic soils. The characteristics of Humic Gley soils in Ohio have been discussed by Schafer and Holowaychuk (*15*).

Humic Gley soils are divided into two groups according to degree of translocation of clay in the profile or according to whether a textural B horizon has developed as the result of clay accumulation. The soil series that have developed textural B horizons are the Brookston, Kokomo, Millsdale, Bonpas, Ragsdale, and Westland. The characteristics of these series vary because of differences in the parent material from which they were formed and in the depth and dark color of the $A_1$ horizon.

The Sloan series is a Humic Gley soil that has weakly developed horizons and lacks the textural B horizon. It is considered to be an intergrade to the Alluvial great soil group.

#### Brookston Series

The very poorly drained Brookston soils are the Humic Gley members of two catenas. They comprise about 37 percent of the area of the catena that includes Miami soils, and about 17 percent of the area of the catena that includes the Russell soils. Variations in topography and relief account for the differences in extent of the Brookston soils in these two catenas. In Clinton County, the Brookston soils occupy a total of about 35,000 acres. The parent material of the Brookston soils is highly calcareous loamy till, of the Wisconsin glacial age, that has been capped, in part, by a thin mantle of silty material.

Two profiles of Brookston silty clay loam—CT–34, sampled in the catena that includes the Miami soils, and CT–51, sampled in the catena that includes the Russell soils—are representative of the Brookston series in Clinton County. The distribution of clay at various depths in these two profiles has been described by Schafer and Holowaychuk (*15*). Organic matter and pH values in the surface horizons are within the ranges that have been determined for medium- and fine-textured Humic Gley profiles in Ohio. The greater depth to carbonates in profile CT–51, in contrast to that in profile CT–34, is apparent from the data. The low sand content to the depth of 72 inches in profile CT–51 is evidence of the silty mantle overlying the loamy till. Profile CT–34 was sampled to a depth of 38+ inches in the C horizon; the loam-textured till underlying the solum was not sampled. The percentage of clay in the $A_p$, or $A_1$ horizon, compared to that in the $B_2$ horizon, shows a ratio of 0.81 for Brookston profile CT–51, and 0.92 for Brookston profile CT–34. This indicates that in Clinton County the textural profile is slightly better developed in the Brookston soil that was sampled on the catena that includes the Russell soils.

### Ragsdale Series

The very poorly drained Ragsdale soils are the Humic Gley soils in the catena that includes the moderately well drained Birkbeck and imperfectly drained Reesville soils. The soils in this catena have developed entirely in neutral or calcareous silt or silt loam material over till of Wisconsin glacial age. The silty mantle is thicker than that in which the Russell soils have developed. Ragsdale soils in Clinton County occupy approximately 10,000 acres. This is about 44 percent of the total area of the soils of the catena.

Ragsdale silty clay loam (CT–20, CT–S33), typical examples of the Ragsdale series, have been analyzed and described in detail. Schafer and Holowaychuk (*15*) have published a description and analysis of Ragsdale profile CT–S33, which is identified in their work as profile CT–S6.

Both of the Ragsdale profiles are low in sand, although profile CT–20 has much less sand than CT–S33. The calcareous till under the silty material was not sampled in either profile. Both profiles are slightly acid or neutral in the surface layer, and the pH increases with increase in depth to calcareous material. The base-saturation percentage of the surface layer is fairly high in profile CT–S33, and it increases with depth. This feature is typical in Humic Gley soils. Profile CT–S33 was sampled in a forested area rather than in a cultivated field. This is reflected in the high content of organic matter in the 6-inch $A_1$ horizon. The ratio of the clay in the surface layer to that in the $B_2$ horizon is 0.84 and 0.85 for the two Ragsdale profiles.

### Bonpas Series

The Bonpas series are Humic Gley soils in the catena that includes the Uniontown and the Henshaw series. They have developed in silt loam or silty clay loam lacustrine or slack-water deposits that were neutral or calcareous. These deposits are underlain by calcareous or neutral silty clay loam, clay loam, or loam material. This type of material accumulated in areas of the Late Wisconsin glaciation where ponding occurred, and also in parts of the Illinoian till plain that were covered by deposits of Wisconsin glacial age. In these areas, the Bonpas soils are predominant and cover about 95 percent of the acreage.

Bonpas silty clay loam (CT–44) was sampled along Anderson Fork where melt water from the Wisconsin glacier ponded in front of the Reesville moraine. Another sample of Bonpas silty clay loam (CT–50) was obtained on the Illinoian till plain, near the Cuba moraine, about one-half mile south of the Wisconsin glacial boundary. This profile apparently has developed in material that had been deposited after the Illinoian glaciation.

These Bonpas profiles exhibit typical characteristics of Humic Gley soils in color, gleying, and mottling, as well as in pH values and content of organic matter. Profile CT–50 is somewhat finer textured than CT–44. The $B_2$ and $B_3$ horizons of profile CT–50 have the texture of silty clay rather than that of silty clay loam. Profile CT–50 is underlain by neutral clay loam material, and it has much greater depth to carbonates than profile CT–44.

### Westland and Millsdale Series

The Westland and Millsdale soils are other Humic Gley soils in Clinton County that have developed textural B horizons. The Westland soils have developed from glacial outwash material of Wisconsin age. The mixed substratum phases of Westland soils differ in that the underlying material is poorly sorted sand and gravel, containing considerable quantities of silt and clay, rather than well-sorted outwash material. The Millsdale soils have developed in till over limestone. Both series are limited in extent in Clinton County and were not sampled during the survey.

### Sloan Series

The Sloan soils are Humic Gley soils that have developed in recent alluvium that washed from highly calcareous glacial drift and from soils that had developed in this material. The surface soil is dark colored, and the subsoil is gleyed and mottled. Horizons are weakly developed. Sloan silt loam (CT–47) is representative of this series and is described in detail. The texture variation in this profile appears to have been caused, in part, by stratification of the parent materials.

## LOW-HUMIC GLEY SOILS

The Low-Humic Gley group includes imperfectly drained to poorly drained soils that have very thin surface horizons, are moderately high in organic matter, and are underlain by mottled gray and brown, gleylike mineral horizons with a low degree of textural differentiation (*21*). In Clinton County, soils of this group are the moderately dark colored, poorly drained members of the catena in which they occur. They occupy nearly level or slightly depressed areas that have an excess of moisture most of the time in winter and spring and occasionally in other seasons. Mixed deciduous swamp forest or marshy meadow vegetation covered these sites before cultivation. In the virgin condition, these soils have a moderately dark, weakly or moderately granular $A_1$ horizon of medium depth. A weakly developed, gray, grayish-brown or dark-gray, mottled, weakly platy $A_2$ horizon is present in some of the soils of this group. Drab colors, considerably mottled, are characteristic of the B horizon of the Low-Humic Gley soils in the county. This horizon has a weak, prismatic primary structure that breaks into angular and subangular blocky units. Some clay enrichment in the B horizon is revealed by the coarser texture of the A horizon and the parent material.

Medium or strongly acid A and upper B horizons are characteristic of this group of soils. According to analyses of Low-Humic Gley soils from the adjoining county to the south (*3*), base saturation in the A and upper B horizons is frequently below 50 percent, but it increases markedly in the lower B.

The soils in Clinton County classified as Low-Humic Gley have a more pronounced concentration of clay in the subsurface horizons than is normal for this group. They are classified as Low-Humic Gley soils because the surface horizon is only moderately high in organic matter and the subsoil has gray, mottled, gleylike characteristics.

The Low-Humic Gley soils, compared with the Humic Gley, have an $A_1$ horizon that is shallower, is generally only 3 to 5 inches thick, and is dark gray instead of very dark gray or black. In addition, the Low-Humic Gley soils are more acid; they have a base saturation of less than 50 percent in the lower A and upper B horizons. In Humic Gley soils, the base saturation of the $A_1$ layer is appreciably more than 50 percent and increases with depth.

### Blanchester Series

The poorly drained Blanchester soils are classified as Low-Humic Gley soils in Clinton County. They have developed in calcareous Illinoian till covered by a shallow mantle of loess. Because these soils commonly occur in depressions, there is a possibility that some of the parent materials were derived from the adjoining slopes. Blanchester silt loam (CT–68) is considered to be representative of the series. It has been analyzed in the laboratory and is described in detail in the section "Morphology and Composition of the Soils."

## PLANOSOLS

In Clinton County the Planosols are characterized by a B horizon that contrasts with the A horizon rather sharply in texture, structure, and consistence.

Under virgin conditions these soils have a thin, very dark gray, granular $A_1$ horizon. The relatively thick, gray $A_2$ horizon is mottled with yellowish brown or light yellowish brown in the lower part and has a weak, platy or weak, fine, subangular blocky structure.

The B horizon has an appreciably greater concentration of clay than the A horizon. It has distinct or prominent mottling and a consistence that is very firm when moist and plastic when wet. It is massive or has a weakly developed prismatic structure that breaks to weak, subangular blocky structure. Gray, platy, silty coatings cap the upper parts of the prismatic units.

### Avonburg, Clermont, and Delmar Series

The imperfectly drained Avonburg and the poorly drained Clermont soils are Planosols in a catena of soils that has developed in Illinoian till covered by a shallow layer of loess. The poorly drained Delmar are Planosols in the catena containing the Russell and other soils. Representative soils for laboratory analyses and detailed descriptions are given for Avonburg silt loam (CT–66, CT–73) and Clermont silt loam (CT–49, CT–67). Samples for the Delmar series were not analyzed nor described, because of the small acreage in the county.

Pale-brown, yellowish-brown, and gray mottles are evidence of the poor drainage in these Planosols. The loess layer on the Illinoian till is evident from the low content of sand in the upper profile of these soils. The loess is 31 to 45 inches thick in the four profiles analyzed. Soil horizons that have developed in till are more dense than those that have developed in loess. The B horizon in these soils has a weak to moderate, prismatic structure.

These soils, to depths of 26 to 45 inches, have a pH of less than 5.0. The pH then increases with depth, and the soils are neutral in reaction at and below depths of 60 to 75 inches, except in sample CT–73. This sample is neutral below 34 inches. The exchangeable cations were determined for the Clermont profile, CT–49; base saturation values parallel those for the pH.

The surface and upper horizons of these soils are silt loam. The B horizons and till material are silty clay loam or clay loam. Till of loam texture was sampled at a depth below 100 inches in two of the profiles. Clermont profile, CT–67, has a finer textured subsoil than the other profiles. A buried soil profile, having a dark-gray $A_1$ horizon and a clay texture below a depth of 45 inches, is apparent in this profile.

## RENDZINA SOILS

Parent material dominates the soil-forming processes in the Rendzina soils. These soils are dark colored and are shallow or moderately shallow to calcareous parent material or to limestone. Horizon differentiation is lacking. The high base status of the parent material and the occurrence of these soils on steep slopes that are subject to geologic erosion have influenced their development.

### Fairmount and Rodman Series

The Fairmount and Rodman soils are classified as Rendzinas. Neither series was mapped separately in Clinton County, and both occur in complexes or in undifferentiated units associated with soils on steep slopes.

The Fairmount soils were derived from Ordovician limestone and calcareous shale. In this respect, they are intergrading to Lithosols. Fragments and outcrops of limestone are common in the profile. The Fairmount soils were mapped in association with the Edenton soils, which are classified as Gray-Brown Podzolic soils.

The Rodman soils are dark colored and shallow to the underlying, highly calcareous glacial outwash. In this respect, they are intergrading to Regosols. They are on steep slopes and are mapped with the Fox and the Casco soils, both of which are classified as Gray-Brown Podzolic soils.

Samples of the Fairmount and the Rodman series were not collected in Clinton County for analysis.

### *Azonal order*

The azonal order consists of soils that lack discernible, genetically related horizons because of youth, resistant parent material, or steep topography. Soils in this order may be forming in flood-plain material or other recently deposited sediment, which has been in place for too short a time to allow the differentiation of horizons other than accumulation of some organic material in the surface layer. The lack of genetically related horizons may also be caused by parent materials that are resistant to change, or by those that occupy steep slopes where removal of material through erosion keeps pace with horizon differentiation.

The great soil groups in the azonal order are: Alluvial soils and Regosols intergrading to Gray-Brown Podzolic soils.

#### ALLUVIAL SOILS

Alluvial soils are fairly important in Clinton County, and they occur on the flood plains of major streams and their tributaries. They are developing in recently deposited alluvium and may be frequently flooded and covered by new sediment. Little or no modification of the alluvium has taken place through the soil-forming processes. Consequently, the soils generally lack discernible horizons. However, some Alluvial soils have weakly developed $A_1$ or $A_p$ horizons because of the accumulation of small amounts of organic matter. Some Alluvial soils have mottles in the lower parts of the profile, which show that they are moderately well drained or imperfectly drained, but they have been changed little otherwise.

In Clinton County, the Alluvial soils have developed in alluvium that washed mainly from uplands and terraces that were underlain by calcareous drift of Wisconsin glacial age. A small part of the alluvium washed from local areas of Illinoian glacial age. The profile characteristics of Alluvial soils are determined mainly by the kinds of sediment. Some variations in the profile are caused by stratification, or differential deposition, of alluvium of various textures.

##### Genesee, Eel, and Shoals Series

The well drained Genesee, the moderately well drained Eel, and the imperfectly drained Shoals are classified as Alluvial soils. The Sloan series, classified in the Humic Gley group, is in the same catena.

The Genesee, Eel, and Shoals soils have developed in medium-textured alluvium, and they are very slightly acid to alkaline in reaction. These soils have slightly developed $A_1$ or $A_p$ horizons. Textural differences in the profile are caused mainly by stratification of the parent material. Differences in these series are caused by drainage characteristics. The soils of the Genesee series are unmottled, those of the Eel series are mottled in the lower part of the profile below depths of 16 to 24 inches, and those of the Shoals series are generally mottled below the surface layer. The Genesee and Eel series are about equal in extent in the county; the Shoals series is much less extensive. The sandy substratum phase of the Genesee series, also delineated in Clinton County, is developing in alluvium, which is underlain at depths of 20 to 36 inches by material that is coarser textured than typical for the series. A detailed technical description of Genesee loam, sandy substratum phase, is given, but soil samples were not collected for analysis.

##### Ross and Medway Series

The well drained Ross and the moderately well drained Medway soils occur in the same catena. They lack horizon differentiation but have darker surface layers and are slightly higher in organic matter than soils in the catena that contains the Genesee soils. These soils compare with Brunizems in color of surface soil and content of organic matter, but they lack profile development and have not formed B horizons. The poorer drainage of the Medway soils is revealed by mottles in the lower part of the profile.

A detailed technical description of Ross silt loam is given, but soil samples were not collected for laboratory analysis.

Medway silt loam (CT–71) has been analyzed and is described in detail. The sample for laboratory analysis was obtained in an area in which limestone bedrock is at a depth of 40 inches or more. In this location, the profile is stratified.

##### Algiers Series

The very poorly drained Algiers soils are Alluvial soils that have developed in 14 to 42 inches of light-colored alluvium underlain by dark-colored alluvium. Mottles in the light-colored alluvium indicate that this soil is poorly drained. Detailed description and laboratory analysis are not given for the Algiers series.

#### REGOSOLS INTERGRADING TO GRAY-BROWN PODZOLIC SOILS

The Regosols in Clinton County have developed in calcareous till. Because of their sloping positions, they have little or no profile development. They occur where runoff and erosion have prevented the degree of profile development that is common to the associated zonal soils.

As a rule, Regosols have an $A_1$ horizon that is comparable to that of the zonal soils in color and thickness. The B horizon, if present, has a brown or yellowish-brown color, but it does not exhibit any appreciable enrichment in clay or a moderate or strong development of structure. The B horizon is frequently absent, and calcareous till underlies the A horizon. This is called an A–C profile.

##### Hennepin Series

The Hennepin soils are classified as Regosols in Clinton County. They are on slopes of 18 percent, or more, and associated with the Miami or the Russell soils. They were mapped in undifferentiated units with either the Miami or the Russell soils. Laboratory analysis and detailed description of the Hennepin series are not given.

## Morphology and Composition of the Soils

This part of the report deals with technical profile descriptions and laboratory analyses of some of the representative soils in Clinton County. Technical profile descriptions are more detailed than those given in the section "Descriptions of the Soils." The data resulting from the analyses are given in table 4.

### *Profile descriptions of representative soils*

Soils were sampled in the field to obtain data for detailed profile descriptions and for laboratory analyses. Some soils were sampled in two locations. All sampled soils are identified by a set of letter-figure symbols, which are referred to throughout the section "Classification of the Soils" and in table 4, "Laboratory analyses of representative soils in Clinton County." The terminology used in the technical profile descriptions is in agreement with definitions in the Soil Survey Manual (*18*). Unless otherwise stated, colors are for moist soil.

TABLE 4.—*Laboratory analyses of*

[Dashed lines indicate

| Soil and sample number | Depth from surface | Horizon | Particle size distribution in millimeters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand 2–1 | Coarse sand 1–0.5 | Medium sand 0.5–0.25 | Fine sand 0.25–0.10 | Very fine sand 0.10–0.05 | Total sand | Silt 0.05–0.002 | Clay (less than 0.002) | Fine clay (less than 0.0002) |
| Avonburg silt loam: | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| CT-66 | 0–8 | $A_p$ | ---- | ---- | ---- | ---- | ---- | 15. 2 | 69. 1 | 15. 7 | ---- |
| | 8–11 | $A_{2g}$ | ---- | ---- | ---- | ---- | ---- | 9. 6 | 63. 5 | 26. 9 | ---- |
| | 11–17 | $B_{21g}$ | ---- | ---- | ---- | ---- | ---- | 6. 5 | 56. 3 | 37. 2 | ---- |
| | 17–26 | $B_{22g}$ | ---- | ---- | ---- | ---- | ---- | 7. 5 | 54. 8 | 37. 7 | ---- |
| | 26–36 | $B_{23gm}$ | ---- | ---- | ---- | ---- | ---- | 13. 1 | 50. 2 | 36. 7 | ---- |
| | 36–44 | $B_{24gm}$ | ---- | ---- | ---- | ---- | ---- | 22. 9 | 43. 6 | 33. 5 | ---- |
| | 44–50 | $B_{25g}$ | ---- | ---- | ---- | ---- | ---- | 21. 4 | 42. 9 | 35. 7 | ---- |
| | 50–60 | $B_{26g}$ | ---- | ---- | ---- | ---- | ---- | 23. 3 | 39. 2 | 37. 5 | ---- |
| | 60–70 | $B_{26g}$ | ---- | ---- | ---- | ---- | ---- | 21. 8 | 40. 6 | 37. 6 | ---- |
| | 70–80 | C | ---- | ---- | ---- | ---- | ---- | 23. 6 | 37. 9 | 38. 5 | ---- |
| | 80–90 | C | ---- | ---- | ---- | ---- | ---- | 26. 7 | 34. 5 | 38. 8 | ---- |
| | 90–100 | C | ---- | ---- | ---- | ---- | ---- | 25. 1 | 36. 3 | 38. 6 | ---- |
| CT-73 | 0–5 | $A_{p1}$ | 2. 1 | 2. 5 | 2. 3 | 4. 1 | 3. 8 | 14. 8 | 72. 2 | 13. 0 | 2. 6 |
| | 5–9 | $A_{p2}$ | 1. 5 | 1. 8 | 1. 7 | 2. 9 | 3. 2 | 11. 1 | 65. 7 | 23. 2 | 8. 5 |
| | 9–14½ | $B_{1g}$ | . 4 | 1. 6 | 1. 5 | 2. 0 | 3. 3 | 8. 8 | 62. 4 | 28. 8 | 11. 6 |
| | 14½–26 | $B_{21g}$ | . 3 | 1. 2 | 1. 2 | 2. 3 | 2. 2 | 7. 2 | 58. 0 | 34. 8 | 19. 6 |
| | 26–34 | $B_{22gm}$ | . 3 | 1. 2 | 1. 5 | 3. 0 | 3. 5 | 9. 5 | 65. 2 | 25. 3 | 11. 8 |
| | 34–42 | $B_{23gm}$ | 1. 2 | 3. 1 | 4. 3 | 6. 8 | 11. 0 | 26. 4 | 45. 9 | 27. 7 | 12. 1 |
| | 42–53 | $B_{24gm}$ | . 7 | 2. 6 | 3. 8 | 8. 0 | 8. 1 | 23. 2 | 48. 2 | 28. 6 | 13. 5 |
| | 53–72 | $B_{31}$ | 1. 3 | 2. 9 | 4. 0 | 8. 4 | 9. 0 | 25. 6 | 39. 9 | 34. 5 | 17. 5 |
| | 72–92 | $B_{32}$ | 1. 5 | 4. 4 | 5. 1 | 8. 8 | 9. 2 | 29. 0 | 34. 4 | 36. 6 | 19. 2 |
| | 92–120 | $C_1$ | 1. 6 | 3. 4 | 5. 1 | 9. 7 | 10. 3 | 30. 1 | 36. 3 | 33. 6 | 15. 2 |
| | 120 | $C_2$ | 2. 5 | 4. 8 | 6. 2 | 10. 1 | 12. 0 | 35. 6 | 38. 8 | 25. 6 | 10. 7 |
| Birkbeck silt loam: | | | | | | | | | | | |
| CT-5 | 0–7 | $A_p$ | ---- | . 9 | 1. 5 | 1. 0 | 10. 9 | 14. 3 | 73. 6 | 12. 1 | 2. 7 |
| | 7–11 | $A_2$ | ---- | . 7 | . 7 | . 5 | 7. 2 | 9. 1 | 67. 1 | 23. 8 | 9. 3 |
| | 11–13 | $B_1$ | ---- | . 7 | . 8 | . 5 | 4. 5 | 6. 5 | 62. 9 | 30. 6 | 15. 6 |
| | 13–21 | $B_2$ | ---- | . 4 | . 9 | . 7 | 3. 4 | 5. 4 | 61. 9 | 32. 7 | 18. 2 |
| | 21–25 | $B_3$ | ---- | . 4 | 1. 1 | . 9 | 3. 8 | 6. 2 | 66. 1 | 27. 7 | 13. 5 |
| | 25–31 | $C_1$ | ---- | . 6 | 1. 1 | . 9 | 5. 2 | 7. 8 | 74. 8 | 17. 4 | 8. 2 |
| | 33–36 | $C_2$ | ---- | 1. 2 | 2. 4 | 1. 3 | 4. 0 | 8. 9 | 74. 3 | 16. 8 | 5. 3 |
| | 56–59 | $C_2$ | ---- | 1. 5 | 1. 4 | 1. 0 | 3. 6 | 7. 5 | 68. 8 | 23. 7 | 6. 3 |
| | 70–80 | $C_2$ | ---- | . 3 | 1. 3 | 1. 4 | 7. 0 | 10. 0 | 63. 7 | 26. 3 | 7. 1 |
| | 90–96 | $C_2$ | ---- | . 1 | . 5 | . 5 | 3. 9 | 5. 0 | 64. 9 | 30. 1 | 8. 0 |
| | 100–120 | D | ---- | 3. 3 | 3. 9 | 4. 4 | 24. 5 | 36. 1 | 51. 2 | 12. 7 | 3. 3 |
| CT-S9 | 0–2½ | $A_1$ | ---- | ---- | ---- | ---- | ---- | 11. 4 | 73. 1 | 15. 5 | ---- |
| | 2½–7½ | $A_2$ | ---- | ---- | ---- | ---- | ---- | 12. 3 | 72. 6 | 15. 1 | ---- |
| | 7½–12 | $B_1$ | ---- | ---- | ---- | ---- | ---- | 12. 5 | 66. 9 | 20. 6 | ---- |
| | 12–17 | $B_{21}$ | ---- | ---- | ---- | ---- | ---- | 10. 0 | 53. 5 | 26. 5 | ---- |
| | 17–27 | $B_{22}$ | ---- | ---- | ---- | ---- | ---- | 19. 8 | 51. 8 | 28. 4 | ---- |
| | 27–36 | $B_{23}$ | ---- | ---- | ---- | ---- | ---- | 16. 7 | 55. 9 | 26. 4 | ---- |
| | 36–44 | $B_3$ | ---- | ---- | ---- | ---- | ---- | 6. 3 | 70. 6 | 23. 1 | ---- |
| | 44–56 | C | ---- | ---- | ---- | ---- | ---- | 9. 0 | 79. 1 | 11. 9 | ---- |
| | 56–90 | D | ---- | ---- | ---- | ---- | ---- | 28. 5 | 49. 0 | 22. 5 | ---- |
| | 68 | D | ---- | ---- | ---- | ---- | ---- | 35. 2 | 45. 1 | 19. 7 | ---- |
| Blanchester silt loam: | | | | | | | | | | | |
| CT-68 | 0–7 | $A_p$ | . 5 | 1. 6 | 2. 8 | 6. 4 | 6. 3 | 17. 6 | 55. 5 | 26. 9 | 12. 1 |
| | 7–17 | $B_{1g}$ | . 7 | 2. 1 | 4. 6 | 8. 9 | 7. 2 | 23. 5 | 43. 9 | 32. 6 | 12. 6 |
| | 17–22 | $B_{21g}$ | . 9 | 2. 2 | 4. 5 | 9. 2 | 7. 5 | 24. 3 | 46. 0 | 29. 7 | 11. 7 |
| | 22–27 | $B_{21g}$ | . 9 | 2. 7 | 4. 5 | 9. 5 | 7. 7 | 25. 3 | 43. 5 | 31. 2 | 13. 7 |
| | 27–36 | $B_{22g}$ | . 7 | 2. 2 | 4. 1 | 9. 0 | 7. 3 | 23. 3 | 40. 5 | 36. 2 | 18. 2 |
| | 36–46 | $B_{23g}$ | 1. 0 | 2. 2 | 4. 0 | 9. 1 | 7. 0 | 23. 3 | 35. 9 | 40. 8 | 23. 6 |
| | 46–58 | $B_{24g}$ | . 9 | 1. 8 | 3. 3 | 7. 9 | 7. 7 | 21. 6 | 29. 6 | 48. 8 | 29. 8 |
| | 58–69 | $B_{24g}$ | 2. 1 | 3. 4 | 4. 0 | 7. 7 | 7. 5 | 24. 7 | 30. 1 | 45. 2 | 23. 0 |
| | 72–76 | $B_3$ | 1. 7 | 3. 6 | 4. 1 | 7. 4 | 6. 8 | 23. 6 | 32. 4 | 44. 0 | 20. 6 |
| | 76–86 | $D_1$ | . 4 | . 9 | 1. 1 | 2. 5 | 2. 3 | 7. 2 | 37. 1 | 55. 7 | 21. 9 |

*representative soils in Clinton County*

analyses were not made]

| pH | Organic matter | Nitrogen | $CaCO_3$ equivalent | Exchangeable cations: H | Exchangeable cations: Ca | Exchangeable cations: Mg | Exchangeable cations: K | Sum exchangeable cations | Total bases | Base saturation |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *Percent* |
| 6. 6 | 2. 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 0 | . 7 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. 5 | . 3 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. 5 | . 3 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. 5 | . 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. 5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 4 | --- | --- | 1. 6 | --- | --- | --- | --- | --- | --- | --- |
| 7. 5 | --- | --- | . 9 | --- | --- | --- | --- | --- | --- | --- |
| 7. 1 | --- | --- | . 9 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 6. 2 | 1. 5 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. 4 | . 4 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. 4 | . 2 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. 6 | . 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. 1 | . 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 4 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 3 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 8 | --- | --- | 5. 9 | --- | --- | --- | --- | --- | --- | --- |
| 7. 9 | --- | --- | 7. 6 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 7. 1 | 1. 9 | . 11 | --- | 2. 8 | 6. 4 | 2. 4 | 0. 11 | 11. 7 | 8. 9 | 76 |
| 7. 0 | . 6 | . 04 | --- | 4. 0 | 6. 4 | 3. 6 | . 12 | 14. 1 | 10. 1 | 72 |
| 5. 8 | . 6 | . 05 | --- | 7. 2 | 7. 4 | 5. 4 | . 20 | 20. 2 | 13. 0 | 64 |
| 6. 4 | . 6 | . 05 | --- | 5. 6 | 9. 2 | 7. 8 | . 20 | 22. 8 | 17. 2 | 76 |
| 7. 7 | --- | . 04 | 9. 2 | 2. 8 | 10. 5 | 8. 8 | . 21 | 22. 3 | 19. 5 | 87 |
| 8. 0 | --- | --- | 25. 9 | --- | --- | --- | --- | --- | --- | --- |
| 8. 2 | --- | --- | 30. 9 | --- | --- | --- | --- | --- | --- | --- |
| 8. 2 | --- | --- | 29. 1 | --- | --- | --- | --- | --- | --- | --- |
| 8. 2 | --- | --- | 29. 1 | --- | --- | --- | --- | --- | --- | --- |
| 8. 1 | --- | --- | 29. 2 | --- | --- | --- | --- | --- | --- | --- |
| 8. 1 | --- | --- | 34. 8 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 6. 7 | 9. 0 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. 5 | 1. 4 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 2 | . 8 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 2 | . 6 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 3 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 6 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. 5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 8. 4 | --- | --- | 27. 7 | --- | --- | --- | --- | --- | --- | --- |
| 8. 4 | --- | --- | 31. 3 | --- | --- | --- | --- | --- | --- | --- |
| 8. 1 | --- | --- | 31. 4 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 6. 5 | 3. 9 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 7 | 2. 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 4 | 1. 2 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 4 | 1. 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 5 | . 8 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. 7 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. 5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. 9 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. 5 | --- | --- | 10. 1 | --- | --- | --- | --- | --- | --- | --- |

TABLE 4.—*Laboratory analyses of*

| Soil and sample number | Depth from surface | Horizon | Particle size distribution in millimeters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand 2–1 | Coarse sand 1–0.5 | Medium sand 0.5–0.25 | Fine sand 0.25–0.10 | Very fine sand 0.10–0.05 | Total sand | Silt 0.05–0.002 | Clay (less than 0.002) | Fine clay (less than 0.0002) |
| | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Bonpas silty clay loam: | | | | | | | | | | | |
| CT-44 | 0–7 | $A_{1p}$ | ------ | ------ | ------ | ------ | ------ | 10. 2 | 56. 2 | 33. 6 | ------ |
| | 7–10 | $A_{12}$ | ------ | ------ | ------ | ------ | ------ | 10. 2 | 56. 8 | 33. 0 | ------ |
| | 10–15 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 9. 7 | 54. 8 | 35. 5 | ------ |
| | 15–20 | $B_{22g}$ | ------ | ------ | ------ | ------ | ------ | 10. 3 | 56. 1 | 33. 6 | ------ |
| | 20–38 | $B_{23g}$ | ------ | ------ | ------ | ------ | ------ | 9. 5 | 56. 2 | 34. 3 | ------ |
| | 38+ | C | ------ | ------ | ------ | ------ | ------ | 10. 0 | 61. 8 | 28. 2 | ------ |
| CT-50 | 0–7 | $A_{1p}$ | ------ | ------ | ------ | ------ | ------ | 10. 1 | 54. 9 | 35. 0 | ------ |
| | 7–20 | $A_{12}$ | ------ | ------ | ------ | ------ | ------ | 10. 1 | 47. 7 | 42. 2 | ------ |
| | 20–30 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 10. 0 | 46. 8 | 43. 2 | ------ |
| | 30–36 | $B_{22g}$ | ------ | ------ | ------ | ------ | ------ | 10. 6 | 46. 9 | 42. 5 | ------ |
| | 36–46 | $B_{23g}$ | ------ | ------ | ------ | ------ | ------ | 8. 9 | 47. 6 | 43. 5 | ------ |
| | 46–64 | $B_{3g}$ | ------ | ------ | ------ | ------ | ------ | 12. 9 | 51. 7 | 35. 4 | ------ |
| | 64–80 | $D_1$ | ------ | ------ | ------ | ------ | ------ | 25. 4 | 41. 6 | 33. 0 | ------ |
| | 80–90 | $D_2$ | ------ | ------ | ------ | ------ | ------ | 28. 4 | 39. 8 | 31. 8 | ------ |
| | 90–102 | $D_3$ | ------ | ------ | ------ | ------ | ------ | 29. 2 | 42. 2 | 28. 6 | ------ |
| | 102+ | $D_4$ | ------ | ------ | ------ | ------ | ------ | 34. 4 | 40. 6 | 25. 0 | ------ |
| Brookston silty clay loam: | | | | | | | | | | | |
| CT-34 | 0–8 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 10. 3 | 52. 1 | 37. 6 | ------ |
| | 8–12 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 10. 1 | 48. 9 | 41. 0 | ------ |
| | 12–16 | $B_{22g}$ | ------ | ------ | ------ | ------ | ------ | 10. 7 | 49. 8 | 39. 5 | ------ |
| | 16–28 | $B_{23g}$ | ------ | ------ | ------ | ------ | ------ | 10. 2 | 50. 4 | 39. 4 | ------ |
| | 28–38 | $B_3C$ | ------ | ------ | ------ | ------ | ------ | 12. 9 | 59. 7 | 27. 4 | ------ |
| | 38+ | C | ------ | ------ | ------ | ------ | ------ | 16. 6 | 50. 9 | 32. 5 | ------ |
| CT-51 | 0–9 | $A_{1p}$ | ------ | ------ | ------ | ------ | ------ | 4. 7 | 66. 5 | 28. 8 | ------ |
| | 9–14 | $A_{12}$ | ------ | ------ | ------ | ------ | ------ | 6. 1 | 60. 2 | 33. 7 | ------ |
| | 14–20 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 6. 7 | 57. 9 | 35. 4 | ------ |
| | 20–35 | $B_{22g}$ | ------ | ------ | ------ | ------ | ------ | 5. 8 | 62. 4 | 31. 8 | ------ |
| | 35–48 | $B_{31g}$ | ------ | ------ | ------ | ------ | ------ | 5. 1 | 66. 4 | 28. 5 | ------ |
| | 48–72 | $B_{32g}$ | ------ | ------ | ------ | ------ | ------ | 5. 8 | 63. 5 | 30. 7 | ------ |
| | 72+ | C | ------ | ------ | ------ | ------ | ------ | 31. 4 | 45. 7 | 22. 9 | ------ |
| Celina silt loam: | | | | | | | | | | | |
| CT-12 | 0–1½ | $A_1$ | ------ | ------ | ------ | ------ | ------ | 26. 2 | 63. 6 | 10. 9 | ------ |
| | 1½–3 | $A_{21}$ | ------ | ------ | ------ | ------ | ------ | 28. 0 | 62. 9 | 9. 1 | ------ |
| | 3–5 | $A_{22}$ | ------ | ------ | ------ | ------ | ------ | 27. 3 | 60. 1 | 12. 6 | ------ |
| | 5–11 | $B_1$ | ------ | ------ | ------ | ------ | ------ | 24. 1 | 49. 2 | 26. 7 | ------ |
| | 11–17 | $B_2$ | ------ | ------ | ------ | ------ | ------ | 20. 3 | 37. 4 | 42. 3 | ------ |
| | 17–20 | $C_1$ | ------ | ------ | ------ | ------ | ------ | 29. 7 | 43. 0 | 27. 3 | ------ |
| | 28–32 | $C_2$ | ------ | ------ | ------ | ------ | ------ | 38. 0 | 44. 4 | 17. 6 | ------ |
| | 38–42 | $C_3$ | ------ | ------ | ------ | ------ | ------ | 27. 8 | 52. 9 | 19. 3 | ------ |
| CT-40 | 0–8 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 27. 7 | 57. 0 | 15. 3 | ------ |
| | 8–12 | $B_1$ | ------ | ------ | ------ | ------ | ------ | 21. 3 | 48. 9 | 29. 8 | ------ |
| | 12–20 | $B_2$ | ------ | ------ | ------ | ------ | ------ | 16. 1 | 39. 0 | 44. 9 | ------ |
| | 20–25 | $B_3C_1$ | ------ | ------ | ------ | ------ | ------ | 25. 3 | 47. 1 | 27. 6 | ------ |
| | 25–28 | $C_2$ | ------ | ------ | ------ | ------ | ------ | 32. 1 | 48. 1 | 19. 8 | ------ |
| | 40–44 | $C_3$ | ------ | ------ | ------ | ------ | ------ | 32. 1 | 47. 1 | 20. 8 | ------ |
| Cincinnati silt loam: | | | | | | | | | | | |
| CT-61 | 0–7 | $A_{p1}$ | ------ | ------ | ------ | ------ | ------ | 15. 7 | 66. 8 | 17. 5 | ------ |
| | 7–10 | $A_{p2}$ | ------ | ------ | ------ | ------ | ------ | 15. 4 | 68. 5 | 16. 1 | ------ |
| | 10–17 | $A_2$ | ------ | ------ | ------ | ------ | ------ | 12. 1 | 64. 5 | 23. 4 | ------ |
| | 17–30 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 9. 6 | 58. 1 | 32. 3 | ------ |
| | 30–36 | $B_{22}$ | ------ | ------ | ------ | ------ | ------ | 18. 9 | 51. 1 | 30. 0 | ------ |
| | 36–56 | $B_{23}$ | ------ | ------ | ------ | ------ | ------ | 26. 7 | 42. 3 | 31. 0 | ------ |
| | 56–59 | $B_{23}$ | ------ | ------ | ------ | ------ | ------ | 33. 5 | 34. 5 | 32. 0 | ------ |
| | 67–70 | $B_{23}$ | ------ | ------ | ------ | ------ | ------ | 34. 7 | 33. 6 | 31. 7 | ------ |
| | 77–80 | $B_{23}$ | ------ | ------ | ------ | ------ | ------ | 33. 3 | 32. 2 | 34. 5 | ------ |
| | 80–83 | C–D | ------ | ------ | ------ | ------ | ------ | 20. 7 | 28. 6 | 50. 7 | ------ |
| | 89–91 | C–D | ------ | ------ | ------ | ------ | ------ | 20. 1 | 28. 9 | 51. 0 | ------ |
| | 93–106 | $D_r$ | ------ | ------ | ------ | ------ | ------ | 6. 0 | 26. 4 | 67. 6 | ------ |

*representative soils in Clinton County*—Continued

| pH | Organic matter | Nitrogen | $CaCO_3$ equivalent | Exchangeable cations: H | Exchangeable cations: Ca | Exchangeable cations: Mg | Exchangeable cations: K | Sum exchangeable cations | Total bases | Base saturation |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *Percent* |
| 6. 1 | 4. 6 | | | | | | | | | |
| 6. 2 | 5. 0 | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 7. 0 | | | | | | | | | | |
| 7. 6 | | | 1. 8 | | | | | | | |
| 7. 7 | | | 9. 5 | | | | | | | |
| | | | | | | | | | | |
| 6. 7 | 3. 2 | | | | | | | | | |
| 6. 4 | 2. 2 | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 7. 0 | | | | | | | | | | |
| 7. 1 | | | | | | | | | | |
| 7. 2 | | | | | | | | | | |
| 7. 6 | | | 12. 8 | | | | | | | |
| | | | | | | | | | | |
| 7. 0 | 4. 9 | | | | | | | | | |
| 6. 8 | 2. 9 | | | | | | | | | |
| 6. 9 | | | | | | | | | | |
| 7. 2 | | | | | | | | | | |
| 7. 7 | | | 9. 4 | | | | | | | |
| 7. 9 | | | 27. 2 | | | | | | | |
| | | | | | | | | | | |
| 6. 7 | 4. 6 | | | | | | | | | |
| 6. 5 | 5. 0 | | | | | | | | | |
| 6. 8 | 2. 9 | | | | | | | | | |
| 7. 1 | | | | | | | | | | |
| 7. 4 | | | 1. 4 | | | | | | | |
| 7. 4 | | | 1. 0 | | | | | | | |
| 7. 7 | | | 11. 8 | | | | | | | |
| | | | | | | | | | | |
| 6. 7 | 6. 4 | | | | | | | | | |
| 6. 4 | 5. 1 | | | | | | | | | |
| 6. 3 | 3. 5 | | | | | | | | | |
| 5. 9 | | | | | | | | | | |
| 6. 6 | | | | | | | | | | |
| 7. 5 | | | 22. 6 | | | | | | | |
| 8. 1 | | | 38. 8 | | | | | | | |
| 8. 2 | | | 33. 6 | | | | | | | |
| | | | | | | | | | | |
| 6. 2 | 1. 6 | | | | | | | | | |
| 5. 6 | | | | | | | | | | |
| 6. 2 | | | | | | | | | | |
| 7. 5 | | | 24. 6 | | | | | | | |
| 7. 9 | | | 39. 8 | | | | | | | |
| 8. 2 | | | 40. 1 | | | | | | | |
| | | | | | | | | | | |
| 6. 7 | 1. 9 | | | | | | | | | |
| 6. 5 | 1. 9 | | | | | | | | | |
| 5. 3 | . 7 | | | | | | | | | |
| 4. 8 | . 3 | | | | | | | | | |
| 4. 9 | . 1 | | | | | | | | | |
| | | | | | | | | | | |
| 4. 8 | | | | | | | | | | |
| 4. 8 | | | | | | | | | | |
| 4. 9 | | | | | | | | | | |
| 5. 0 | | | | | | | | | | |
| 5. 3 | | | | | | | | | | |
| 6. 5 | | | | | | | | | | |
| 6. 3 | | | | | | | | | | |

600034—62——5

TABLE 4.—*Laboratory analyses of*

| Soil and sample number | Depth from surface | Horizon | Particle size distribution in millimeters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand 2–1 | Coarse sand 1–0.5 | Medium sand 0.5–0.25 | Fine sand 0.25–0.10 | Very fine sand 0.10–0.05 | Total sand | Silt 0.05–0.002 | Clay (less than 0.002) | Fine clay (less than 0.0002) |
| | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Clermont silt loam: | | | | | | | | | | | |
| CT-49 | 0–6 | $A_p$ | 0. 9 | 1. 8 | 1. 2 | 5. 3 | 4. 2 | 13. 4 | 69. 3 | 17. 3 | 6. 2 |
| | 6–9 | $A_{21}$ | . 6 | 1. 4 | . 9 | 4. 4 | 4. 3 | 11. 6 | 70. 3 | 18. 1 | 7. 1 |
| | 9–14 | $A_{22g}$ | . 7 | 1. 4 | 1. 0 | 4. 0 | 3. 7 | 10. 8 | 68. 0 | 21. 1 | 8. 6 |
| | 14–23 | $B_{1g}$ | . 3 | 1. 1 | . 7 | 3. 3 | 3. 1 | 8. 5 | 63. 1 | 28. 4 | 14. 1 |
| | 23–31 | $B_{21g}$ | 1. 2 | 1. 8 | 2. 0 | 3. 6 | 2. 0 | 10. 8 | 57. 2 | 32. 0 | 17. 4 |
| | 31–48 | $B_{22g}$ | . 6 | 1. 6 | 1. 5 | 8. 2 | 7. 7 | 19. 6 | 41. 5 | 38. 9 | 19. 0 |
| | 48–63 | $B_{23g}$ | . 5 | 1. 5 | 1. 6 | 8. 9 | 8. 1 | 20. 6 | 46. 4 | 33. 0 | 21. 5 |
| | 63–76 | $B_{24g}$ | . 4 | 1. 3 | 1. 3 | 9. 9 | 9. 7 | 22. 6 | 42. 4 | 35. 0 | 21. 7 |
| | 76–90 | $B_{31}$ | . 5 | 1. 7 | 1. 6 | 8. 5 | 8. 6 | 20. 9 | 41. 6 | 37. 5 | 21. 6 |
| | 90–104 | $B_{31}$ | . 6 | 2. 1 | 2. 0 | 10. 8 | 8. 9 | 24. 4 | 41. 6 | 34. 0 | 17. 6 |
| | 104–127 | $B_{32}$ | 1. 6 | 4. 4 | 3. 7 | 14. 6 | 9. 7 | 34. 0 | 40. 2 | 25. 8 | 11. 4 |
| CT-67 | 0–8 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 14. 9 | 62. 1 | 23. 0 | ------ |
| | 8–11 | $A_{2g}$ | ------ | ------ | ------ | ------ | ------ | 11. 1 | 62. 8 | 26. 1 | ------ |
| | 11–20 | $B_{1g}$ | ------ | ------ | ------ | ------ | ------ | 6. 3 | 56. 3 | 37. 4 | ------ |
| | 20–30 | $B_{21g}$ | ------ | ------ | ------ | ------ | ------ | 5. 5 | 50. 8 | 43. 7 | ------ |
| | 30–45 | $B_{22g}$ | ------ | ------ | ------ | ------ | ------ | 6. 8 | 52. 5 | 40. 7 | ------ |
| | 45–54 | $A_{1b}$ | ------ | ------ | ------ | ------ | ------ | 13. 8 | 40. 3 | 45. 9 | ------ |
| | 54–65 | $B_{21gb}$ | ------ | ------ | ------ | ------ | ------ | 12. 1 | 41. 6 | 46. 3 | ------ |
| | 65–75 | $B_{22gb}$ | ------ | ------ | ------ | ------ | ------ | 20. 7 | 34. 1 | 45. 2 | ------ |
| | 75–79 | $B_{22gb}$ | ------ | ------ | ------ | ------ | ------ | 23. 7 | 31. 3 | 45. 0 | ------ |
| | 79–83 | C | ------ | ------ | ------ | ------ | ------ | 6. 1 | 33. 1 | 60. 8 | ------ |
| | 83–86 | $D_r$ | ------ | ------ | ------ | ------ | ------ | 31. 9 | 39. 3 | 28. 8 | ------ |
| Crosby silt loam: | | | | | | | | | | | |
| CT-14 | 0–9 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 23. 4 | 57. 5 | 19. 1 | ------ |
| | 9–12 | $B_1$ | ------ | ------ | ------ | ------ | ------ | 7. 6 | 54. 0 | 38. 4 | ------ |
| | 12–18 | $B_2$ | ------ | ------ | ------ | ------ | ------ | 17. 9 | 38. 3 | 43. 8 | ------ |
| | 18–23 | $B_3C_1$ | ------ | ------ | ------ | ------ | ------ | 19. 9 | 46. 2 | 33. 9 | ------ |
| | 31–35 | $C_2$ | ------ | ------ | ------ | ------ | ------ | 26. 6 | 43. 5 | 29. 9 | ------ |
| | 40–45 | $C_3$ | ------ | ------ | ------ | ------ | ------ | 30. 7 | 47. 6 | 21. 7 | ------ |
| CT-38 | 0–8 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 19. 9 | 60. 2 | 19. 9 | ------ |
| | 8–12 | $B_1$ | ------ | ------ | ------ | ------ | ------ | 14. 0 | 48. 6 | 37. 4 | ------ |
| | 12–19 | $B_2$ | ------ | ------ | ------ | ------ | ------ | 15. 4 | 42. 4 | 42. 2 | ------ |
| | 19–23 | $B_3C_1$ | ------ | ------ | ------ | ------ | ------ | 17. 9 | 44. 7 | 37. 4 | ------ |
| | 23–27 | $C_2$ | ------ | ------ | ------ | ------ | ------ | 31. 7 | 47. 5 | 20. 8 | ------ |
| | 38–42 | $C_2$ | ------ | ------ | ------ | ------ | ------ | 32. 3 | 47. 6 | 20. 1 | ------ |
| Fincastle silt loam: | | | | | | | | | | | |
| CT-24 | 0–9 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 14. 6 | 70. 6 | 14. 8 | ------ |
| | 9–12 | $A_2$ | ------ | ------ | ------ | ------ | ------ | 10. 3 | 65. 2 | 24. 5 | ------ |
| | 12–16 | $B_1$ | ------ | ------ | ------ | ------ | ------ | 6. 3 | 56. 0 | 37. 7 | ------ |
| | 16–21 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 6. 0 | 54. 2 | 39. 8 | ------ |
| | 21–28 | $B_{22}$ | ------ | ------ | ------ | ------ | ------ | 7. 3 | 51. 6 | 41. 1 | ------ |
| | 28–33 | $B_3$ | ------ | ------ | ------ | ------ | ------ | 13. 9 | 47. 6 | 38. 5 | ------ |
| | 33–38 | C | ------ | ------ | ------ | ------ | ------ | 26. 3 | 50. 3 | 23. 4 | ------ |
| CT-27 | 0–8 | $A_p$ | ------ | ------ | ------ | ------ | ------ | 7. 3 | 74. 1 | 18. 6 | ------ |
| | 8–14 | $B_1$ | ------ | ------ | ------ | ------ | ------ | 4. 1 | 71. 7 | 24. 2 | ------ |
| | 14–22 | $B_{21}$ | ------ | ------ | ------ | ------ | ------ | 3. 2 | 63. 6 | 33. 2 | ------ |
| | 22–29 | $B_{22}$ | ------ | ------ | ------ | ------ | ------ | 5. 5 | 63. 5 | 31. 0 | ------ |
| | 29–36 | $B_3$ | ------ | ------ | ------ | ------ | ------ | 17. 5 | 55. 9 | 26. 6 | ------ |
| | 36–40 | C | ------ | ------ | ------ | ------ | ------ | 34. 1 | 45. 2 | 20. 7 | ------ |
| Henshaw silt loam: | | | | | | | | | | | |
| CT-1 | 0–10 | $A_p$ | ------ | 1. 1 | 1. 7 | 1. 6 | 8. 3 | 12. 7 | 69. 9 | 17. 4 | 7. 0 |
| | 10–14 | $A_2$ | ------ | . 2 | . 8 | 1. 0 | 6. 5 | 8. 5 | 63. 0 | 28. 5 | 13. 4 |
| | 14–20 | $B_{21}$ | ------ | . 4 | . 9 | . 7 | 5. 1 | 7. 1 | 58. 2 | 34. 7 | 19. 4 |
| | 20–34 | $B_{22}$ | ------ | . 6 | 1. 2 | . 6 | 3. 7 | 6. 1 | 57. 5 | 36. 4 | 21. 8 |
| | 34–46 | C | ------ | 1. 1 | . 9 | . 6 | 6. 0 | 9. 6 | 66. 1 | 24. 3 | 12. 9 |
| Medway silt loam: | | | | | | | | | | | |
| CT-71 | 0–7 | $A_p$ | 1. 1 | 1. 9 | 3. 5 | 8. 1 | 7. 2 | 21. 8 | 50. 5 | 27. 7 | 5. 4 |
| | 7–13 | $C_1$ | . 2 | 2. 5 | 1. 4 | 27. 8 | 25. 2 | 57. 1 | 31. 1 | 11. 8 | 3. 1 |
| | 13–22 | $C_2$ | . 1 | 2. 5 | 14. 4 | 32. 6 | 15. 8 | 65. 4 | 24. 9 | 9. 7 | 2. 7 |
| | 22–31 | $C_3$ | . 2 | 2. 7 | 15. 4 | 34. 0 | 15. 0 | 67. 3 | 20. 9 | 11. 8 | 4. 6 |

*representative soils in Clinton County*—Continued

| pH | Organic matter | Nitrogen | $CaCO_3$ equivalent | Exchangeable cations | | | | Sum exchangeable cations | Total bases | Base saturation |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | H | Ca | Mg | K | | | |
| | *Percent* | *Percent* | *Percent* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *Percent* |
| 6. 9 | 2. 5 | . 10 | | 4. 4 | 8. 7 | . 7 | . 06 | 13. 9 | 9. 5 | 68 |
| 5. 0 | 1. 1 | . 05 | | 7. 9 | 2. 2 | . 6 | . 03 | 10. 7 | 2. 8 | 28 |
| 4. 8 | . 8 | . 03 | | 9. 5 | 1. 7 | 1. 1 | . 05 | 12. 4 | 2. 9 | 23 |
| 4. 8 | . 7 | . 03 | | 12. 1 | 2. 2 | 2. 6 | . 12 | 17. 0 | 4. 9 | 29 |
| 4. 8 | | . 03 | | 13. 0 | 3. 2 | 4. 2 | . 20 | 20. 6 | 7. 6 | 37 |
| 5. 1 | | . 03 | | 8. 7 | 6. 3 | 7. 8 | . 14 | 22. 9 | 14. 2 | 62 |
| 5. 2 | | . 03 | | 6. 7 | 8. 7 | 9. 0 | . 14 | 24. 5 | 17. 8 | 73 |
| 6. 5 | | . 03 | | 3. 6 | 11. 8 | 9. 8 | . 12 | 25. 3 | 21. 7 | 86 |
| 7. 1 | | . 02 | | 3. 2 | 12. 3 | 9. 4 | . 12 | 25. 0 | 21. 8 | 87 |
| 7. 3 | | . 03 | | 2. 3 | 10. 2 | 8. 7 | . 13 | 21. 3 | 19. 0 | 89 |
| 7. 3 | | . 04 | | 2. 0 | 8. 3 | 6. 5 | . 14 | 16. 9 | 14. 9 | 88 |
| | | | | | | | | | | |
| 6. 7 | 2. 1 | | | | | | | | | |
| 4. 9 | 1. 0 | | | | | | | | | |
| 4. 7 | . 4 | | | | | | | | | |
| 4. 7 | . 4 | | | | | | | | | |
| 4. 9 | . 4 | | | | | | | | | |
| 5. 2 | | | | | | | | | | |
| 5. 7 | | | | | | | | | | |
| 6. 4 | | | | | | | | | | |
| 7. 2 | | | | | | | | | | |
| 7. 6 | | | 3. 6 | | | | | | | |
| 7. 8 | | | 48. 5 | | | | | | | |
| | | | | | | | | | | |
| 6. 1 | 2. 6 | | | | | | | | | |
| 5. 6 | | | | | | | | | | |
| 6. 2 | | | | | | | | | | |
| 7. 6 | | | 21. 6 | | | | | | | |
| 8. 1 | | | 34. 4 | | | | | | | |
| 8. 3 | | | 37. 6 | | | | | | | |
| | | | | | | | | | | |
| 6. 6 | 2. 7 | | | | | | | | | |
| 6. 8 | | | | | | | | | | |
| 7. 1 | | | | | | | | | | |
| 7. 5 | | | 12. 9 | | | | | | | |
| 7. 9 | | | 37. 8 | | | | | | | |
| 8. 2 | | | 38. 6 | | | | | | | |
| | | | | | | | | | | |
| 7. 6 | 2. 1 | | | | | | | | | |
| 7. 1 | . 7 | | | | | | | | | |
| 6. 5 | | | | | | | | | | |
| 6. 6 | | | | | | | | | | |
| 6. 8 | | | | | | | | | | |
| 7. 3 | | | | | | | | | | |
| 7. 9 | | | 39. 0 | | | | | | | |
| | | | | | | | | | | |
| 6. 5 | 1. 9 | | | | | | | | | |
| 5. 6 | | | | | | | | | | |
| 5. 6 | | | | | | | | | | |
| 5. 9 | | | | | | | | | | |
| 6. 9 | | | | | | | | | | |
| 7. 8 | | | 20. 2 | | | | | | | |
| | | | | | | | | | | |
| 6. 3 | | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 6. 8 | | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| | | | | | | | | | | |
| 7. 1 | 4. 7 | | | | | | | | | |
| 7. 1 | 1. 7 | | | | | | | | | |
| 7. 0 | . 7 | | | | | | | | | |
| 6. 9 | . 4 | | | | | | | | | |

TABLE 4.—*Laboratory analyses of*

| Soil and sample number | Depth from surface | Horizon | Particle size distribution in millimeters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand 2–1 | Coarse sand 1–0.5 | Medium sand 0.5–0.25 | Fine sand 0.25–0.10 | Very fine sand 0.10–0.05 | Total sand | Silt 0.05–0.002 | Clay (less than 0.002) | Fine clay (less than 0.0002) |
| | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Miami silt loam: | | | | | | | | | | | |
| CT-13 | 0–5 | $A_p$ | ----- | ----- | ----- | ----- | ----- | 31.7 | 48.1 | 20.2 | ----- |
| | 5–9 | $B_1$ | ----- | ----- | ----- | ----- | ----- | 21.7 | 40.7 | 37.6 | ----- |
| | 9–16 | $B_2$ | ----- | ----- | ----- | ----- | ----- | 18.8 | 31.6 | 49.6 | ----- |
| | 16–21 | $B_3C_1$ | ----- | ----- | ----- | ----- | ----- | 25.3 | 42.9 | 31.8 | ----- |
| CT-37 | 0–8 | $A_p$ | ----- | ----- | ----- | ----- | ----- | 22.1 | 51.2 | 26.7 | ----- |
| | 8–9 | $B_1$ | ----- | ----- | ----- | ----- | ----- | 19.2 | 41.7 | 39.1 | ----- |
| | 9–13 | $B_2$ | ----- | ----- | ----- | ----- | ----- | 16.2 | 34.8 | 49.0 | ----- |
| | 13–15 | $B_3C_1$ | ----- | ----- | ----- | ----- | ----- | 20.4 | 41.0 | 38.6 | ----- |
| | 15–20 | $C_2$ | ----- | ----- | ----- | ----- | ----- | 31.5 | 51.6 | 16.9 | ----- |
| | 24–30 | $C_3$ | ----- | ----- | ----- | ----- | ----- | 32.2 | 50.9 | 16.9 | ----- |
| | 35–37 | $C_4$ | ----- | ----- | ----- | ----- | ----- | 31.2 | 48.0 | 20.8 | ----- |
| Ragsdale silty clay loam: | | | | | | | | | | | |
| CT-20 | 0–8 | $A_p$ | | | | | | 5.1 | 66.4 | 28.5 | |
| | 8–15 | $B_{21}$ | ----- | ----- | ----- | ----- | ----- | 4.2 | 61.9 | 33.9 | ----- |
| | 15–19 | $B_{22g}$ | ----- | ----- | ----- | ----- | ----- | 4.5 | 61.5 | 34.0 | ----- |
| | 19–28 | $B_{23g}$ | ----- | ----- | ----- | ----- | ----- | 3.4 | 63.2 | 33.4 | ----- |
| | 28–36 | $B_{24g}$ | ----- | ----- | ----- | ----- | ----- | 3.2 | 64.4 | 32.4 | ----- |
| | 36 | C | ----- | ----- | ----- | ----- | ----- | 5.3 | 71.1 | 23.6 | ----- |
| CT-S33 | 0–6 | $A_1$ | ----- | 2.3 | 3.1 | 2.0 | 5.7 | 13.1 | 58.9 | 28.0 | 13.5 |
| | 6–15 | $B_{21}$ | ----- | 3.4 | 3.5 | 2.2 | 6.0 | 15.1 | 52.0 | 32.9 | 13.9 |
| | 15–27 | $B_{22g}$ | ----- | 2.1 | 3.3 | 2.2 | 6.7 | 14.3 | 53.2 | 32.5 | 15.6 |
| | 27–60 | $B_{3g}C$ | ----- | 1.4 | 2.0 | 1.5 | 5.9 | 10.8 | 60.3 | 28.9 | 13.7 |
| Reesville silt loam: | | | | | | | | | | | |
| CT-6 | 0–4 | $A_1$ | ----- | .6 | 1.1 | .8 | 4.9 | 7.4 | 76.8 | 15.8 | 1.6 |
| | 4–7 | $A_2$ | ----- | .6 | 1.3 | .9 | 5.8 | 8.7 | 76.8 | 14.5 | 2.4 |
| | 7–12 | $A_3$ | ----- | .9 | 1.3 | .8 | 4.5 | 7.5 | 70.9 | 21.6 | 7.3 |
| | 12–18 | $B_1$ | ----- | .4 | .7 | .5 | 3.8 | 5.4 | 62.4 | 32.2 | 14.8 |
| | 18–22 | $B_{21}$ | ----- | .2 | .5 | .4 | 3.6 | 4.7 | 59.0 | 36.3 | 19.1 |
| | 22–28 | $B_{22}$ | ----- | .2 | .5 | .9 | 2.7 | 3.8 | 57.6 | 38.6 | 23.9 |
| | 28–33 | $B_3$ | ----- | .3 | .9 | .9 | 6.2 | 8.3 | 58.5 | 33.2 | 17.4 |
| | 33–42 | C | ----- | .9 | 2.4 | 1.1 | 6.9 | 11.3 | 70.6 | 18.1 | 8.2 |
| | 42–52 | $D_1$ | ----- | ----- | ----- | ----- | ----- | 33.1 | 47.9 | 19.0 | ----- |
| | 52–60 | $D_2$ | ----- | 6.0 | 5.9 | 5.3 | 7.0 | 23.2 | 51.3 | 25.5 | 6.2 |
| | 60–72 | $D_3$ | ----- | 8.2 | 10.4 | 6.3 | 14.2 | 39.1 | 39.4 | 21.5 | 9.0 |
| | 72–80 | $D_4$ | ----- | 7.9 | 7.7 | 4.7 | 11.8 | 32.1 | 45.9 | 22.0 | 5.9 |
| | 80–83 | $D_5$ | ----- | 8.2 | 12.8 | 7.8 | 14.7 | 43.5 | 39.6 | 16.9 | 3.6 |
| CT-8 | 0–9 | $A_p$ | ----- | 1.7 | 1.6 | .8 | 4.0 | 8.1 | 79.7 | 12.2 | 4.2 |
| | 9–13 | $A_2$ | ----- | 1.0 | 1.5 | .5 | 1.9 | 4.9 | 74.7 | 20.4 | 7.2 |
| | 13–17 | $B_1$ | ----- | .8 | 1.1 | .5 | 1.9 | 4.3 | 71.5 | 24.2 | 10.0 |
| | 17–25 | $B_{21}$ | ----- | .4 | .7 | .4 | 2.1 | 3.6 | 64.9 | 31.5 | 16.8 |
| | 25–33 | $B_{22}$ | ----- | .2 | .6 | .4 | 2.4 | 3.6 | 59.8 | 36.6 | 21.8 |
| | 33–38 | $B_3$ | ----- | .1 | .5 | .5 | 3.6 | 4.7 | 63.3 | 32.0 | 18.0 |
| | 38–50 | C | ----- | .4 | 1.7 | 1.6 | 3.2 | 6.9 | 76.4 | 16.7 | 7.2 |
| | 72 | D | ----- | 9.8 | 8.2 | 4.5 | 10.4 | 32.9 | 50.5 | 16.6 | 4.9 |
| Rossmoyne silt loam: | | | | | | | | | | | |
| CT-65 | 0–8 | $A_p$ | ----- | ----- | ----- | ----- | ----- | 11.6 | 73.3 | 15.1 | ----- |
| | 8–11 | $A_2$ | ----- | ----- | ----- | ----- | ----- | 7.0 | 68.0 | 25.0 | ----- |
| | 11–16 | $B_1$ | ----- | ----- | ----- | ----- | ----- | 4.8 | 65.5 | 29.7 | ----- |
| | 16–20 | $B_{21}$ | ----- | ----- | ----- | ----- | ----- | 4.6 | 64.3 | 31.1 | ----- |
| | 20–25 | $B_{22m}$ | ----- | ----- | ----- | ----- | ----- | 8.2 | 58.6 | 33.2 | ----- |
| | 25–32 | $B_{22m}$ | ----- | ----- | ----- | ----- | ----- | 14.6 | 51.4 | 34.0 | ----- |
| | 32–42 | $B_{23m}$ | ----- | ----- | ----- | ----- | ----- | 19.7 | 44.2 | 36.1 | ----- |
| | 42–54 | $B_{31}$ | ----- | ----- | ----- | ----- | ----- | 23.2 | 34.1 | 43.7 | ----- |
| | 54–60 | $B_{32}$ | ----- | ----- | ----- | ----- | ----- | 19.8 | 27.3 | 52.9 | ----- |
| | 60–67 | $B_{33}$ | ----- | ----- | ----- | ----- | ----- | 22.3 | 30.5 | 47.2 | ----- |
| | 67–72 | $B_{33}$ | ----- | ----- | ----- | ----- | ----- | 28.1 | 33.4 | 38.5 | ----- |
| | 72–78 | $B_{33}$ | ----- | ----- | ----- | ----- | ----- | 20.7 | 31.2 | 48.1 | ----- |
| | 85–91 | C | ----- | ----- | ----- | ----- | ----- | 11.6 | 22.4 | 66.0 | ----- |

*representative soils in Clinton County*—Continued

| pH | Organic matter | Nitrogen | $CaCO_3$ equivalent | Exchangeable cations: H | Exchangeable cations: Ca | Exchangeable cations: Mg | Exchangeable cations: K | Sum exchangeable cations | Total bases | Base saturation |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *meq./100g.* | *meq./100g.* | *meq./100g.* | *meq./100g.* | *meq./100g.* | *meq./100g.* | *Percent* |
| 6. 7 | 2. 8 | | | | | | | | | |
| 6. 0 | | | | | | | | | | |
| 6. 8 | | | | | | | | | | |
| 7. 6 | | | 22. 3 | | | | | | | |
| 7. 5 | 2. 2 | | | | | | | | | |
| 7. 3 | | | | | | | | | | |
| 7. 1 | | | | | | | | | | |
| 7. 7 | | | 12. 1 | | | | | | | |
| 7. 9 | | | 39. 8 | | | | | | | |
| 8. 3 | | | 41. 7 | | | | | | | |
| 8. 2 | | | 39. 0 | | | | | | | |
| 6. 2 | 4. 1 | | | | | | | | | |
| 6. 5 | 1. 9 | | | | | | | | | |
| 6. 7 | | | | | | | | | | |
| 7. 0 | | | | | | | | | | |
| 7. 2 | | | | | | | | | | |
| 7. 5 | | | 4. 4 | | | | | | | |
| 6. 7 | 9. 6 | . 41 | | 8. 4 | 20. 6 | 7. 2 | 0. 35 | 36. 6 | 28. 2 | 77 |
| 6. 9 | 2. 8 | . 13 | | 4. 6 | 15. 5 | 6. 9 | . 37 | 27. 4 | 22. 8 | 83 |
| 7. 3 | | . 07 | | 3. 4 | 14. 4 | 6. 9 | . 36 | 25. 1 | 21. 7 | 87 |
| 7. 7 | | | . 7 | 1. 8 | 12. 2 | 6. 1 | . 36 | 20. 5 | 18. 7 | 91 |
| 7. 1 | 7. 5 | . 33 | | 5. 6 | 15. 8 | 4. 4 | . 42 | 26. 2 | 20. 6 | 79 |
| 6. 3 | 3. 1 | . 17 | | 6. 2 | 8. 8 | 2. 8 | . 17 | 18. 0 | 11. 8 | 66 |
| 5. 4 | 1. 2 | . 06 | | 7. 4 | 6. 2 | 3. 1 | . 21 | 16. 9 | 9. 5 | 56 |
| 4. 7 | . 75 | . 04 | | 12. 0 | 5. 1 | 3. 9 | . 28 | 21. 3 | 9. 3 | 44 |
| 5. 0 | . 79 | . 05 | | 11. 2 | 8. 9 | 7. 5 | . 34 | 27. 9 | 16. 7 | 60 |
| 5. 4 | . 83 | . 05 | | 7. 6 | 11. 9 | 9. 7 | . 34 | 29. 5 | 21. 9 | 74 |
| 6. 7 | . 79 | . 05 | | 4. 0 | 12. 8 | 9. 4 | . 30 | 26. 5 | 22. 5 | 85 |
| 8. 0 | | . 03 | 22. 3 | | | | | | | |
| 8. 0 | | | 31. 4 | | | | | | | |
| 8. 1 | | . 05 | 14. 4 | | | | | | | |
| 8. 0 | | | 31. 8 | | | | | | | |
| 8. 2 | | . 04 | 26. 9 | | | | | | | |
| 8. 2 | | . 03 | 9. 8 | | | | | | | |
| 6. 1 | 2. 2 | | | | | | | | | |
| 4. 9 | . 7 | | | | | | | | | |
| 4. 6 | . 3 | | | | | | | | | |
| 4. 7 | . 3 | | | | | | | | | |
| 6. 1 | . 4 | | | | | | | | | |
| 7. 3 | . 3 | | | | | | | | | |
| 7. 9 | | | 23. 2 | | | | | | | |
| 8. 1 | | | 15. 8 | | | | | | | |
| 7. 0 | 2. 8 | | | | | | | | | |
| 4. 9 | . 8 | | | | | | | | | |
| 4. 7 | . 6 | | | | | | | | | |
| 4. 7 | . 6 | | | | | | | | | |
| 4. 7 | . 4 | | | | | | | | | |
| 5. 1 | . 4 | | | | | | | | | |
| 6. 5 | . 3 | | | | | | | | | |
| 7. 4 | | | 1. 0 | | | | | | | |
| 7. 4 | | | . 8 | | | | | | | |
| 7. 5 | | | . 4 | | | | | | | |
| 7. 5 | | | . 5 | | | | | | | |
| 7. 4 | | | . 7 | | | | | | | |
| 7. 5 | | | 4. 5 | | | | | | | |

TABLE 4.—*Laboratory analyses of*

| Soil, and sample number | Depth from surface | Horizon | Particle size distribution in millimeters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand 2–1 | Coarse sand 1–0.5 | Medium sand 0.5–0.25 | Fine sand 0.25–0.10 | Very fine sand 0.10–0.05 | Total sand | Silt 0.05–0.002 | Clay (less than 0.002) | Fine clay (less than 0.0002) |
| | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Russell silt loam: | | | | | | | | | | | |
| CT–29 | 0–8 | $A_p$ | ---- | ---- | ---- | ---- | ---- | 5. 7 | 79. 3 | 15. 0 | ---- |
| | 8–15 | $B_1$ | ---- | ---- | ---- | ---- | ---- | 2. 1 | 67. 6 | 30. 2 | ---- |
| | 15–19 | $B_{21}$ | ---- | ---- | ---- | ---- | ---- | 4. 1 | 63. 0 | 32. 9 | ---- |
| | 19–27 | $B_{22}$ | ---- | ---- | ---- | ---- | ---- | 13. 1 | 55. 5 | 31. 4 | ---- |
| | 27–34 | $B_{23}$ | ---- | ---- | ---- | ---- | ---- | 30. 1 | 39. 8 | 30. 1 | ---- |
| | 34–42 | $B_3$ | ---- | ---- | ---- | ---- | ---- | 32. 5 | 41. 2 | 26. 3 | ---- |
| | 42–46 | C | ---- | ---- | ---- | ---- | ---- | 33. 1 | 45. 9 | 21. 0 | ---- |
| CT–30 | 0–9 | $A_p$ | ---- | ---- | ---- | ---- | ---- | 7. 0 | 77. 5 | 15. 5 | ---- |
| | 9–11 | $B_1$ | ---- | ---- | ---- | ---- | ---- | 4. 1 | 72. 0 | 23. 9 | ---- |
| | 11–15 | $B_{21}$ | ---- | ---- | ---- | ---- | ---- | 2. 9 | 65. 7 | 31. 4 | ---- |
| | 15–23 | $B_{22}$ | ---- | ---- | ---- | ---- | ---- | 5. 2 | 61. 0 | 33. 8 | ---- |
| | 23–31 | $B_{23}$ | ---- | ---- | ---- | ---- | ---- | 13. 0 | 56. 7 | 30. 3 | ---- |
| | 31–40 | $B_3$ | ---- | ---- | ---- | ---- | ---- | 17. 5 | 50. 8 | 32. 7 | ---- |
| | 40–45 | C | ---- | ---- | ---- | ---- | ---- | 27. 2 | 54. 4 | 18. 4 | ---- |
| Sloan silt loam: | | | | | | | | | | | |
| CT–47 | 0–13 | $A_{11}$ | ---- | ---- | ---- | ---- | ---- | 24. 5 | 54. 9 | 20. 6 | ---- |
| | 13–30 | $A_{12}$ | ---- | ---- | ---- | ---- | ---- | 23. 3 | 45. 5 | 31. 2 | ---- |
| | 30–42 | $C_{1g}$ | ---- | ---- | ---- | ---- | ---- | 35. 7 | 37. 7 | 26. 6 | ---- |
| | 42–67 | $C_{2g}$ | ---- | ---- | ---- | ---- | ---- | 47. 5 | 29. 2 | 23. 3 | ---- |
| | 67+ | D | ---- | ---- | ---- | ---- | ---- | 29. 2 | 48. 6 | 22. 2 | ---- |
| Williamsburg silt loam: | | | | | | | | | | | |
| CT–72 | 0–2 | $A_{p1}$ | . 6 | 1. 0 | 1. 1 | 1. 5 | 2. 2 | 6. 4 | 80. 2 | 13. 4 | 2. 9 |
| | 2–7½ | $A_{p2}$ | . 5 | . 8 | 1. 0 | 1. 4 | 1. 5 | 5. 2 | 78. 0 | 16. 8 | 2. 9 |
| | 7½–12 | $A_2$ | . 0 | . 3 | . 5 | . 5 | 1. 0 | 2. 3 | 73. 1 | 24. 6 | 9. 9 |
| | 12–20 | $B_1$ | ([1]) | . 4 | . 3 | . 4 | . 8 | 1. 9 | 69. 9 | 28. 2 | 13. 6 |
| | 20–37 | $B_{21}$ | . 3 | . 6 | . 9 | 1. 4 | 1. 7 | 4. 9 | 70. 0 | 25. 1 | 11. 2 |
| | 37–50 | $B_{22}$ | 1. 4 | 4. 6 | 7. 7 | 11. 7 | 13. 0 | 38. 4 | 45. 0 | 16. 6 | 5. 6 |
| | 50–64 | $B_{23}$ | 1. 2 | 3. 1 | 4. 5 | 9. 8 | 10. 5 | 29. 1 | 38. 6 | 32. 3 | 15. 5 |
| | 64–79 | $B_{31}$ | 1. 4 | 5. 8 | 8. 5 | 15. 4 | 12. 9 | 44. 0 | 25. 7 | 30. 3 | 16. 8 |
| | 79–84 | $B_{32}$ | 9. 2 | 20. 5 | 11. 3 | 9. 2 | 6. 2 | 56. 4 | 12. 9 | 30. 7 | 15. 5 |
| Xenia silt loam: | | | | | | | | | | | |
| CT–55 | 0–7 | $A_p$ | ---- | ---- | ---- | ---- | ---- | 11. 5 | 74. 2 | 14. 3 | ---- |
| | 7–11 | $B_1$ | ---- | ---- | ---- | ---- | ---- | 3. 1 | 69. 5 | 27. 4 | ---- |
| | 11–19 | $B_{21}$ | ---- | ---- | ---- | ---- | ---- | 2. 5 | 62. 9 | 34. 6 | ---- |
| | 19–24 | $B_{22}$ | ---- | ---- | ---- | ---- | ---- | 9. 8 | 57. 8 | 32. 4 | ---- |
| | 24–30 | $B_{23}$ | ---- | ---- | ---- | ---- | ---- | 24. 5 | 45. 0 | 30. 5 | ---- |
| | 30–34 | $B_3$ | ---- | ---- | ---- | ---- | ---- | 25. 8 | 47. 1 | 27. 1 | ---- |
| | 34–41 | $C_1$ | ---- | ---- | ---- | ---- | ---- | 31. 2 | 49. 2 | 19. 6 | ---- |
| | 41–46 | $C_2$ | ---- | ---- | ---- | ---- | ---- | 35. 9 | 49. 9 | 14. 2 | ---- |

[1] Trace.

*representative soils in Clinton County*—Continued

| pH | Organic matter | Nitrogen | $CaCO_3$ equivalent | Exchangeable cations: H | Exchangeable cations: Ca | Exchangeable cations: Mg | Exchangeable cations: K | Sum exchangeable cations | Total bases | Base saturation |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *meq./100 g.* | *Percent* |
| 7.2 | 1.8 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.8 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.3 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.3 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6.2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.0 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.6 | --- | --- | 18.4 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 5.6 | 1.8 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.3 | 1.0 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.4 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.6 | --- | --- | 32.7 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 7.4 | 5.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.3 | 2.6 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.6 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.8 | --- | --- | 2.2 | --- | --- | --- | --- | --- | --- | --- |
| 7.9 | --- | --- | 22.6 | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 5.6 | 4.0 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.4 | 1.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.1 | .6 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4.9 | .2 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4.8 | .1 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4.9 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.6 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6.7 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6.7 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |
| 6.1 | 2.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.3 | .4 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.3 | .7 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.6 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6.3 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.6 | --- | --- | 3.0 | --- | --- | --- | --- | --- | --- | --- |
| 8.0 | --- | --- | 16.8 | --- | --- | --- | --- | --- | --- | --- |
| 8.1 | --- | --- | 18.2 | --- | --- | --- | --- | --- | --- | --- |

**AVONBURG SILT LOAM, CT–66**

This soil was sampled April 1957 in a legume-grass meadow, located 3 miles southeast of Blanchester and 400 feet east of State Highway No. 123, in Marion Township. The site is on Illinoian till plain. The area has a slope of about 1 percent and an elevation of about 1,010 feet above sea level. The till is covered by a thin mantle of loess.

$A_p$ 0 to 8 inches, dark grayish-brown to grayish-brown (10YR 4/2 to 5/2) silt loam; weak, fine, granular structure; friable; numerous manganese concretions; roots abundant; abrupt, smooth boundary.

$A_{2g}$ 8 to 11 inches, yellowish-brown (10YR 5/6) silt loam distinctly mottled with light gray (2.5Y 7/2), light brownish gray (2.5Y 6/2), and brownish yellow (10YR 6/6); weak, medium, subangular blocky structure, some weak, platy structure in lower part of horizon; friable; stains and concretions of manganese; few roots; gradual, smooth boundary.

$B_{21g}$ 11 to 17 inches, yellowish-brown (10YR 5/6 to 5/8) silty clay loam distinctly mottled with light gray (2.5Y 7/2) and brownish yellow (10YR 6/6); some strong-brown and pale-brown colors; moderate, medium, subangular blocky structure; firm; gray silty coating on cleavage faces; stains and concretions of manganese; few, fine roots; gradual, wavy boundary.

$B_{22g}$ 17 to 26 inches, strong-brown (7.5YR 5/6 to 5/8) silty clay loam distinctly mottled with light brownish gray (10YR 6/2 to 2.5Y 6/2) and yellowish brown (10YR 5/8); prismatic structure breaking to moderate, fine and medium, subangular blocky; firm; gray coatings on structure-unit faces; stains and concretions of manganese; gradual lower boundary.

$B_{23gm}$ 26 to 36 inches, mottled strong-brown (7.5YR 5/6 to 5/8) and light-gray (2.5Y 7/1 to 5Y 6/1) silty clay loam; coarse, prismatic structure breaking to moderate, medium, subangular blocky; firm; gray coatings on structure-unit faces; discontinuous clay skins; few black stains and concretions of manganese; diffuse lower boundary.

$B_{24gm}$ 36 to 44 inches, strong-brown (7.5YR 5/6 to 5/8) silty clay loam distinctly mottled with light gray to gray (5Y 7/1 to 6/1); weak, prismatic structure that breaks to weak, subangular blocky; firm; gray clayey coating on structure-unit faces; some black stains and concretions of manganese; diffuse lower boundary.

$B_{25g}$ 44 to 50 inches, mottled light-gray (5Y 7/1) to gray (5Y 6/1) and yellowish-brown (10YR 5/6 to 5/8) clay loam; massive; firm; numerous black stains and concretions.

$B_{26g}$ 50 to 70 inches, prominently mottled yellowish-brown (10YR 5/6 to 5/8), gray (5Y 5/1 to 6/1), and light olive-brown (2.5Y 5/4) clay loam. (Auger boring: sampled at 50 to 60 inches and 60 to 70 inches.)

C 70 to 100 inches, distinctly mottled yellowish-brown (10YR 5/6), gray (5Y 5/1 to 6/1), and light olive-brown (2.5Y 5/4 to 5/6) clay loam; some brownish-yellow colors; very firm; a few, small, rounded igneous pebbles and some concretions of manganese. (Auger boring: sampled at 70 to 80 inches, 80 to 90 inches, and 90 to 100 inches.)

**AVONBURG SILT LOAM, CT–73**

This soil was sampled April 15, 1958 in a cultivated field, located one-half mile east of Blanchester city limits and 350 feet north of State Highway No. 28 in Marion Township. The site is on the Illinoian till plain. The area has a slope of 1 percent. The till is covered by a thin mantle of loess.

$A_{p1}$ 0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable when moist, nonsticky when wet; clear, smooth boundary.

$A_{p2}$ 5 to 9 inches, pale-brown (10YR 6/3) silt loam; many, fine, distinct mottles of brownish yellow (10YR 6/6) and very pale brown (10YR 8/3); weak, fine and medium, subangular blocky structure; friable when moist, nonsticky when wet; manganese concretions; abrupt, smooth boundary.

$B_{1g}$ 9 to 14½ inches, very pale brown (10YR 7/3) silty clay loam; many, medium, distinct mottles of light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/8); moderate, medium, subangular blocky structure; slightly sticky; manganese concretions; clear, smooth boundary.

$B_{21g}$ 14½ to 26 inches, light yellowish-brown (10YR 6/4) silty clay loam; many, medium, distinct mottles of gray (10YR 6/1) and brownish yellow (10YR 6/6); light-gray (10YR 7/2) coatings; weak, medium, columnar structure breaking to strong, medium and coarse, subangular blocky; slightly sticky; manganese concretions; gradual, wavy boundary.

$B_{22gm}$ 26 to 34 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct mottles of brownish yellow (10YR 6/6); light-gray (10YR 7/2) and very dark grayish-brown (10YR 3/2) coatings; moderate, medium and coarse, subangular blocky structure; firm; manganese concretions; diffuse boundary.

$B_{23gm}$ 34 to 42 inches, light yellowish-brown (10YR 6/4) clay loam; many, medium, distinct mottles of brownish yellow (10YR 6/6); moderate, medium and coarse, subangular blocky structure; firm; many, coarse, distinct coatings of light gray (10YR 7/2) and manganese coatings of very dark grayish brown (10 YR 3/2); diffuse boundary.

$B_{24gm}$ 42 to 53 inches, yellowish-brown (10YR 5/6) clay loam; many, coarse, distinct mottles and coatings of gray (10YR 6/1) and light brownish gray (10YR 6/2); few manganese coatings; fewer mottles than in $B_{22gm}$; weak to moderate, coarse, subangular blocky structure; very firm, slightly sticky.

$B_{31}$ 53 to 72 inches, yellowish-brown (10YR 5/6) clay loam; grayish-brown (10YR 5/2) mottles; firm; manganese coatings.

$B_{32}$ 72 to 92 inches, yellowish-brown (10YR 5/6) clay loam; gray (10YR 6/1) mottles; firm.

$C_1$ 92 to 120 inches, yellowish-brown (10YR 5/8) clay loam; many, medium, distinct mottles of gray (10YR 6/1); firm; calcareous; an increase in small pebbles.

$C_2$ 120 inches, yellowish-brown (10YR 5/6) loam till; gray (10YR 6/1) mottles; calcareous.

**BIRKBECK SILT LOAM, CT–5**

This soil was sampled March 24, 1954 in a cultivated field. The site is located 50 feet south of Hiney Road, 2,100 feet east of the intersection of Hiney and Gano Roads, ½ mile south and 1⅞ miles east of Lumberton. The site has a slope of 1 to 1½ percent. Parent material is calcareous loess.

$A_p$ 0 to 7 inches, grayish-brown (10YR 5/2) silt loam (2.5Y 6/2 to 7/2, when dry); weak, medium, granular structure; friable; abrupt, smooth boundary.

$A_2$ 7 to 11 inches, yellowish-brown (10YR 5/6) silt loam (10YR 6/4, when dry); common, medium, faint mottles of light brownish gray (10YR 6/2) and pale yellow (2.5Y 7/4); weak to moderate, fine, subangular blocky structure; friable; clear, smooth boundary.

$B_1$ 11 to 13 inches, yellowish-brown (10YR 5/6) coarse silty clay loam (10YR 7/6, when dry); peds coated pale brown (10YR 6/3); moderate, fine, subangular blocky structure; friable; gradual boundary.

$B_2$ 13 to 21 inches, yellowish-brown (10YR 5/4) silty clay loam (10YR 6/6, when dry); moderate, medium, subangular blocky structure; moderately sticky; roots tend to occur on surface of peds; occasional, soft, black concretions up to 0.5 centimeter in diameter; gradual, wavy boundary.

$B_3$ 21 to 25 inches, brownish-yellow (10YR 6/6) to olive-yellow (2.5Y 6/6), coarse silty clay loam, intermingled with yellowish brown (10YR 5/4), (10YR 7/8 to 6/8, when dry); weak, fine and medium, subangular blocky structure; clay coatings on surfaces of peds; friable; gradual, wavy boundary.

$C_1$ 25 to 31 inches, brownish-yellow (10YR 6/8) silt loam (10YR 6/6 to 2.5Y 6/6, when dry); common, distinct, medium mottles of light yellowish brown (2.5Y 6/4); weak, fine and medium, subangular blocky structure; friable; calcareous; diffuse, wavy boundary.

$C_2$ 31 to 100 inches, brownish-yellow (10YR 6/8) silt loam (10YR 7/6, when dry); few, distinct, medium mottles of light gray (2.5Y 7/2); weak, very coarse, prismatic structure with massive interiors; firm in place; numerous, moderately soft to hard, calcareous concretions having irregular, smooth shapes and as much as 2.5 centimeters in diameter; calcareous. (Sampled at depths of 33 to 36 inches, 56 to 59 inches, 70 to 80 inches, and 90 to 96 inches.)

D 100 to 120 inches, yellowish-brown (10YR 5/6) silt loam (2.5Y 7/4, when dry); faintly mottled; poorly assorted and mixed with fine gravel.

### BIRKBECK SILT LOAM, CT-S9

This soil was sampled March 24, 1953 in a site 30 yards southeast of Sabina Road, one-fourth of a mile southeast of the intersection with Spencer Road. The site is in a woodland area consisting of white and red oaks mixed with some elm and soft maple. Slope is 2 percent.

$A_1$ 0 to 2½ inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable; abrupt, wavy boundary.

$A_2$ 2½ to 7½ inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, platy structure breaking to weak, fine, subangular blocky; friable; clear, smooth boundary.

$B_1$ 7½ to 12 inches, yellowish-brown (10YR 5/6) silt loam; weak, fine, subangular blocky structure; friable; clear, smooth boundary.

$B_{21}$ 12 to 17 inches, yellowish-brown (10YR 5/6) silt loam; ped coatings of grayish brown (10YR 5/2); moderate, fine and medium, subangular blocky structure; firm, slightly plastic; gradual boundary.

$B_{22}$ 17 to 27 inches, yellowish-brown (10YR 5/6) coarse silty clay loam; strong, medium, subangular blocky structure; firm, moderately plastic; diffuse boundary.

$B_{23}$ 27 to 36 inches, yellowish-brown (10YR 5/6) fine silt loam; few, faint mottles of brownish yellow (10YR 6/8); moderate, medium and coarse, subangular blocky structure; firm; occasional fine, soft, black concretions; gradual boundary.

$B_3$ 36 to 44 inches, mottled yellowish-brown (10YR 5/6), dark yellowish-brown (10YR 4/4), and light yellowish-brown (10YR 6/4) silt loam; weak, coarse, subangular blocky structure; friable; abrupt boundary.

C 44 to 56 inches, mottled brownish-yellow (10YR 6/8) and light yellowish-brown (2.5Y 6/4) silt loam; massive; friable, nonplastic; calcareous; clear boundary.

D 56 to 90 inches, yellowish-brown (10YR 5/6) loam, faintly mottled; massive; calcareous till containing small pebbles and fragments of limestone. (Two samples were obtained: One was a composite sample to represent the entire layer; the other was a localized sample at a depth of 68 inches.)

### BLANCHESTER SILT LOAM, CT-68

This soil was sampled in June 1957 in a legume-grass meadow. The site is located 2½ miles south of Blanchester, Ohio, and one-third mile south of the intersection of Woodville and Fayetteville Roads, 30 rods east of the Fayetteville Road. It is on the Illinoian till plain that has a slope of 1 percent.

$A_p$ 0 to 7 inches, dark-gray (10YR 4/1) silt loam; weak, medium, angular blocky structure; friable; roots abundant; appears to have about 2 inches of overwash; clear boundary.



$B_{1g}$ 7 to 17 inches, very dark gray (10YR 3/1) clay loam; fine, distinct mottles of yellowish brown (10YR 5/6); surface of peds very dark gray, interiors yellowish brown; moderate, medium, subangular blocky structure; firm; fine roots follow cleavage faces; gradual boundary.

$B_{21g}$ 17 to 27 inches, dark-gray (2.5Y 4/1) to very dark gray (2.5Y 3/1) clay loam; common, distinct mottles of yellowish brown (10YR 5/6 to 5/8); surfaces of peds dark gray and very dark gray, interiors yellowish brown; discontinuous clay skins; moderate, fine and medium, subangular blocky structure; firm; few, fine roots confined to cleavage faces; gradual boundary. (Sampled at depths of 17 to 22 inches and 22 to 27 inches.)

$B_{22g}$ 27 to 36 inches, gray (10YR 5/1) clay loam; common, prominent mottles of yellowish brown (10YR 5/6) and dark brown (10YR 4/3); surfaces of peds gray, interiors yellowish brown; discontinuous clay skins; moderate to strong, medium, subangular blocky structure; firm; few roots along cleavage faces; numerous black concretions of manganese; gradual boundary.

$B_{23g}$ 36 to 46 inches, gray (10YR 5/1) clay; common, prominent mottles of yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4); surfaces of peds gray, interiors brown and yellowish brown; moderate, medium, subangular blocky structure; very firm; numerous black concretions of manganese; roots very few to absent; gradual boundary.

$B_{24g}$ 46 to 69 inches, gray (10YR 5/1) to dark-gray (10YR 4/1) clay; many, prominent mottles of yellowish brown (10YR 5/6 to 5/8); weak, medium, subangular blocky structure; very firm; some black concretions. (Sampled at depths of 46 to 58 inches and 58 to 69 inches.)

$B_3$ 69 to 76 inches, distinctly mottled brownish-yellow (10YR 6/6), yellowish-brown (10YR 5/6), and light olive-gray (5Y 6/2) clay; massive; very firm; few black concretions. (Sampled at depths of 72 to 76 inches.)

$D_1$ 76 to 86 inches, mottled light olive-gray (5Y 6/2) and light olive-brown (2.5Y 5/4 to 6/4) clay; massive; calcareous.

$D_2$ Limestone bedrock.

### BONPAS SILTY CLAY LOAM, CT-44

This soil was sampled June 29, 1955 in a cultivated field. The site is located on Anderson Fork, five-eighths of a mile southwest of Reed Road near the north boundary of Wayne Township. The parent material is a slackwater deposit in the area of the Late Wisconsin glaciation.

$A_{1p}$ 0 to 7 inches, black (10YR 2/1) silty clay loam; weak, medium, granular structure and massive; friable; abrupt boundary.

$A_{12}$ 7 to 10 inches, black (10YR 2/1) silty clay loam; weak, fine, subangular blocky structure; friable; abrupt boundary.

$B_{21}$ 10 to 15 inches, very dark gray (2.5Y 3/1) silty clay loam; common, fine, faint mottles of olive brown (2.5Y 4/3); strong, medium, angular and subangular blocky structure; firm, plastic; clear boundary.

$B_{22g}$ 15 to 20 inches, dark-gray (2.5Y 4/1) silty clay loam; many, medium, distinct mottles of light olive brown (2.5YR 5/4, 5/6); moderate, fine and medium, angular blocky structure; firm, plastic; clear boundary.

$B_{23g}$ 20 to 38 inches, light olive-brown (2.5Y 5/6) silty clay loam; many, medium, prominent coatings and mottles of dark gray (2. 5Y 4/1) and gray (2.5Y 5/1); weak, medium, prismatic structure breaking to weak, coarse, angular blocky; firm, plastic; slightly calcareous; clear, wavy boundary.

C 38 inches +, yellowish-brown (10YR 5/6) silty clay loam; few, fine, distinct coatings and mottles of gray (10YR 5/1); weak, coarse, angular blocky structure and massive; plastic; calcareous, containing light-gray segregations of lime.

#### BONPAS SILTY CLAY LOAM, CT–50

This soil was sampled August 9, 1955 in a pastured field that had formerly been cultivated, located one-fourth of a mile east of the Glady Road. The site consists of deposits of Wisconsin glacial age on the Illinoian till plain, one-half of a mile south of the Wisconsin glacial boundary.

$A_{1p}$ 0 to 7 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, subangular blocky structure; firm; abrupt boundary.

$A_{12}$ 7 to 20 inches, black (10YR 2/1) silty clay; weak, coarse, prismatic structure, which breaks to strong, medium, subangular blocky; firm; clear boundary.

$B_{21}$ 20 to 30 inches, very dark gray (10YR 3/1) silty clay; few, fine, distinct mottles of yellowish brown (10YR 5/4) and few, fine, faint mottles of very dark grayish brown (10YR 3/2); strong, medium and coarse, subangular blocky structure; firm; clear boundary.

$B_{22g}$ 30 to 36 inches, dark-gray (5Y 4/1) silty clay; many, fine and medium, prominent mottles of yellowish brown (10YR 5/4) and faint mottles of very dark gray (10YR 3/1); weak, coarse, subangular blocky structure and massive; firm; gradual boundary.

$B_{23g}$ 36 to 46 inches, grayish-brown (10YR 5/2) silty clay with common, fine, distinct, very dark gray (10YR 3/1) and yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure and massive; firm; lower boundary gradual.

$B_{3g}$ 46 to 64 inches, yellowish-brown (10YR 5/6, 5/4) silty clay loam; many, fine and medium, distinct mottles of grayish brown (10YR 5/2) and light gray (10YR 6/1); massive; abrupt boundary.

$D_1$ 64 to 80 inches, grayish-brown (10YR 5/2) clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/4, 5/6) and light gray (10YR 7/1); massive; firm.

$D_2$ 80 to 90 inches, strong-brown (7.5YR 5/8) clay loam; few, fine, distinct mottles of gray (N 5/0); firm.

$D_3$ 90 to 102 inches, strong-brown (7.5YR 5/6) clay loam; few, medium, distinct mottles of light yellowish brown (2.5Y 6/4) and gray (N 6/0); firm.

$D_4$ 102 inches +, light yellowish-brown (10YR 6/4) and light-gray (10YR 6/1) loam; calcareous.

#### BROOKSTON SILTY CLAY LOAM, CT–34

This soil was sampled May 10, 1955 in a cultivated field. The site was located 600 feet northeast of Stivers Road and three-quarters of a mile northwest of State Highway No. 729.

$A_p$ 0 to 8 inches, black (10YR 2/1) silty clay loam; weak, coarse, granular and moderate, medium, subangular blocky structure; firm; abrupt boundary.

$B_{21}$ 8 to 12 inches, very dark gray (10YR 3/1) silty clay; strong, fine, angular blocky structure; firm; clear boundary.

$B_{22g}$ 12 to 16 inches, gray (10YR 5/1) fine silty clay loam; few, fine, faint mottles of brown (10YR 5/3); moderate, medium, subangular blocky structure; firm; gradual boundary.

$B_{23g}$ 16 to 28 inches, gray (N 5/0) fine silty clay loam; few, fine, prominent mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm; clear boundary.

$B_3C$ 28 to 38 inches, light-gray (10YR 6/1) silty clay loam; many, medium, prominent mottles of brownish yellow (10YR 6/8); weak, coarse and medium, subangular blocky structure; firm; calcareous; gradual boundary.

C 38 inches +, gray (5YR 6/1) silty clay loam; many, medium, prominent mottles of brownish yellow (10YR 6/8); massive; calcareous till.

#### BROOKSTON SILTY CLAY LOAM, CT–51

This soil was sampled August 22, 1955 in a cultivated field. The site was located 150 feet east of Curry Road and one-quarter of a mile north of Carter Road.

$A_{1p}$ 0 to 9 inches, very dark brown (10YR 2/2) silty clay loam; strong, medium, granular structure; friable abrupt boundary.

$A_{12}$ 9 to 14 inches, black (10YR 2/1) silty clay loam; strong, medium, subangular blocky structure; firm; clear boundary.

$B_{21}$ 14 to 20 inches, black (10YR 2/1) silty clay loam; strong, medium, subangular blocky structure; firm; clear boundary.

$B_{22g}$ 20 to 35 inches, gray (10YR 5/1) silty clay loam; many, medium, prominent mottles of yellowish brown (10YR 5/6); strong, coarse, subangular blocky structure; firm; gradual boundary.

$B_{31g}$ 35 to 48 inches, pale-brown (10YR 6/3) silty clay loam; many, medium, prominent mottles of brownish yellow (10YR 6/6); weak, coarse, subangular blocky structure; firm; slightly calcareous; gradual boundary.

$B_{32g}$ 48 to 72 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, prominent mottles of brownish yellow (10YR 6/8); massive; firm; slightly calcareous.

C 72 inches +, yellowish-brown (10YR 5/4) loam; massive; firm; calcareous till.

#### CELINA SILT LOAM, CT–12

This soil was sampled in 1955 in a woodland pasture. The site was located 100 yards east of Polk Road and one-half mile south of the intersection of Polk and Weaver Roads. It is on the Wisconsin till plain. The slope is 2 percent.

$A_1$ 0 to 1½ inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; abrupt, wavy boundary.

$A_{21}$ 1½ to 3 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, granular structure; friable; clear, wavy boundary.

$A_{22}$ 3 to 5 inches, brown (10YR 5/3) silt loam; moderate, medium, subangular blocky structure; friable; abrupt, smooth boundary.

$B_1$ 5 to 11 inches, light yellowish-brown (10YR 6/4) loam or clay loam; few, fine, faint mottles of pale brown (10YR 6/3); moderate, medium, angular blocky structure; firm; clear, smooth boundary.

$B_2$ 11 to 17 inches, dark yellowish-brown (10YR 3/4) clay; common, faint mottles; moderate, medium, angular blocky structure; prominent clay coatings on ped surfaces; firm; abrupt, wavy boundary.

$C_1$ 17 to 20 inches, dark-brown (10YR 4/3) clay loam; weak, coarse, subangular blocky structure to massive; occasional clay coatings penetrate as tongues into this horizon; firm; calcareous. (The 20- to 28-inch depth was not described nor sampled.)

$C_2$ 28 to 32 inches, dark-brown (10YR 4/3) loam; massive; friable; calcareous. (The 32- to 38-inch depth was not described nor sampled.)

$C_3$ 38 to 42 inches, dark-brown (10YR 4/3) silt loam with occasional light brownish-gray (10YR 6/2) seams of lime; massive; friable; calcareous till.

#### CELINA SILT LOAM, CT–40

This soil was sampled June 17, 1955 in a cultivated field. The site was located 100 yards west of Borum Road and one-fourth of a mile southeast of the airport. It is on the Wisconsin till plain. The slope of the sampled area ranges from 2 to 6 percent.

$A_p$ 0 to 8 inches, dark-brown (10YR 3/3) silt loam; weak, fine and medium, granular structure; friable; abrupt boundary.

$B_1$ 8 to 12 inches, dark grayish-brown (10YR 4/2) clay loam; few, fine, faint mottles of very dark grayish brown (10YR 3/2); moderate, fine, subangular blocky structure; firm; clear boundary.

$B_2$ 12 to 20 inches, dark-brown (10YR 4/3) clay; few, fine, faint mottles; moderate, medium and coarse, subangular blocky structure; prominent clay coatings on ped surfaces; firm; clear, wavy boundary.

$B_3C_1$ 20 to 25 inches, dark-brown (10YR 4/3) coarse clay loam; few, fine, faint mottles; weak, medium and coarse, subangular blocky structure; prominent clay coatings on ped surfaces penetrate as tongues from the $B_2$ horizon into this horizon; firm; calcareous.

$C_2$ 25 to 28 inches, dark yellowish-brown (10YR 4/4) loam; few, fine, faint mottles of dark gray and dark grayish brown (10YR 4/1, 4/2); very weak, coarse, subangular blocky structure; friable; contains many small stones; calcareous. (The 28- to 40-inch depth was not described nor sampled.)

$C_3$ 40 to 44 inches, olive-brown (2.5Y 4/3) loam; many, fine and medium, prominent mottles of light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/4); massive; friable; calcareous till.

#### CINCINNATI SILT LOAM, CT–61

This soil was sampled September 28, 1956. The site is in a gently rolling, cultivated field in rotation meadow, located near Westboro, 300 yards east of U.S. Highway No. 68 in Jefferson Township. The soil parent material is silt-mantled Illinoian till, underlain by weathered shale and limestone.

$A_{p1}$ 0 to 7 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable.

$A_{p2}$ 7 to 10 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable.

$A_2$ 10 to 17 inches, strong-brown (7.5YR 5/6) silt loam; weak, thin, platy structure that breaks readily to fine granular; friable.

$B_{21}$ 17 to 30 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, fine, subangular blocky structure; friable.

$B_{22}$ 30 to 36 inches, yellowish-brown (10YR 5/6) silty clay loam; weak to moderate, medium, subangular blocky structure; friable.

$B_{23}$ 36 to 80 inches, yellowish-brown (10YR 5/4) clay loam; moderate, medium, subangular blocky structure; firm; derived from glacial till; occasional black concretions. (Sampled at depths of 36 to 56, 56 to 59, 67 to 70, and 77 to 80 inches.)

C–D 80 to 93 inches, clay, consisting of a mixture of till and weathered shale. (Sampled at depths of 80 to 83 and 89 to 91 inches.)

$D_r$ 93 to 106 inches, clay, consisting of weathered shale.

At 106 inches, limestone bedrock.

#### CLERMONT SILT LOAM, CT–49

This soil was sampled August 23, 1955 in a meadow of whiteclover. The site was located 2½ miles south-southwest of Martinsville and 200 yards south and 30 yards west of the intersection of the Jonesboro and Mudswitch Roads in Clark Township. It is on the nearly level Illinoian till plain, which has an elevation of about 1,020 feet, and about 2½ miles southwest of the Cuba Moraine, which is the outer boundary of Wisconsin glaciation in Clinton County. Illinoian till is covered by a thin mantle of loess and underlain by limestone and calcareous shale of the Richmond group (Ordovician).

$A_p$ 0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable, moderately hard when dry; abrupt boundary.

$A_{21}$ 6 to 9 inches, light brownish-gray (10YR 6/2) silt loam; distinct mottles of light yellowish brown (10YR 6/4); massive in place (plowsole) but tends to break into weak, medium, platy units when moved; firm in place, friable when moved, moderately hard when dry; boundary wavy, with tongues extending to $B_{1g}$ horizon.

$A_{22g}$ 9 to 14 inches, yellowish-brown (10YR 5/6) silt loam; distinct mottles of light gray (10YR 7/2); massive or very weak, coarse, subangular blocky structure with tendency to break into very weak, platy units; friable when moist, moderately hard when dry; diffuse boundary.

$B_{1g}$ 14 to 23 inches, light-gray (10YR 6/1 to 7/1) coarse silty clay loam; distinct, numerous, white flecks (10YR 8/1) and prominent mottles of yellowish brown, and reddish yellow (10YR 5/4 to 5/6 and 7.5YR 6/6); massive in place but breaks into very weak, subangular units, and these, in turn, into weak, platy units; friable when moist, moderately hard when dry; gradual boundary.

$B_{21g}$ 23 to 31 inches, mottled gray (10YR 6/1) and strong-brown (7.5YR 5/8) coarse silty clay loam; ped surfaces have gray (10YR 6/1) silty coatings and numerous flecks of white (10YR 8/1); interior of peds has distinct mottles of gray (10YR 6/1) and strong brown (7.5YR 5/8); weak, fine, prismatic structure breaking into weak, coarse, subangular and angular blocky; firm when moist, very hard when dry, sticky and moderately plastic when wet; gradual boundary.

$B_{22g}$ 31 to 48 inches, gray (N 5/0) silty clay loam; prominent, common, large mottles of yellowish brown (10YR 5/8); extensive black coatings on ped faces; massive in place but breaks into weak, medium, prismatic forms, which in turn break into weak, coarse, subangular and angular blocky units; extremely firm when moist, extremely hard when dry, and sticky and plastic when wet; soft black concretions; diffuse boundary.

$B_{23g}$ 48 to 63 inches, clay loam, prominently mottled with gray (N 5/0), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/8); some black coatings on ped surfaces; weak, fine to coarse, subangular and angular blocky structure; very firm when moist, extremely hard when dry, sticky and moderately plastic when wet.

$B_{24g}$ 63 to 76 inches, gray (2.5Y 5/1) clay loam; distinct mottles of yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/4); firm when moist, very hard when dry, sticky and plastic when wet.

$B_{31}$ 76 to 104 inches, yellowish-brown (10YR 5/8) and dark yellowish-brown (10YR 4/4) clay loam; distinct mottles of gray (10YR 6/1); firm when moist, very hard when dry, moderately sticky and moderately plastic when wet. (Sampled at depths of 76 to 90 and 90 to 104 inches.)

$B_{32}$ 104 to 127 inches, yellowish-brown (10YR 5/4) loam; distinct mottles of light gray (N 7/0); firm when moist, very hard when dry, slightly sticky and slightly plastic when wet.

Some leached limestone fragment (ghosts) in lower $B_3$.

#### CLERMONT SILT LOAM, CT–67

This soil was sampled in April 1957 in a legume-grass meadow. The site is located 3 miles southeast of Blanchester, and 80 rods east of State Highway No. 123. It is on the nearly level Illinoian till plain and has an elevation of about 1,000 feet. Slope is about one-half percent.

$A_p$ 0 to 8 inches, gray (10YR 5/1) silt loam mottled with dark brown (7.5YR 4/4); weak, fine, granular structure; friable; numerous iron and manganese concretions; roots common; abrupt, smooth boundary.

$A_{2g}$ 8 to 11 inches, gray (10YR 6/1) silt loam; common, prominent mottles of strong brown (7.5YR 5/6 to 5/8); some yellowish-brown colors noted; very weak, medium, subangular blocky structure; friable; some dark-brown or black stains and concretions of manganese; roots few; gradual boundary.

$B_{1g}$ 11 to 20 inches, gray (10YR 6/1), coarse silty clay loam; common, fine, prominent mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6); gray, silty coatings on cleavage faces; weak to moderate, medium, subangular blocky structure; moderately firm; some discontinuous clay skins; roots few; gradual boundary.

$B_{21g}$ 20 to 30 inches, gray (10YR 6/1) silty clay; prominent mottles of yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6); some strong-brown colors noted; thin, gray coatings on cleavage faces; weak, coarse, prismatic structure breaking to moderate, medium, subangular blocky; firm; discontinuous clay skins; some dark-brown or black stains and concretions; fine roots on cleavage faces; diffuse boundary.

$B_{22g}$ 30 to 45 inches, gray (10YR 6/1) silty clay; prominent mottles of dark brown (7.5YR 4/4), yellowish brown (10YR 5/6), and brownish yellow (10YR 6/6); gray color confined to cleavage faces; coarse to very coarse, prismatic structure breaks to weak, medium, subangular blocky units; firm; discontinuous clay skins; gradual, wavy boundary.

$A_{1b}$ 45 to 54 inches, dark-gray (10YR 4/1) silty clay mottled with olive brown (2.5Y 4/4) and brownish yellow (10YR 6/6); massive; very firm; some dark-brown or black concretions; gradual boundary.

$B_{21gb}$ 54 to 65 inches, mottled yellowish-brown (10YR 5/6) and gray (10YR 6/1 and 5/1) silty clay; very firm; a few, small, rounded pebbles; some dark-brown or black stains and concretions.

$B_{22gb}$ 65 to 79 inches, mottled yellowish-brown (10YR 5/6 to 5/8), gray (10YR 5/1 to 6/1), and light brownish-gray (10YR 6/2) clay; very firm; few, small pebbles. (Sampled at depths of 65 to 75 and 75 to 79 inches.)

C 79 to 83 inches, gray (5Y 5/1 to 6/1) clay; very firm.

$D_r$ 83 to 86 inches, weathered calcareous shale, underlain by limestone bedrock.

#### CROSBY SILT LOAM, CT-14

This soil was sampled in 1955 in a cultivated field. The site was located 50 yards east of the Borum Road and 150 yards south of the railroad. It was on the nearly level Wisconsin till plain. Slope is about 1 percent.

$A_p$ 0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, subangular blocky structure; friable; abrupt boundary.

$B_1$ 9 to 12 inches, yellowish-brown (10YR 5/4) silty clay loam; many, fine and medium, distinct mottles and ped coatings of gray (10YR 5/1) and grayish brown (10YR 5/2); moderate, medium, angular blocky structure; firm; clear boundary.

$B_2$ 12 to 18 inches, dark grayish-brown (10YR 4/2) silty clay; many, fine and medium, prominent mottles of dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/6); prominent clay coatings on ped faces; strong, medium, prismatic structure breaking to strong, coarse, angular blocky; very firm; abrupt, wavy boundary.

$B_3C_1$ 18 to 23 inches, dark-brown (10YR 4/3) silty clay loam; many, fine, distinct mottles of yellowish brown (10YR 5/4); clay coatings of grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) on ped faces extend into this horizon; weak, coarse, subangular blocky structure; friable; calcareous. (The 23- to 31-inch depth was not described nor sampled.)

$C_2$ 31 to 35 inches, olive-brown (2.5Y 4/3) coarse clay loam; many, fine, distinct mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/4); massive; friable; calcareous till. (The 35- to 40-inch depth was not described nor sampled.)

$C_3$ 40 to 45 inches, olive-brown (2.5Y 4/3) loam; common, fine, distinct mottles of yellowish brown (10YR 5/4); common, light brownish-gray (10YR 6/2) seams of lime; massive; friable; calcareous till.

#### CROSBY SILT LOAM, CT-38

This soil was sampled June 16, 1955 in a cultivated field. The site was located one-half mile south of U.S. Highway No. 22 and 150 yards west of the Hornbeam Road. It was on the nearly level Wisconsin till plain.

$A_p$ 0 to 8 inches, very dark gray (10YR 3/1) silt loam; weak, medium, granular structure; friable; abrupt boundary.

$B_1$ 8 to 12 inches, grayish-brown (10YR 5/2) silty clay loam; common, fine, prominent mottles of yellowish brown (10YR 5/8); moderate, fine and medium, subangular blocky structure; firm; clear boundary.

$B_2$ 12 to 19 inches, dark grayish-brown (10YR 4/2) silty clay; common, fine, distinct mottles of yellowish brown (10YR 5/6); clay coatings of very dark grayish brown (10YR 3/2) on ped surfaces; moderate, fine and medium, subangular blocky structure; very firm; abrupt, wavy boundary.

$B_3C_1$ 19 to 23 inches, dark grayish-brown (10YR 4/2) silty clay loam; many, medium, distinct mottles of yellowish brown (10YR 5/6): clay coatings of very dark grayish brown (10YR 3/2) on ped surfaces; moderate coarse, subangular blocky structure and massive, firm calcareous; clear boundary.

$C_2$ 23 to 27 inches, brownish yellow (10YR 6/6) loam; common, fine, distinct mottles of gray (10YR 5/1); weak, medium and coarse, subangular blocky structure; friable; calcareous. (The 27- to 38-inch depth was not described nor sampled.)

$C_3$ 38 to 42 inches, olive-brown (2.5Y 4/3) loam; few, medium, distinct mottles of yellowish brown (10YR 5/4); massive; friable; occasional seams of lime; calcareous till.

#### FINCASTLE SILT LOAM, CT-24

This soil was sampled March 26, 1955 in a bluegrass pasture. The site was located nine-sixteenths of a mile east of the intersection of the Regan and Texas Roads, 50 feet north of road. The sampled area has slopes of 2 to 6 percent.

$A_p$ 0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; abrupt boundary.

$A_2$ 9 to 12 inches, pale-brown (10YR 6/3) silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/8); weak, coarse, crumb structure; friable; abrupt boundary.

$B_1$ 12 to 16 inches, brown (10YR 5/3) silty clay loam; many, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm; clear boundary.

$B_{21}$ 16 to 21 inches, brown (10YR 4/3) silty clay loam; many, medium, faint mottles of yellowish brown (10YR 5/4); moderate, medium, angular blocky structure; firm; gradual boundary.

$B_{22}$ 21 to 28 inches, brown (10YR 4/3) coarse silty clay; many, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, fine and medium, subangular blocky structure; firm; gradual boundary.

$B_3$ 28 to 33 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, faint mottles of yellowish brown (10YR 5/6); moderate, fine, subangular blocky structure; firm; abrupt, wavy boundary.

C 33 to 38 inches, pale-brown (10YR 6/3) loam or silt loam; many, medium, faint mottles of yellowish brown (10YR 5/6); massive; friable; calcareous till.

#### FINCASTLE SILT LOAM, CT-27

This soil was sampled April 5, 1955 in a cultivated field located east of right-angle turn on Hiatt Road, three-fourths of a mile from the intersection with George Road. The sampled area has slopes of 2 to 6 percent.

$A_p$ 0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, subangular blocky structure and weak, coarse, granular; friable; abrupt boundary.

$B_1$ 8 to 14 inches, brown (10YR 5/3) silt loam; many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm; clear boundary.

$B_{21}$ 14 to 22 inches, dark yellowish-brown (10YR 4/4) silty clay loam; common, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, medium and coarse, subangular blocky structure; firm; gradual boundary.

$B_{22}$ 22 to 29 inches, brown (10YR 5/3) silty clay loam; common, medium, distinct mottles of yellowish brown (10YR 5/6); peds coated dark yellowish brown (10YR 4/4); weak, coarse, subangular blocky structure and massive; firm; occasional fine, black concretions; gradual boundary.

$B_3$ 29 to 36 inches, light brownish-gray (10YR 6/2) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/8); massive to weak, medium, subangular blocky structure; friable; clear boundary.

C 36 to 40 inches, light brownish-gray (10YR 6/2) and dark yellowish-brown (10YR 4/4) mottled loam; massive; friable; calcareous till.

#### GENESEE LOAM, SANDY SUBSTRATUM PHASE

The profile description of this soil was obtained in a pasture along Creek Road, one-fourth of a mile southwest of U.S. Highway No. 22. The soil material consists of alluvium over gravel. A sample for laboratory analysis was not obtained for this soil. Values for reaction were determined by field methods.

$A_1$ and $C_1$ 0 to 18 inches, brown (10YR 4/3) loam; weak, fine, granular structure; friable; pH 6.8; gradual boundary.

$C_2$ 18 to 24 inches, dark yellowish-brown (10YR 3/4) silty clay loam; massive; friable; pH 6.0; clear boundary.

$C_3$ 24 to 30 inches, dark yellowish-brown (10YR 3/4) clay loam; massive; friable; pH 6.8; abrupt, wavy boundary.

D 30 inches +, calcareous gravelly material, poorly sorted to well sorted, containing large cobbles and fragments of limestone.

Depth to this gravelly material ranges from 18 to 30 inches.

#### HENSHAW SILT LOAM, CT-1

This soil was sampled in 1953 in a cultivated field. The site is located one-half mile southwest of the intersection of the Sherod and Clarksville Roads. It is in east-central Warren County, about 2 miles west of the Clinton County line. The soil is considered to be representative of the Henshaw soils in Clinton County.

A , 0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; abrupt boundary.

$A_2$ 10 to 14 inches, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2), mottled coarse silty clay loam; moderate, thin, platy structure; friable; abrupt boundary.

$B_{21}$ 14 to 20 inches, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2), mottled silty clay loam; strong, medium, angular blocky structure; firm; gradual boundary.

$B_{22}$ 20 to 34 inches, pale-brown (10YR 6/3) and brownish-yellow (10YR 6/6), mottled silty clay loam; strong, coarse, angular blocky structure; firm; clear boundary.

C 34 to 46 inches, light brownish-gray (10YR 6/2) and brownish-yellow (10YR 6/6), mottled silt loam; weak, coarse, prismatic structure to massive; friable.

This profile was not sampled at a depth to reach calcareous material.

#### MEDWAY SILT LOAM, CT-71

This soil was sampled September 6, 1957 in a cultivated field. The site was located 1 mile west of Lumberton and 100 yards west of the McCrary Road. It was on nearly level bottom land. The parent material is alluvium.

$A_p$ 0 to 7 inches, very dark brown (10YR 2/2) silt loam o coarse clay loam; weak, fine and medium, granular structure; friable; abrupt, smooth boundary.

$C_1$ 7 to 13 inches, black (10YR 2/1) to very dark brown (10YR 2/2) fine sandy loam; weak, medium and fine, subangular blocky structure; friable; gradual boundary.

$C_2$ 13 to 22 inches, very dark brown (10YR 2/2) fine sandy loam; common, medium, distinct mottles of dark grayish brown (10YR 4/2) and brown (10YR 5/3); weak, medium, subangular blocky structure; friable; organic material or coatings on ped faces and along cracks and root channels; clear boundary.

$C_3$ 22 to 31 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) fine sandy loam; common, coarse, faint mottles of dark brown (10YR 4/3); weak, subangular blocky structure; friable; organic coatings on ped faces and along root channels; gradual boundary.

$C_4$ 31 to 45 inches, yellowish-brown (10YR 5/6–5/8), heavy fine sandy loam; common, medium, faint mottles of brown (10YR 5/3) and yellowish brown (10YR 5/4); weak, medium and coarse, subangular blocky structure; friable; very thin, discontinuous clay skins on faces of peds; few, black or very dark brown stains and concretions of manganese; clear, wavy boundary. (Not sampled for laboratory analysis.)

$D_1$ 45 to 60 inches, weathered limestone; a few rounded igneous pebbles; calcareous. (Not sampled for laboratory analysis.)

$D_r$ 60 inches +, limestone bedrock.

#### MIAMI SILT LOAM, CT-13

This soil was sampled in 1953 in a grass pasture. The site is located 400 feet south of U.S. Highway No. 22, and 150 feet west of Reed Road. It is on the Wisconsin till plain and has a 3 percent slope.

$A_p$ 0 to 5 inches, dark-brown (10YR 4/3) loam or silt loam; moderate, fine, granular structure; friable; abrupt boundary.

$B_1$ 5 to 9 inches, dark-brown (10YR 4/3) clay loam; moderate, fine, subangular blocky structure; firm; clear boundary.

$B_2$ 9 to 16 inches, dark yellowish-brown (10YR 4/4) clay; strong, medium, angular blocky structure; prominent clay coatings on surfaces of peds; very firm; abrupt, wavy boundary.

$B_3C_1$ 16 to 21 inches, dark yellowish-brown (10YR 3/4) clay loam; moderate, medium, subangular blocky structure and massive; prominent clay coatings along ped surfaces; firm; calcareous; gradual boundary.

$C_2$ Loam-textured, highly calcareous till but not sampled nor described.

#### MIAMI SILT LOAM, CT-37

This soil was sampled June 16, 1955 in a cultivated field. The site is located 40 feet south of the Greenfield Pike at a point 1.4 miles south of Sabina. It is on the Wisconsin till plain and has slopes of 2 to 6 percent.

$A_p$ 0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; strong, medium, granular structure; friable; abrupt boundary; part of the $B_1$ horizon has been mixed with this horizon in tillage.

$B_1$ 8 to 9 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium and coarse, angular blocky structure; firm; abrupt boundary.

$B_2$ 9 to 13 inches, dark yellowish-brown (10YR 4/4, 3/4) clay; moderate, medium, angular blocky structure; very firm; clear boundary.

$B_3C_1$ 13 to 15 inches, yellowish-brown (10YR 5/4) clay loam; moderate, fine and medium, subangular blocky structure; firm; abrupt boundary.

$C_2$ 15 to 20 inches, yellowish-brown (10YR 5/4–5/8) silt loam; moderate, medium, subangular blocky structure; firm; many stones; calcareous. (The 20- to 24-inch depth was not sampled nor described.)

$C_3$ 24 to 30 inches, olive-brown (2.5Y 4/3) silt loam or loam; massive; friable; numerous small stones; calcareous. (The 30- to 35-inch depth was not sampled nor described.)

$C_4$ 35 to 37 inches, dark-brown (10YR 4/3) loam; massive; friable; calcareous till containing many stones.

#### MILTON SILT LOAM

This is a profile description in an area of this soil in a cultivated field 200 yards north of U.S. Highway No. 22 at the intersection with Creek Road. The soil material is glacial till overlying limestone bedrock. The thickness of the till mantle is 19 inches in the profile described, but it ranges from less than 10 inches up to 40 inches in the immediate vicinity of this site. Slabs of limestone are on the soil surface where the soil mantle is thin. Soil samples for laboratory analyses were not obtained for this soil. Values for reaction were determined by field methods.

$A_p$ 0 to 4 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable; pH 5.2; abrupt, wavy boundary.

$B_1$ 4 to 8 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, fine, subangular blocky structure; firm; pH 5.4; clear, smooth boundary.

$B_{21}$ 8 to 14 inches, dark yellowish-brown (10YR 4/4) clay loam; strong, medium, subangular and angular blocky structure; very firm; pH 5.5; gradual, smooth boundary.

$B_{22}$ 14 to 19 inches, dark yellowish-brown (10YR 4/4) clay loam; few, fine, faint mottles of yellowish brown (10YR 5/6); moderate, medium and coarse, subangular blocky structure; very firm; pH 6.5; abrupt, smooth boundary.

$D_1$ 19 to 22 inches, pale-olive (5Y 6/4) clay; massive; very firm; calcareous; derived from limestone material.

$D_r$ 22 inches +, Ordovician limestone interbedded with calcareous clay shale.

#### OCKLEY SILT LOAM

This profile description was obtained in an alfalfa field on Ockley silt loam that had been included in an area mapped as Fox silt loam. The site is located one-fourth of a mile southwest of the intersection of Pyle Road and Clarksville Road, then 100 yards northwest across the Pennsylvania Railroad tracks. The site is on a terrace of glacial outwash material, along Todd Fork, and it has a slope of 1 percent. The soil approaches Fox silt loam in characteristics. The D horizon consisted of well-sorted calcareous gravel. Soil samples for laboratory analysis were not obtained at this site. Values for reaction were determined by field methods.

$A_p$ 0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, medium, crumb structure; friable; pH 6.6; abrupt boundary.

$A_3$ 8 to 10 inches, dark-brown (7.5YR 4/4) silt loam; moderate, fine, angular blocky structure; friable; pH 6.5; abrupt boundary.

$B_1$ 10 to 21 inches, dark-brown (7.5YR 4/4) silt loam; brown (7.5YR 5/4) coatings on peds; moderate, medium, angular blocky structure; friable; pH 5.6; gradual boundary.

$B_2$ 21 to 34 inches, strong-brown (7.5YR 5/6) to brown (7.5YR 5/4) silty clay loam; strong, fine and medium, subangular blocky structure; firm; pH 5.4; clear boundary.

$B_3$ 34 to 44 inches, dark-brown (7.5YR 4/4) fine clay loam; moderate, medium, angular blocky structure; firm; pH 5.4; abrupt boundary.

D 44 inches +, calcareous outwash gravel.

#### RAGSDALE SILTY CLAY LOAM, CT-20

This soil was sampled December 12, 1954 in a cultivated field. The site was located 150 feet north of Speers Road and one-fourth of a mile east of State Highway No. 134.

$A_p$ 0 to 8 inches, very dark brown (10YR 2/2), coarse silty clay loam; moderate, medium, granular structure; friable; abrupt boundary.

$B_{21}$ 8 to 15 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine, subangular blocky structure; friable; gradual boundary.

$B_{22g}$ 15 to 19 inches, very dark gray (10YR 3/1) silty clay loam; common, fine, faint mottles of dark grayish brown (10YR 4/2); moderate, medium, angular blocky structure; firm; gradual boundary.

$B_{23g}$ 19 to 28 inches, grayish-brown (2.5Y 5/2) silty clay loam; many, medium, prominent mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm; gradual boundary.

$B_{24g}$ 28 to 36 inches, grayish-brown (10YR 5/2) silty clay loam; many, medium, prominent mottles of yellowish brown (10YR 5/8); moderate, medium, subangular blocky structure; firm; abrupt, wavy boundary.

C 36 inches, brownish-yellow (10YR 6/8) silt loam; many, medium and large, prominent mottles of grayish brown (2.5Y 5/2); massive; firm; calcareous loess.

#### RAGSDALE SILTY CLAY LOAM, CT-S33

This soil was sampled March 24, 1953 in a deciduous forest. The site was located 3 miles northwest of Reesville, 120 yards southeast of the Sabina Road, one-quarter of a mile southwest of the Spencer Road. It is in a gently undulating, slightly depressed area having a slope of less than 1 percent. This profile was identified as CT-S6 in the work of Schafer and Holowaychuk (*15*).

$A_1$ 0 to 6 inches, black (10YR 2/1) coarse silty clay loam; moderate, medium and coarse, granular structure; friable; partly decomposed leaf litter on soil surface; clear boundary.

$B_{21}$ 6 to 15 inches, very dark gray (10YR 3/1) silty clay loam; strong, fine and medium, angular blocky structure; firm, plastic; gradual boundary.

$B_{22g}$ 15 to 27 inches, dark-gray (5Y 4/1) silty clay loam; many, fine and medium, prominent mottles of light olive brown (2.5Y 5/4); moderate, medium and coarse, angular blocky structure; firm, plastic; diffuse boundary.

$B_{3g}C$ 27 to 60 inches, mottled olive (5Y 5/4) and brownish-yellow (10YR 6/8) coarse silty clay loam; moderate, fine and medium, prismatic structure; occasional vertical cracks coated dark gray; slightly calcareous.

D 60 inches +, calcareous, gritty loam till; not sampled.

#### REESVILLE SILT LOAM, CT-6

This soil was sampled March 25, 1954 in a woodland consisting of elm, hard maple, ash, and cherry. The site is 2 miles south of Port William, 100 yards north of the Speers Road at the intersection of the Speers and Horseshoe Roads. It is on the Wisconsin till plain and has slopes of ½ to 1 percent. A 42-inch mantle of loess covers the calcareous loam till at this location.

$A_0$ 1 to 2 inches, leaf litter.

$A_1$ 0 to 4 inches, very dark gray (10YR 3/1) silt loam; when dry, gray (10YR 5/1); strong, medium to coarse, granular structure; neutral; clear boundary.

$A_2$ 4 to 7 inches, grayish-brown (10YR 5/2) silt loam; when dry, gray (10YR 6/1); weak, medium to fine, granular structure; friable; slightly acid; clear, smooth boundary.

$A_3$ 7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; when dry, pale yellow (2.5Y 7/4); common, medium and coarse, faint mottles of pale brown (10YR 6/3); moderate, fine, subangular blocky structure; friable; medium acid; diffuse, wavy boundary.

$B_1$ 12 to 18 inches, yellowish-brown (10YR 5/6) silty clay loam; when dry, very pale brown (10YR 7/3); common, medium, distinct mottles of pale brown (10YR 6/3), which tend to cover faces of peds; moderate to strong, fine, subangular blocky structure; friable; very strongly acid; gradual boundary.

$B_{21}$ 18 to 22 inches, yellowish-brown (10YR 5/4) silty clay loam; when dry, light yellowish brown (10YR 6/4); common, medium, faint mottles of pale brown

(10YR 6/3); strong, fine, subangular blocky structure; firm, moderately sticky when moist or wet; strongly acid; clear boundary.

$B_{22}$ 22 to 28 inches, brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) fine silty clay loam mottled with yellowish brown (10YR 5/8 to 5/6); when dry, yellowish brown (10YR 5/6); weak, fine, subangular blocky structure; moderately sticky; roots abundant and horizontally oriented; medium acid.

$B_3$ 28 to 33 inches, brownish-yellow (10YR 6/6) silty clay loam mottled with dark yellowish brown (10YR 4/3) on faces of peds; when dry, brownish yellow (10YR 6/6); weak, medium to coarse, subangular blocky structure; firm; slightly acid.

C 33 to 42 inches, yellowish-brown (10YR 5/6) silt loam; when dry, brownish yellow (10YR 6/6) or olive yellow (2.5Y 6/6); few, medium, distinct mottles of light brownish gray (10YR 6/2); massive breaking occasionally to weak, very coarse, prismatic structure; friable; calcareous.

$D_1$ 42 to 52 inches, yellowish-brown (10YR 5/6) loam; when dry, pale yellow (2.5Y 7/4); very coarse, prismatic structure with indication of weak platiness; firm in place, moderately friable; calcareous glacial till.

$D_2$ 52 to 60 inches, olive-brown (2.5Y 4/4) loam till; when dry, light yellowish brown (2.5Y 6/4); common, medium, distinct mottles of light olive brown (2.5Y 5/6) and yellowish brown (10YR 5/8); breaks into very coarse prisms, the faces of which are coated with light brownish-gray (2.5Y 6/2 to 5/2) clayey material; roots on prism faces; occasional igneous cobbles and black fragments of shale; calcareous.

$D_3$ 60 to 72 inches, yellowish-brown (10YR 5/8) loam till; when dry, light yellowish brown (2.5Y 6/4); considerable fine gravel; calcareous.

$D_4$ 72 to 80 inches, yellowish-brown (10YR 5/4) loam till; when dry, light yellowish brown (2.5Y 6/4); fine gravel and black shale; calcareous.

$D_5$ 80 to 83 inches, olive-brown (2.5Y 4/4 to 5/4) loam till; calcareous.

### REESVILLE SILT LOAM, CT-8

This soil was sampled May 20, 1954 in a nearly level, cultivated field. This site is located one-half mile west of the intersection of the Lebanon and the Hadley Roads, 500 feet north of the Lebanon Road.

$A_p$ 0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; very weak, fine and medium, granular structure; friable; abrupt boundary.

$A_2$ 9 to 13 inches, pale-brown (10YR 6/3) silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium, platy structure; friable; clear, smooth boundary.

$B_1$ 13 to 17 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct mottles of pale brown (10YR 6/3); moderate, fine and medium, subangular blocky structure; friable; clear, smooth boundary.

$B_{21}$ 17 to 25 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium, distinct mottles of pale brown (10YR 6/3); surfaces of peds brown (10YR 5/3); moderate, medium, subangular blocky structure; friable; black concretions in lower part; clear, smooth boundary.

$B_{22}$ 25 to 33 inches, brownish-yellow (10YR 6/6) silty clay loam; many, medium, distinct mottles of grayish brown (10YR 5/2); moderate, coarse and medium, subangular blocky structure, firm; clear, smooth boundary.

$B_3$ 33 to 38 inches, brownish-yellow (10YR 6/6, 6/8) silty clay loam; many, fine, distinct mottles of pale brown (10YR 6/3) and light yellowish brown (10YR 6/4); weak, medium, subangular blocky structure and massive; friable; abrupt, wavy boundary.

C 38 to 50 inches, pale-brown (10YR 6/3) silt loam; many, medium, distinct mottles of brownish yellow (10YR 6/8) and strong brown (7.5YR 5/8); massive; firm and compact in place, friable; calcareous. (The 50- to 72-inch depth was not sampled nor described.)

D 72 inches, yellowish-brown (10YR 5/4) silt loam till; high content of sand and small stones; massive; friable; calcareous.

### ROSS SILT LOAM

This soil profile description was obtained in a cultivated field located one-fourth of a mile east of New Burlington and 50 feet north of the Burlington Road. The parent material is stratified alluvium. Soil samples for laboratory analysis were not obtained at this site.

$A_p$ 0 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, granular structure; friable; neutral; abrupt boundary.

$C_1$ 12 to 15 inches, very dark grayish-brown (10YR 3/2) gravelly loam; massive; friable; neutral; clear boundary.

$C_2$ 15 to 29 inches, very dark brown (10YR 2/2) coarse silty clay loam; moderate, coarse, angular blocky structure; friable; slightly calcareous; gradual boundary.

$C_3$ 29 to 36 inches, dark-brown (10YR 4/3 to 3/2) silt loam; massive; friable; slightly calcareous; not described below a depth of 3 feet.

### ROSSMOYNE SILT LOAM, CT-65

This soil was sampled April 25, 1957 in a legume-grass meadow. The site was located 3 miles south of Blanchester, and 60 rods west of State Highway No. 123. It is on the Illinoian till plain and has an elevation of about 1,010 feet above sea level. The area is covered by a thin mantle of loess and has a slope of about 1 percent.

$A_p$ 0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; abundant, fine roots; abrupt boundary.

$A_2$ 8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; few, fine, faint mottles of yellowish brown (10YR 5/6 to 5/8); weak, fine to medium, subangular blocky structure; friable; few, fine roots; gradual boundary.

$B_1$ 11 to 16 inches, yellowish-brown (10YR 5/4 to 5/8) silty clay loam; faint, light coatings or mottles of light brownish gray (10YR 6/2); weak, medium, subangular blocky structure; friable; few, fine roots; gradual boundary.

$B_{21}$ 16 to 20 inches, strong-brown (7.5YR 5/6 to 5/8) and yellowish-brown (10YR 5/6 to 5/8) silty clay loam; surfaces of peds coated light brownish gray (2.5Y 6/2); moderate, medium and fine, subangular blocky structure; firm; very few roots; gradual boundary.

$B_{22m}$ 20 to 32 inches, strong-brown (7.5YR 5/6 to 5/8) and yellowish-brown (10YR 5/6 to 5/8) silty clay loam; surfaces of peds coated light gray (10YR 7/2); weak, thick, platy structure in place breaking to strong, medium and coarse, subangular blocky; firm; some stains of manganese and concretions in lower part; diffuse boundary. (Sampled at depths of 20 to 25 and 25 to 32 inches.)

$B_{23m}$ 32 to 42 inches, mottled brown (10YR 5/3), yellowish-brown (10YR 5/4), and dark yellowish-brown (10YR 4/4) silty clay loam; continuous clayey coatings of light brownish gray (2.5Y 6/2); moderate, coarse, subangular blocky structure; firm; many black stains of manganese and concretions; gradual boundary.

$B_{31}$ 42 to 54 inches, mottled dark-brown (10YR 4/3), brown (10YR 5/3), and yellowish-brown (10YR 5/6) clay; weak, very coarse, prismatic structure breaking to weak or moderate, medium and coarse, subangular blocky; very firm; numerous black stains of manganese and concretions; gradual boundary.

$B_{32}$ 54 to 60 inches, yellowish-brown (10YR 5/4 to 5/8) clay; numerous black stains of manganese and concretions; weak, coarse and very coarse, subangular blocky structure and massive; very firm; gradual boundary.

$B_{33}$ 60 to 84 inches, yellowish-brown (10YR 5/4, 5/6, and 5/8) clay loam and clay; grayish-brown (2.5Y 5/2) colors observed; common black stains of manganese and concretions; massive; some very small igneous pebbles. (Sampled with auger at depths of 60 to 67, 67 to 72, and 72 to 78 inches.)

C 84 to 94 inches, distinctly mottled yellowish-brown (10YR 5/6 to 5/8), light olive-brown (2.5Y 5/4), and light brownish-gray (2.5Y 6/2) clay; massive; firm; weakly calcareous. (Sampled with auger at depth of 85 to 91 inches.)

#### RUSSELL SILT LOAM, CT-29

This soil was sampled April 7, 1955 in a cultivated field. The site is in Wilson Township, 350 feet southwest of the Melvin Road and three-fourths of a mile northwest of the intersection of the Melvin and Stone Roads. It is an inclusion in an area mapped as the Xenia soils. The site has a slope of 3 percent. This area is part of the Wisconsin till plain but has a thin mantle of silt loam (loess) over the till.

$A_p$ 0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; abrupt boundary.

$B_1$ 8 to 15 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; clear, smooth boundary.

$B_{21}$ 15 to 19 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, fine and medium, subangular and angular blocky structure; firm; abrupt, smooth boundary.

$B_{22}$ 19 to 27 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; abrupt, smooth boundary. (The soil profile to this depth has developed in the mantle of silt, which is about 27 inches thick at this site. The percentage of sand in this horizon suggests, however, that sampling entered the till-derived material.)

$B_{23}$ 27 to 34 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium and coarse, subangular blocky structure; very firm; fragments of black shale and pebbles; clear, smooth boundary.

$B_3$ 34 to 42 inches, dark-brown (7.5YR 4/2) loam; weak, coarse, subangular blocky structure and massive; friable; fragments of black shale and pebbles, abrupt, wavy boundary.

C 42 to 46 inches, yellowish-brown (10YR 5/6) and dark-brown (10YR 4/3) loam; massive; friable; calcareous till.

#### RUSSELL SILT LOAM, CT-30

This soil was sampled April 15, 1955 in a cultivated field located 275 yards southeast of State Highway No. 729 and one-fourth of a mile southwest of Lees Creek. The site has slopes of less than 2 percent.

$A_p$ 0 to 9 inches, brown (10YR 5/3) silt loam; weak, medium, granular structure; friable; abrupt boundary.

$B_1$ 9 to 11 inches, dark-brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; clear, smooth boundary.

$B_{21}$ 11 to 15 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; gradual, smooth boundary.

$B_{22}$ 15 to 23 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; firm; gradual, smooth boundary.

$B_{23}$ 23 to 31 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, medium, subangular blocky structure; very firm; occasional fine black concretions; diffuse boundary.

$B_3$ 31 to 40 inches, dark yellowish-brown (10YR 4/4) silty clay loam; weak, medium to coarse, subangular blocky structure and massive; abrupt boundary.

C 40 to 45 inches, yellowish-brown (10YR 5/4), light brownish-gray (10YR 6/2), and pale-brown (10YR 6/3) silt loam with a high sand content; massive; friable; calcareous till; pebbles and a small amount of black shale present.

#### SLOAN SILT LOAM, CT-47

This soil was sampled July 1955 on the first bottom in the upper watershed of Cowans Creek. The site is located along the south bank of the creek, 300 feet northeast of the Antioch Road and 7 miles southeast of Wilmington in Green Township.

$A_{11}$ 0 to 13 inches, very dark gray (10YR 3/1) or very dark brown (10YR 2/2) silt loam; weak, fine and medium, granular structure; friable; gradual boundary.

$A_{12}$ 13 to 30 inches, very dark gray (10YR 3/1) clay loam; common, fine, faint mottles of dark brown (10YR 3/3); moderate, medium, angular blocky structure; friable; gradual boundary.

$C_{1g}$ 30 to 42 inches, dark-gray (10YR 4/1) loam; common, medium, distinct mottles of dark brown (10YR 3/3) and coatings of very dark gray (N 3/0); moderate, medium and coarse, angular blocky structure; friable, slightly sticky; gradual boundary.

$C_{2g}$ 42 to 67 inches, dark-gray (10YR 4/1) loam; common mottles of yellowish brown (10YR 5/8); weak, medium, subangular blocky structure; friable, slightly sticky; abrupt boundary.

D 67 inches +, mottled, calcareous loam till.

#### WILLIAMSBURG SILT LOAM, CT-72

This soil was sampled April 14, 1958, 5 miles northeast of Blanchester, in a bluegrass meadow located 50 feet northeast of Statler Road in Vernon Township, and 1½ miles north of Pansy Road. The site is on an outwash terrace with a slope of 1 percent. The upper part of the solum has developed from silty material. The lower part has developed from clay loam and sandy clay loam. The underlying material, at a depth of 84 inches, is calcareous gravelly and sandy loam.

$A_{p1}$ 0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; friable; abrupt, smooth boundary.

$A_{p2}$ 2 to 7½ inches, dark-brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; abrupt, smooth boundary.

$A_2$ 7½ to 12 inches, yellowish-brown (10YR 5/4) to dark yellowish-brown (10YR 4/4) silt loam; moderate, very fine, subangular blocky structure crushing to fine and very fine, granular; friable; clear, smooth boundary.

$B_1$ 12 to 20 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; gradual, smooth boundary.

$B_{21}$ 20 to 37 inches, yellowish-brown (10YR 5/6) silt loam; few, fine, faint streaks of light yellowish brown (10YR 6/4), dark yellowish brown (10YR 4/4), and light gray (10YR 7/2); strong, coarse, subangular blocky structure breaking to strong, fine and medium, subangular blocky; firm; clear, irregular boundary, which occurs at depths ranging from 30½ to 37 inches. (Sampled at depth of 20 to 27½ inches.)

$B_{22}$ 37 to 50 inches, light yellowish-brown (10YR 6/4) loam; common, medium, distinct mottles of dark grayish brown (10YR 4/2) and brownish yellow (10YR 6/6); strong, coarse, subangular blocky structure; friable; clear, smooth boundary.

$B_{23}$ 50 to 64 inches, brown (10YR 5/3) clay loam; common, medium, distinct mottles of dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/4); weak, coarse and medium, subangular blocky structure; very firm; manganese concretions; gradual, smooth boundary.

$B_{31}$ 64 to 79 inches, dark yellowish-brown (10YR 4/4) clay loam; many, fine, distinct mottles of yellowish brown (10YR 5/8) and very pale brown (10YR 8/3); massive; firm; manganese concretions; diffuse boundary.

$B_{32}$ 79 to 84 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; many, fine, distinct mottles of pale brown (10YR 6/3) and yellowish brown (10YR 5/8); massive breaking to single grain; this is a layer containing poorly assorted sand and gravel; cemented in places.

D 84 inches +, calcareous sandy and gravelly loam. (Not sampled for laboratory analysis.)

**XENIA SILT LOAM, CT–55**

This soil was sampled May 8, 1956 in a bluegrass pasture. The site was located along U.S. Highway No. 68, 200 yards east of railroad and 0.1 mile north of Champlin. Slopes are 2 to 4 percent. The parent material is 24 inches of silt over till of Wisconsin age.

$A_p$ 0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and fine, granular structure; friable; abrupt boundary.

$B_1$ 7 to 11 inches, dark yellowish-brown (10YR 4/4), coarse silty clay loam; weak, fine, subangular blocky structure; friable; clear, smooth boundary.

$B_{21}$ 11 to 19 inches, dark-brown (10YR 4/3) to yellowish-brown (10YR 5/4) silty clay loam; peds coated with brown (10YR 5/3); strong, fine and very fine, subangular blocky structure; firm; numerous concretions of dark brown; gradual, smooth boundary.

$B_{22}$ 19 to 24 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, faint mottles of brown (10YR 5/3); moderate, fine, subangular blocky structure; firm; numerous dark-brown concretions; abrupt boundary.

$B_{23}$ 24 to 30 inches, yellowish-brown (10YR 5/4) clay loam; common, fine, faint mottles of brown (10YR 5/3); weak, fine, subangular blocky structure; firm; numerous dark-brown concretions; contains small stones and pebbles derived from till; gradual boundary.

$B_3$ 30 to 34 inches, yellowish-brown (10YR 5/6) clay loam or loam; common, fine, faint mottles of brown (10YR 5/3); weak, fine, subangular blocky structure; friable; numerous brown concretions; abrupt, wavy boundary.

$C_1$ 34 to 41 inches, yellowish-brown (10YR 5/6) loam; common, fine, faint mottles of grayish brown (10YR 5/2); massive; friable; calcareous till.

$C_2$ 41 to 46 inches, yellowish-brown (10YR 5/6) loam; common, fine, distinct mottles of grayish brown (10YR 5/2) and brownish yellow (10YR 6/8); massive; friable; calcareous till.

# *Engineering Properties of the Soils*

This soil survey report for Clinton County, Ohio, contains information that can be used by engineers to—

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Assist in the design of drainage and irrigation systems, farm ponds, diversion terraces, and other structures for soil and water conservation.
3. Make reconnaissance surveys of soil and ground conditions that will aid in locating highways and airports and in planning detailed soil surveys of the intended locations.
4. Locate sources of sand and gravel.
5. Correlate pavement performance with soil mapping units and thus develop information that will be useful in designing and maintaining the pavements.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs, for the purpose of making soil maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

*The mapping and the descriptive report are somewhat generalized, however, and should be used only in planning more detailed field surveys to determine the in-place condition of the soil at the site of the proposed engineering construction.*

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, sand—may have special meanings in soil science. These and other terms used in the report are defined in the Glossary at the end of the report.

## Engineering Soil Classification Systems

Many highway engineers classify soil material according to the system adopted by the American Association of State Highway Officials (*1*). In this system, soil materials are classified in seven principal groups. The groups range from A–1, which is soil of high bearing capacity, to A–7, which consists of clay soil having low strength when wet. In each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number for each tested soil is shown in parentheses following the soil group symbol in the third from last column in table 5.

Some engineers prefer to use the Unified soil classification system (*23*). In this system, soil materials are identified as coarse grained, eight classes; fine grained, six classes; and highly organic soils. An approximate classification of soils can be made in the field. The Unified classification of tested Clinton County soils is given in the fourth from last column in table 5.

### *Soil test data*

To be able to make the best use of the soil maps and soil survey reports, the engineer should know the physical properties of the soil materials and the in-place condition of the soil. After testing soil materials and observing their behavior in engineering structures, the engineer can develop design recommendations for the soil units delineated on the maps.

Samples of 15 soil types in Clinton County were tested according to standard procedures to help evaluate the soils for engineering purposes (table 5). Most soils were sampled in more than one place. For these, the data in table 5 are averages of all the samples obtained for the soil. The engineering classifications in this table are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits.

The mechanical analyses were made by combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method should not be used in naming textural class for soil classification.

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 clayey soil increases from a very dry state, the material changes from a solid to a semisolid, or plastic, state. As the moisture content is further increased, the material changes from the plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 5 also gives the results of moisture-density tests for the 14 soils. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of a compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in earthwork, for, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Permeability tests were conducted on saturated cores of undisturbed soil. The results are a measure of hydraulic conductivity. Field infiltration velocity was determined by the use of double-ring infiltrometers using a constant head of water. The rates shown in table 5 are those observed after a 5-hour test period and a constant intake rate had been established. The subsoil was tested after removal of the surface soil.

TABLE 5.—*Engineering test data*

[Furnished by the Ohio State University Soil Laboratories and the Ohio

| Soil type | Sample numbers | Depth from surface | Horizon | Grain-size distribution: Percentage passing sieve— No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Percentage of each soil separate: Coarse sand (2.0–0.42 mm.) | Fine sand (0.42–0.074 mm.) |
|---|---|---|---|---|---|---|---|---|---|
| | | *Inches* | | | | | | | |
| Avonburg silt loam | CT-66, CT-73, WA-1 | 0–12 | A | 100 | 100 | 94 | 87 | 6 | 7 |
| | | 12–32 | B | 100 | 100 | 97 | 89 | 3 | 8 |
| | | 32–60 | B | 100 | 99 | 96 | 87 | 3 | 9 |
| | | 60–110 | B | 100 | 99 | 94 | 78 | 5 | 16 |
| Birkbeck silt loam | CT-5, CT-52 | 0–12 | A | 100 | 100 | 99 | 96 | 1 | 3 |
| | | 12–36 | B | 100 | 100 | 99 | 95 | 1 | 4 |
| | | 36–50 | C | 100 | 99 | 97 | 91 | 2 | 6 |
| | | 50–60 | C | 100 | 98 | 92 | 82 | 6 | 10 |
| Blanchester silt loam | CT-68, CT-74, WA-2 | 0–7 | A | 100 | 100 | 97 | 89 | 3 | 8 |
| | | 7–40 | B | 100 | 100 | 98 | 92 | 2 | 6 |
| | | 40–66 | B | 100 | 99 | 96 | 88 | 3 | 8 |
| | | 66–96 | B | 100 | 98 | 95 | 78 | 3 | 17 |
| Brookston silty clay loam | CT-51, RO-31 | 0–14 | A | 100 | 100 | 97 | 89 | 3 | 8 |
| | | 14–46 | B | 100 | 98 | 93 | 86 | 5 | 7 |
| | | 46+ | C | -------- | 96 | 90 | 74 | 6 | 16 |
| Celina silt loam | CT-28, CT-40, CT-54 | 0–8 | A | 100 | 99 | 95 | 80 | 4 | 15 |
| | | 8–26 | B | 100 | 97 | 92 | 80 | 5 | 12 |
| | | 26+ | C | -------- | 89 | 79 | 62 | 10 | 17 |
| Clermont silt loam | CT-67, WA-3 | 0–17 | A | 100 | 100 | 97 | 90 | 3 | 7 |
| | | 17–48 | B | 100 | 100 | 99 | 95 | 1 | 4 |
| | | 48–74 | B | 100 | 100 | 98 | 93 | 2 | 5 |
| Crosby silt loam | CT-23, CT-31, FR-S8 | 0–9 | A | 100 | 99 | 95 | 86 | 4 | 9 |
| | | 9–26 | B | 100 | 97 | 92 | 82 | 5 | 10 |
| | | 26+ | C | -------- | 90 | 80 | 65 | 10 | 15 |

## Engineering Data and Interpretations

Table 6 contains a brief description of the soils mapped in Clinton County and gives their estimated engineering classifications and physical properties. Additional information on Clinton County soils is in the sections "Descriptions of the Soils" and "Use and Management of the Soils."

The engineering data in table 6 are based on the soil tests shown in table 5, on information in other parts of the soil survey report, and on experience with the same kinds of soils in other counties.

In table 6, depth to seasonally high water table refers to the shallowest depth at which saturated soil occurs in winter and early in spring because of a perched or other ground-water table. If less than normal precipitation falls during the wet season, saturated soil may be considerably deeper. Soil conditions immediately after heavy precipitation are not considered. In all soils, particularly in those on sloping areas and uplands, the depth to the water table is greater late in spring, in summer, and in fall than is shown in table 6.

Approximate depth to substratum is the approximate depth at which the subsoil ends and where the glacial till, raw deposits of gravel, silt, or clay, or bedrock material begin.

Normal depth to bedrock means the general depth to bedrock over most of the soil area. In some places, bedrock may be nearer the surface than shown in the table. In many places, the depth may be as much as 100 or 200 feet, although the indicated depth is shown to be greater than 10 feet.

Terms for soil texture and grain size in table 6 are those commonly used by engineers.

*for 14 soils in Clinton County*

Department of Highways Testing Laboratory. Dashes indicate data not available]

| Grain-size distribution—Con.: Percentage of each soil separate—Con.: Silt (0.074–0.005 mm.) | Grain-size distribution—Con.: Percentage of each soil separate—Con.: Clay (less than 0.005 mm.) | Liquid limit | Plastic limit | Plasticity index | Moisture-density: Maximum dry density | Moisture-density: Optimum moisture content | Bulk density | Classification: Unified [1] | Classification: AASHO [2] | Permeability of cores | Field infiltration velocity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Lb. per cu. ft.* | *Percent of dry weight* | *Gm. per cc.* | | | *In. per hr.* | *In. per hr.* |
| 58 | 29 | 29 | 25 | 4 | ---- | ---- | 1.44 | ML | A-4(8) | 0.20 | 0.91 |
| 46 | 43 | 41 | 21 | 20 | 107 | 18 | 1.52 | CH | A-7-6(12) | .05 | ---- |
| 42 | 45 | 37 | 21 | 16 | 108 | 17 | 1.69 | CL | A-6(10) | .03 | ---- |
| 33 | 45 | 36 | 22 | 14 | 110 | 17 | ---- | CL | A-6(10) | ---- | ---- |
| 65 | 31 | 30 | 24 | 6 | ---- | ---- | 1.45 | ML | A-4(8) | ---- | ---- |
| 60 | 35 | 35 | 23 | 12 | ---- | ---- | 1.48 | CL | A-6(9) | ---- | ---- |
| 65 | 26 | 28 | 21 | 7 | ---- | ---- | 1.69 | ML | A-4(8) | ---- | ---- |
| 54 | 28 | 25 | 20 | 5 | ---- | ---- | ---- | ML | A-4(8) | ---- | ---- |
| 46 | 43 | 37 | 25 | 12 | 99 | 22 | 1.35 | CL | A-6(9) | 1.10 | .94 |
| 40 | 52 | 47 | 24 | 23 | 98 | 21 | 1.50 | CH | A-7-6(15) | .19 | .20 |
| 38 | 50 | 47 | 24 | 23 | 98 | 21 | 1.55 | CH | A-7-6(15) | .05 | ---- |
| 30 | 48 | 36 | 21 | 15 | ---- | ---- | ---- | CL | A-6(10) | ---- | ---- |
| 45 | 44 | 45 | 31 | 14 | ---- | ---- | 1.34 | MH or OH. | A-7-5(11) | ---- | ---- |
| 41 | 45 | 40 | 22 | 18 | ---- | ---- | 1.52 | CL | A-6(11) | ---- | ---- |
| 49 | 25 | 25 | 18 | 7 | ---- | ---- | 1.68 | ML or SC. | A-4(8) | ---- | ---- |
| 50 | 30 | 30 | 23 | 7 | ---- | ---- | 1.39 | ML | A-4(8) | ---- | ---- |
| 32 | 48 | 38 | 22 | 16 | ---- | ---- | 1.53 | CL | A-6(10) | ---- | ---- |
| 34 | 28 | 23 | 16 | 7 | ---- | ---- | ---- | ML or SC. | A-4(5) | ---- | ---- |
| 53 | 37 | 30 | 23 | 7 | ---- | ---- | 1.45 | ML | A-4(8) | .20 | 1.02 |
| 47 | 48 | 42 | 21 | 21 | 102 | 19 | 1.49 | CH | A-7-6(13) | .05 | .16 |
| 50 | 43 | 41 | 21 | 20 | 102 | 19 | 1.55 | CH | A-7-6(12) | .05 | ---- |
| 55 | 31 | 28 | 24 | 4 | ---- | ---- | 1.33 | ML | A-4(8) | ---- | 1.60 |
| 35 | 47 | 39 | 24 | 15 | ---- | ---- | 1.50 | CL | A-6(10) | ---- | .46 |
| 28 | 37 | 26 | 19 | 7 | ---- | ---- | 1.50 | ML or SC. | A-4(6) | ---- | ---- |

TABLE 5.—*Engineering test data*

| Soil type | Sample numbers | Depth from surface | Horizon | Grain-size distribution: Percentage passing sieve— No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 200 (0.074 mm.) | Percentage of each soil separate: Coarse sand (2.0–0.42 mm.) | Fine sand (0.42–0.074 mm.) |
|---|---|---|---|---|---|---|---|---|---|
| | | *Inches* | | | | | | | |
| Fincastle silt loam | CT–15, CT–27 | 0–10 | A | 100 | 100 | 98 | 91 | 2 | 7 |
| | | 10–36 | B | 100 | 97 | 94 | 86 | 3 | 8 |
| | | 36+ | C | -------- | 87 | 79 | 60 | 8 | 19 |
| Miami silt loam | RO–12, RO–27, RO–18, RO–13. | 0–8 | A | -------- | 96 | 91 | 75 | 5 | 16 |
| | | 8–24 | B | -------- | 90 | 84 | 70 | 6 | 14 |
| | | 24+ | C | -------- | 83 | 70 | 52 | 13 | 18 |
| Ockley silt loam | GN–7, RO–28, WA–5 | 0–10 | A | 100 | 97 | 86 | 74 | 11 | 12 |
| | | 10–28 | B | 100 | 99 | 84 | 70 | 15 | 14 |
| | | 28–48 | B | 95 | 71 | 57 | 43 | 14 | 14 |
| | | 48+ | D | -------- | 48 | 23 | 11 | 25 | 12 |
| Reesville silt loam | CT–6 | 0–12 | A | 100 | 100 | 99 | 96 | 1 | 3 |
| | | 12–36 | B | 100 | 100 | 99 | 96 | 1 | 3 |
| | | 36–50 | C | 100 | 98 | 97 | 94 | 1 | 3 |
| | | 50+ | C | -------- | 92 | 84 | 73 | 8 | 11 |
| Rossmoyne silt loam | CT–65, WA–S13, RO–25. | 0–9 | A | 100 | 100 | 97 | 91 | 3 | 6 |
| | | 9–36 | B | 100 | 100 | 98 | 92 | 2 | 6 |
| | | 36–60 | B | 100 | 99 | 95 | 82 | 4 | 13 |
| | | 60–96 | B | -------- | 98 | 94 | 80 | 4 | 14 |
| Williamsburg silt loam | CT–72 | 0–12 | A | 100 | 99 | 98 | 95 | 1 | 3 |
| | | 12–30 | B | 100 | 100 | 99 | 98 | 1 | 1 |
| | | 30–50 | BD | 99 | 98 | 92 | 65 | 6 | 27 |
| | | 50–64 | D | 99 | 96 | 90 | 64 | 6 | 26 |
| Xenia silt loam | CT–25, CT–26, CT–55. | 0–11 | A | 100 | 99 | 96 | 86 | 3 | 10 |
| | | 11–34 | B | 100 | 98 | 93 | 79 | 5 | 14 |
| | | 34+ | C | -------- | 88 | 79 | 61 | 9 | 18 |

[1] According to the Unified soil classification system (*23*).
[2] According to the Classification of Soils and Soil-Aggregate Mixtures for Highway Purposes, AASHO Designation: M 145–49 (*1*).

*for 14 soils in Clinton County*—Continued

| Grain-size distribution—Con. | | Liquid limit | Plastic limit | Plasticity index | Moisture-density | | Bulk density | Classification | | Permeability of cores | Field infiltration velocity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage of each soil separate—Con. | | | | | | | | | | | |
| Silt (0.074–0.005 mm.) | Clay (less than 0.005 mm.) | | | | Maximum dry density | Optimum moisture content | | Unified [1] | AASHO [2] | | |
| | | | | | *Lb. per cu. ft.* | *Percent of dry weight* | *Cm. per cc.* | | | *In. per hr.* | *In. per hr.* |
| 59 | 32 | 31 | 27 | 4 | ---- | ---- | 1.36 | ML | A-4(8) | ---- | ---- |
| 40 | 46 | 37 | 23 | 14 | ---- | ---- | 1.50 | CL | A-6(10) | .40 | ---- |
| 26 | 34 | 29 | 19 | 10 | ---- | ---- | 1.54 | ML or SC. | A-4(5) | .09 | ---- |
| 45 | 30 | 27 | 22 | 5 | ---- | ---- | 1.42 | ML | A-4 (8) | ---- | ---- |
| 22 | 48 | 39 | 23 | 16 | ---- | ---- | 1.58 | CL | A-6 (9) | ---- | ---- |
| 18 | 34 | 27 | 18 | 9 | ---- | ---- | 1.66 | ML or SC. | A-4 (3) | ---- | ---- |
| 50 | 24 | 25 | 21 | 4 | ---- | ---- | 1.39 | ML | A-4 (8) | ---- | ---- |
| 35 | 35 | 31 | 20 | 11 | ---- | ---- | 1.49 | CL | A-6 (7) | ---- | ---- |
| 19 | 24 | 29 | 19 | 10 | ---- | ---- | ---- | ML or SC. | A-4 (2) | ---- | ---- |
| 6 | 5 | (3) | (3) | (3) | ---- | ---- | ---- | GW or GP. | A-1-a (0) | ---- | ---- |
| 64 | 32 | 48 | 45 | 3 | ---- | ---- | 1.31 | ML | A-5 (10) | ---- | ---- |
| 51 | 45 | 39 | 24 | 15 | ---- | ---- | 1.44 | CL | A-6 (10) | ---- | ---- |
| 63 | 31 | 30 | 23 | 7 | ---- | ---- | 1.57 | ML | A-4 (8) | ---- | ---- |
| 37 | 36 | 27 | 18 | 9 | ---- | ---- | ---- | ML | A-4 (8) | ---- | ---- |
| 62 | 29 | 30 | 26 | 4 | ---- | ---- | 1.43 | ML | A-4 (8) | .64 | ---- |
| 53 | 39 | 34 | 23 | 11 | ---- | ---- | 1.55 | CL | A-6 (8) | .15 | ---- |
| 34 | 48 | 37 | 21 | 16 | ---- | ---- | 1.62 | CL | A-6 (10) | .07 | ---- |
| 31 | 49 | 39 | 21 | 18 | ---- | ---- | ---- | CL | A-6 (11) | ---- | ---- |
| 63 | 32 | 29 | 18 | 11 | ---- | ---- | 1.38 | CL | A-6 (8) | ---- | ---- |
| 65 | 33 | 36 | 25 | 11 | 105 | 19 | 1.51 | CL | A-6 (8) | ---- | ---- |
| 43 | 22 | 18 | 14 | 4 | 122 | 12 | 1.68 | SM | A-4 (6) | ---- | ---- |
| 38 | 26 | 22 | 15 | 7 | 119 | 12 | ---- | SM | A-4 (6) | ---- | ---- |
| 56 | 30 | 31 | 27 | 4 | ---- | ---- | 1.44 | ML | A-4 (8) | ---- | ---- |
| 33 | 46 | 35 | 20 | 15 | ---- | ---- | 1.46 | CL | A-6 (10) | ---- | ---- |
| 24 | 37 | 26 | 17 | 9 | ---- | ---- | 1.58 | ML or SC. | A-4 (5) | ---- | ---- |

[3] Nonplastic.

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| AgA0 | Algiers silt loam | Less than 1 | 3 | More than 10. | Poorly drained alluvium; 3 feet of silt, organic silt, and organic clay; in substratum is stratified silty sand, clayey sand, and clayey silt. | 0–18<br>18–36<br>36–60 |
| AvA1<br>AvB1<br>AvB2 | Avonburg silt loam, 0 to 2 percent slopes.<br>Avonburg silt loam, 2 to 6 percent slopes.<br>Avonburg silt loam, 2 to 6 percent slopes, moderately eroded. | Less than 2 | 7–10 | More than 8. | Imperfectly drained upland; inorganic silt and clay with slight to high plasticity; compact glacial till may occur below a depth of 6 feet; limestone or shale normally occurs well below 7 feet. | 0–12<br>12–60<br>60–110+ |
| BbA1<br>BbB1<br>BbB2 | Birkbeck silt loam, 0 to 2 percent slopes.<br>Birkbeck silt loam, 2 to 6 percent slopes.<br>Birkbeck silt loam, 2 to 6 percent slopes, moderately eroded. | 3 to 5 | 3 | More than 10. | Moderately well drained upland; 3 feet of silt, clayey silt, and silty clay; silty substratum varies in thickness from 2 to 5 feet or more; glacial till consisting of sand-silt and clayey silt may occur at depths below 5 or 6 feet. | 0–12<br>12–36<br>36–60<br>60+ |
| BcA0 | Blanchester silt loam | Less than 1 | 6–10 | More than 8. | Poorly drained, slightly depressed upland; silty and clayey, compact glacial till may occur below a depth of 6 feet; limestone or shale normally is at depths well below 8 or 10 feet. | 0–8<br>8–60<br>60–96 |
| PaA+ | Bonpas silt loam, overwashed | Less than 1 | 4½ | More than 10. | Poorly drained, depressed areas in beds of glacial lakes; 4 feet of silt and medium-plastic silty clay; substratum is strata of sandy silt, silt, and silty clay. | 0–18<br>18–54<br>54+ |
| PcA0 | Bonpas silty clay loam | Less than 1 | 4 | More than 10. | Similar to Bonpas silt loam except that surface layer has more clay and less silt and sand. | 0–16<br>16–48<br>48+ |
| BsA0<br>BsA+ | Brookston silt loam<br>Brookston silt loam, overwashed. | Less than 1 | 4 | More than 10. | Poorly drained upland depressions and level areas; surface layer is organic silt grading to inorganic silty clay and clay at depths of 1 to 4 feet; underlain at a depth of 4 feet by glacial till consisting of silty sand, clayey silt, and mixtures of sand and silt. | 0–12<br>12–48<br>48+ |
| BrA0 | Brookston silty clay loam | Less than 1 | 4 | More than 10. | Same as Brookston silt loam except that surface layer has more clay. | 0–12<br>12–48<br>48+ |
| CfF2<br>CgE2 | Casco and Rodman soils, 25 to 50 percent slopes, moderately eroded.<br>Casco, Rodman, and Fox soils, 18 to 25 percent slopes, moderately eroded. | Deep | 1½–2 | More than 10. | Steep to very steep slopes; well-drained clayey sand and mixtures of sand and silt about 2 feet thick; substratum is sand and gravel outwash. | 0–6<br>6–20<br>20+ |
| CeA1<br>CeB1<br>CeB2<br>CeC2 | Celina silt loam, 0 to 2 percent slopes.<br>Celina silt loam, 2 to 6 percent slopes.<br>Celina silt loam, 2 to 6 percent slopes, moderately eroded.<br>Celina silt loam, 6 to 12 percent slopes, moderately eroded. | Indefinite | 2 | More than 10. | Moderately well drained upland; 1½ to 2½ feet of silt and medium plastic clay; underlain by silty-sandy and clayey-sandy glacial till. | 0–8<br>8–24<br>24+ |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Permeability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam | ML | A-4 | 100 | 98–100 | 75–95 | 0. 2–1. 5 | 2. 0–3. 0 | 6. 0–7. 0 | High to very high. |
| Silty clay loam, silty clay. | MH, OH | A-7 | 100 | 95–100 | 85–95 | . 05–. 15 | 2. 0–3. 5 | 6. 0–7. 2 | |
| Silty clay loam | ML, CL, CH. | A-4, A-6, A-7. | 97–100 | 92–100 | 70–95 | . 05–. 25 | 1. 2–3. 0 | 6. 6–7. 2 | |
| Silt loam | ML | A-4 | 100 | 99–100 | 85–97 | . 15–1. 0 | 2. 0–3. 0 | 5. 0–6. 2 | High. |
| Silty clay loam, silty clay. | CL, CH | A-6, A-7 | 100 | 98–100 | 85–97 | . 01–. 2 | 1. 2–2. 2 | 4. 5–5. 5 | |
| Silty clay loam | CL, CH | A-6, A-7 | 98–100 | 92–100 | 70–92 | . 01–. 5 | 1. 2–2. 2 | 6. 0–7. 5 | |
| Silt loam | ML | A-4 | 100 | 99–100 | 93–99 | . 3–2. 0 | 2. 2–3. 5 | 5. 6–7. 3 | Moderate. |
| Silty clay loam | CL | A-6 | 100 | 98–100 | 93–98 | . 1–1. 0 | 1. 8–2. 5 | 5. 2–7. 0 | |
| Silt loam | ML | A-4 | 100 | 95–99 | 88–95 | . 05–1. 0 | 2. 0–2. 5 | 7. 3–8. 4 | |
| Silt loam, loam | ML | A-4 | 97–100 | 85–97 | 60–90 | . 1–1. 0 | 1. 2–2. 5 | 7. 5–8. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 100 | 99–100 | 85–97 | . 2–1. 5 | 2. 0–3. 2 | 5. 0–6. 5 | High. |
| Silty clay loam, silty clay. | CL, MH, CH. | A-6, A-7 | 100 | 98–100 | 85–97 | . 02–2. 5 | 1. 2–2. 2 | 5. 5–6. 0 | |
| Silty clay loam | CL, CH | A-6, A-7 | 98–100 | 92–100 | 70–92 | . 01–. 5 | 1. 2–2. 2 | 6. 5–7. 5 | |
| Silt loam | ML, OL | A-4, A-5 | 100 | 95–100 | 75–95 | . 2–1. 8 | 2. 0–3. 0 | 6. 5–7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 100 | 93–100 | 60–85 | . 05–. 8 | 1. 2–2. 2 | 6. 7–7. 4 | |
| Silt loam | ML, CL | A-4, A-6 | 99–100 | 93–99 | 50–85 | . 1–1. 0 | 1. 0–2. 2 | 7. 0–8. 0 | |
| Silty clay loam | MH, OH | A-7 | 100 | 95–100 | 78–95 | . 2–1. 5 | 2. 0–3. 0 | 6. 5–7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 100 | 93–100 | 60–85 | . 05–. 8 | 1. 2–2. 2 | 6. 7–7. 4 | |
| Silt loam | ML, CL | A-4, A-6 | 99–100 | 93–99 | 50–85 | . 1–1. 0 | 1. 0–2. 2 | 7. 0–8. 0 | |
| Silt loam | CL, OL | A-6, A-5 | 100 | 97–100 | 80–95 | . 2–2. 5 | 2. 0–3. 5 | 6. 4–7. 0 | Moderate to high. |
| Clay loam, silty clay loam. | CL, CH | A-6, A-7 | 99–100 | 95–99 | 78–93 | . 02–. 8 | 1. 2–2. 2 | 6. 6–7. 6 | |
| Loam, clay loam | ML, CL | A-4, A-6 | 93–99 | 82–97 | 55–90 | . 05–. 8 | 1. 0–2. 2 | 7. 5–8. 0 | |
| Silty clay loam | MH, OH | A-7 | 100 | 97–100 | 80–95 | . 2–2. 0 | 2. 0–3. 5 | 6. 4–7. 0 | Moderate to high. |
| Clay loam, silty clay loam. | CL, CH | A-6, A-7 | 99–100 | 95–99 | 78–93 | . 02–. 8 | 1. 2–2. 2 | 6. 6–7. 6 | |
| Loam, clay loam | ML, CL | A-4, A-6 | 93–99 | 82–97 | 55–90 | . 05–. 8 | 1. 0–2. 2 | 7. 5–8. 0 | |
| Loam | SM, SC, ML. | A-4 | 95–99 | 80–98 | 30–60 | . 5–3. 5 | . 5–2. 0 | 6. 4–7. 0 | Low in subsoil; almost none in substratum. |
| Sandy clay loam | SC, ML | A-4 | 90–98 | 70–95 | 25–55 | . 3–3. 5 | . 5–1. 5 | 6. 4–7. 4 | |
| Gravel and sand | GW, GP | A-1 | 70–90 | 10–60 | 5–25 | 5+ | . 1–0. 5 | 7. 5–8. 5 | |
| Silt loam | ML | A-4 | 98–100 | 95–99 | 73–88 | . 2–2. 0 | 2. 0–3. 0 | 5. 6–7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98–100 | 93–98 | 73–88 | . 08–. 8 | 1. 2–2. 2 | 5. 1–7. 0 | |
| Loam | SC, ML | A-4 | 93–98 | 80–93 | 50–80 | . 1–. 8 | 1. 0–2. 2 | 7. 4–8. 0 | |

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| CcB1 | Cincinnati silt loam, 2 to 6 percent slopes. | Deep | 5–7 | More than 8. | Well-drained, gently to moderately sloping upland; inorganic silt and plastic clayey and silty materials; compact glacial till may occur at depths below 5 or 6 feet; limestone or shale may occur below a depth of 7 feet. | 0–12<br>12–48<br>48–72 |
| CcB2 | Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| CcC1 | Cincinnati silt loam, 6 to 12 percent slopes. | | | | | |
| CcC2 | Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| CtA1 | Clermont silt loam | Less than 1 | 7–10 | More than 8. | Poorly drained, nearly level upland; upper 6 feet or more is silt of low plasticity and silt mixed with plastic clay; underlain by several feet of compact glacial till; limestone or shale normally occurs well below depths of 7 to 10 feet. | 0–16<br>16–72<br>72–100 |
| CrA1 | Crosby silt loam, 0 to 2 percent slopes. | Less than 1 | 2–2½ | More than 10. | Gently to moderately sloping upland; imperfectly drained; 2 to 2½ feet of silt and medium plastic clay; underlain by silty-sandy and clayey-sandy glacial till. | 0–8<br>8–24<br>24+ |
| CrB1 | Crosby silt loam, 2 to 6 percent slopes. | | | | | |
| CrB2 | Crosby silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| DeA1 | Delmar silt loam | Less than 1 | 3–3½ | More than 10. | Poorly drained, nearly level upland; 3½ feet of silt and silt-clay of medium plasticity; substratum is silty-sandy and clayey-sandy glacial till. | 0–10<br>10–42<br>42+ |
| EdB2 | Edenton silt loam, 2 to 6 percent slopes, moderately eroded. | Deep | 2–4 | 3 to 6 | Well-drained, gently sloping to strongly sloping upland; 2 to 4 feet of silt and plastic clay; generally underlain by several feet of glacial till; limestone or shale normally occurs below depths of 4 or 5 feet. | 0–8<br>8–36 |
| EdC2 | Edenton silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| EdD2 | Edenton silt loam, 12 to 18 percent slopes, moderately eroded. | | | | | |
| EsC3 | Edenton soils, 6 to 12 percent slopes, severely eroded. | | | | | |
| EsD3 | Edenton soils, 12 to 18 percent slopes, severely eroded. | | | | | |
| EfE2 | Edenton and Fairmount soils, 18 to 25 percent slopes, moderately eroded. | Similar to Edenton silt loam except for steeper relief and somewhat thinner surface soil and | | | | |
| EfE3 | Edenton and Fairmount soils, 18 to 25 percent slopes, severely eroded. | | | | | |
| EfF2 | Edenton and Fairmount soils, 25 to 50 percent slopes, moderately eroded. | | | | | |
| EmA0 | Eel loam | Less than 1 | 1 | More than 10. | Moderately well drained, stratified alluvium; upper 3 feet consists of silty-sandy, clayey-sandy, and sandy or silty clay; underlain by more clearly differentiated layers of sand, silt, and silty clay. | 0–12<br>12–36<br>36+ |
| EeA0 | Eel silt loam | Less than 1 | 1 | More than 10. | Similar to Eel loam except that upper 3 feet has less sand and more silt; limestone bedrock can occur at a depth of 3 feet. | 0–12<br>12–36<br>36+ |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Permeability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam | ML | A-4 | 100 | 97-100 | 82-97 | 0. 15-1. 0 | 2. 0-3. 0 | 5. 0-6. 5 | High. |
| Silty clay loam, silty clay. | CL, CH | A-6, A-7 | 100 | 98-100 | 85-97 | . 02-. 25 | 1. 2-2. 2 | 4. 5-5. 5 | |
| Clay loam, silty clay | CL, CH | A-6, A-7 | 98-100 | 92-100 | 70-92 | . 01- . 5 | 1. 2-2. 2 | 6. 0-7. 5 | |
| Silt loam | ML | A-4 | 100 | 99-100 | 85-97 | . 15-1. 0 | 2. 0-3. 0 | 5. 0-6. 2 | High. |
| Silty clay loam, silty clay. | CL, CH | A-6, A-7 | 100 | 98-100 | 85-97 | . 01- . 2 | 1. 2-2. 2 | 4. 5-5. 5 | |
| Silty clay loam | CL, CH | A-6, A-7 | 98-100 | 92-100 | 70-92 | . 01- . 5 | 1. 2-2. 2 | 6. 0-7. 5 | |
| Silt loam | ML | A-4 | 98-100 | 95-100 | 75-90 | . 2-1. 7 | 2. 0-3. 0 | 5. 6-7. 0 | Moderate. |
| Silty clay loam | ML, CL | A-6 | 98-100 | 93-98 | 75-90 | . 08- . 8 | 1. 2-2. 2 | 5. 1-7. 0 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| Silt loam | ML | A-4 | 98-100 | 97-100 | 80-95 | . 2-1. 7 | 2. 0-3. 0 | 5. 0-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98-100 | 95-100 | 78-93 | . 08- . 5 | 1. 2-2. 2 | 5. 0-6. 5 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| Silt loam | ML | A-4 | 100 | 97-100 | 82-95 | . 15-1. 0 | 2. 0-3. 0 | 5. 0-6. 0 | High. |
| Silty clay loam | CL, CH | A-6, A-7 | 99-100 | 95-100 | 75-95 | . 02- . 5 | 1. 2-2. 2 | 5. 0-7. 6 | |
| subsoil. Depth to bedrock is 2 to 5 feet. | | | | | | | | | |
| Loam | SM-SC, ML. | A-4 | 98-100 | 90-98 | 50-75 | . 5-3. 0 | 1. 5-3. 0 | 6. 5-7. 4 | Moderate. |
| Loam, clay loam | CL | A-4, A-6 | 99-100 | 95-99 | 73-88 | . 2-3. 0 | 1. 5-2. 5 | 6. 5-7. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 92-98 | 70-88 | . 1-3. 0 | 1. 2-2. 2 | 7. 0-7. 9 | |
| Silt loam, silty clay loam. | ML, CL | A-4, A-6 | 100 | 95-100 | 70-90 | . 2-2. 0 | 2. 0-3. 2 | 6. 5-7. 4 | Moderate. |
| Clay loam | ML, CL | A-4, A-6 | 100 | 97-100 | 80-92 | . 1-1. 5 | 1. 5-3. 0 | 6. 5-7. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 92-100 | 70-90 | . 08-3. 0 | 1. 2-2. 2 | 7. 0-7. 9 | |

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| FnA1 | Fincastle silt loam, 0 to 2 percent slopes. | Less than 1 | 3–3½ | More than 10. | Nearly level to gently sloping, imperfectly drained upland; 3 to 3½ feet of silt and silt-clay; substratum consists of silty-sandy and clayey-sandy glacial till. | 0–10<br>10–42<br>42+ |
| FnB1 | Fincastle silt loam, 2 to 6 percent slopes. | | | | | |
| FnB2 | Fincastle silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| FxA1 | Fox silt loam, 0 to 2 percent slopes. | Deep | 3 | More than 10. | Nearly level to moderately sloping terrace or outwash areas; 2 to 3½ feet of silt and clayey sand; substratum consists of gravel and sand. | 0–12<br>12–36<br>36+ |
| FxB1 | Fox silt loam, 2 to 6 percent slopes. | | | | | |
| FxB2 | Fox silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| FxC2 | Fox silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| FcD2 | Fox and Casco soils, 12 to 18 percent slopes, moderately eroded. | Deep | 1½–2½ | More than 10. | Strong to steep slopes; silty sand and clayey sand underlain by sandy and gravelly outwash. | 0–8<br>8–24<br>24+ |
| FdD3 | Fox, Casco, and Rodman soils, 12 to 25 percent slopes, severely eroded. | | | | | |
| GnA0 | Genesee loam | Less than 1 | Less than 1 | More than 10. | Well-drained alluvium; upper 3 feet is silty sand, clayey sand, and mixtures of sand and silt; underlain by stratified silt, clayey sand, and mixtures of sand and silt; in places limestone is at a depth of 3 feet. | 0–8<br>8–36<br>36+ |
| GmA0 | Genesee loam, sandy substratum. | Less than 1 | Less than 1 | More than 10. | Very similar to Genesee loam except that substratum below a depth of 3 feet has considerably more sand; in places limestone is at a depth of 3 feet. | 0–8<br>8–36<br>36+ |
| GeA0 | Genesee silt loam | Less than 1 | Less than 1 | More than 10. | Similar to Genesee loam except that surface layer has more silt and less sand; in places limestone is at a depth of 3 feet. | 0–8<br>8–36<br>36+ |
| GsA0 | Genesee silt loam, sandy substratum. | Less than 1 | Less than 1 | More than 10. | Similar to Genesee loam except that surface layer has more silt and less sand and the lower substratum (below 3 feet) has considerably more sand; limestone in places is at a depth of 3 feet. | 0–8<br>8–36<br>36+ |
| Gu | Gullied land | Deep | 0 | Indefinite | Steep, severely eroded slopes; compact silty-sandy and clayey-sandy glacial till. | --------- |
| HeF1 | Hennepin and Miami soils, 25 to 50 percent slopes. | Deep | 1 | More than 5. | Well-drained upland on steep to very steep slopes; silt-clay 1 foot thick; underlain by silty-sand and clayey-sand glacial till; bedrock may be at shallow depths. | 0–6<br>6–12<br>12+ |
| HeF2 | Hennepin and Miami soils, 25 to 50 percent slopes, moderately eroded. | | | | | |
| HeF3 | Hennepin and Miami soils, 25 to 50 percent slopes, severely eroded. | | | | | |
| HnA1 | Henshaw silt loam | Less than 1 | 3½ | More than 10. | Imperfectly drained, nearly level or depressed areas; silt and silty clay slack-water deposits of glacial origin. | 0–12<br>12–42<br>42+ |
| KoA+ | Kokomo silt loam, overwashed | Less than 1 | 4½ | More than 10. | Poorly drained depressions on upland till plains; 3½ to 5 feet of organic silt, silty clay, and sandy clay; substratum consists of silty-sandy and clayey-sandy glacial till. | 0–18<br>18–54<br>54+ |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Perme-ability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam | ML | A-4 | 98-100 | 97-100 | 80-95 | 0. 2-1. 7 | 2. 0-3. 0 | 5. 2-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98-100 | 95-100 | 78-93 | . 08- . 8 | 1. 2-2. 2 | 5. 2-6. 5 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| Silt loam | ML | A-4 | 97-100 | 90-99 | 55-75 | . 3-2. 5 | 1. 0-2. 2 | 6. 0-7. 0 | Low in subsoil; almost none in substratum. |
| Gravelly clay loam, sandy clay loam. | SC, ML | A-2, A-4 | 93-99 | 70-97 | 30-65 | . 15-3. 0 | . 8-2. 0 | 5. 4-7. 3 | |
| Gravel and sand | GW, GP | A-1 | 70-90 | 10-60 | 5-25 | 5+ | . 1-0. 5 | 7. 5-8. 5 | |
| Silt loam, sandy clay loam. | ML | A-4 | 93-100 | 78-98 | 30-75 | . 5-2. 5 | . 8-2. 2 | 6. 0-7. 0 | Low in subsoil; almost none in substratum. |
| Gravelly clay loam, sandy clay loam. | SC, ML | A-4 | 93- 99 | 70-97 | 30-65 | . 15-3. 0 | . 8-2. 0 | 5. 4-7. 3 | |
| Gravel and sand | GW, GP | A-1 | 70-90 | 10-60 | 5-25 | 5+ | . 1-0. 5 | 7. 5-8. 5 | |
| Loam | SM, SC, ML. | A-4 | 98-100 | 90-98 | 50-75 | . 5-3. 0 | 1. 5-3. 0 | 6. 5-7. 4 | Moderate. |
| Loam, clay loam | CL | A-4, A-6 | 99-100 | 95-99 | 73-88 | . 2-3. 0 | 1. 5-2. 5 | 6. 5-7. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 92-98 | 70-88 | . 1-3. 0 | 1. 2-2. 2 | 7. 0-7. 9 | |
| Loam | SM, SC, ML. | A-4 | 98-100 | 90-98 | 50-75 | . 5-3. 0 | 1. 5-3. 0 | 6. 5-7. 4 | Moderate. |
| Loam, clay loam | CL | A-4, A-6 | 99-100 | 95-99 | 73-88 | . 2-3. 0 | 1. 5-2. 5 | 6. 5-7. 5 | |
| Loam | SC, ML | A-4 | 97-100 | 90-98 | 45-75 | . 2-3. 5 | 1. 0-2. 0 | 7. 0-7. 9 | |
| Silt loam | ML | A-4 | 100 | 95-100 | 70-88 | . 2-2. 5 | 2. 0-3. 2 | 6. 5-7. 4 | Moderate. |
| Loam, clay loam | CL | A-4, A-6 | 99-100 | 95-99 | 73-88 | . 2-3. 0 | 1. 5-2. 5 | 6. 5-7. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 92-98 | 70-88 | . 1-3. 0 | 1. 2-2. 2 | 7. 0-7. 9 | |
| Silt loam | ML | A-4 | 100 | 95-100 | 70-88 | . 2-2. 5 | 2. 0-3. 2 | 6. 5-7. 4 | Moderate. |
| Loam, clay loam | CL | A-4, A-6 | 99-100 | 95-99 | 73-88 | . 2-3. 0 | 1. 5-2. 5 | 6. 5-7. 5 | |
| Loam | SC, ML | A-4 | 97-100 | 90-98 | 45-75 | . 2-3. 5 | 1. 0-2. 0 | 7. 0-7. 9 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 4 | Moderate. |
| Silt loam | ML | A-4 | 97-100 | 95-98 | 70-88 | . 2-2. 0 | 1. 5-3. 0 | 6. 5-7. 4 | Moderate. |
| Silty clay loam | CL | A-6 | 97-100 | 90-98 | 70-88 | . 08- . 8 | 1. 2-2. 2 | 6. 6-7. 3 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| Silt loam | ML | A-4 | 100 | 99-100 | 87-97 | . 15-1. 0 | 2. 0-3. 0 | 5. 8-7. 0 | Moderate to high. |
| Silty clay loam | CL | A-6 | 100 | 99-100 | 90-98 | . 02-. 25 | 1. 5-2. 2 | 5. 5-7. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 97-100 | 85-96 | . 01-. 25 | 1. 5-2. 2 | 7. 4-8. 2 | |
| Silt loam | CL, OL | A-6, A-5 | 100 | 90-99 | 87-95 | . 2-2. 0 | 2. 0-3. 8 | 6. 1-7. 0 | Moderately high to high. |
| Clay loam, silty clay loam. | CL, CH | A-6, A-7 | 99-100 | 95-99 | 78-93 | . 02- . 8 | 1. 2-2. 2 | 6. 4-7. 5 | |
| Loam, clay loam | ML, CL | A-4, A-6 | 93-99 | 82-87 | 55-90 | . 05- . 8 | 1. 0-2. 2 | 7. 5-8. 0 | |

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| MwA0 | Medway loam | Less than 1 | 1 | More than 10. | Moderately well drained alluvium; sandy silt, silty sand, silt, and sandy clay; bedrock in places may be at a depth of 5 feet. | 0–12<br>12+ |
| MyA0 | Medway silt loam | Less than 1 | 1 | More than 10. | Very similar to Medway loam except that surface layer has more silt and less sand; limestone in places is at a depth of 5 feet. | 0–12<br>12+ |
| MmB1 | Miami silt loam, 2 to 6 percent slopes. | Deep | 2 | More than 10. | Well-drained, gently sloping to steep upland; 2 feet of silt and silty-sandy clay of medium plasticity; underlain by silty-sandy and clayey-sandy glacial till. | 0–8<br>8–24<br>24+ |
| MmB2 | Miami silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| MmC1 | Miami silt loam, 6 to 12 percent slopes. | | | | | |
| MmC2 | Miami silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| MmD1 | Miami silt loam, 12 to 18 percent slopes. | | | | | |
| MmD2 | Miami silt loam, 12 to 18 percent slopes, moderately eroded. | | | | | |
| MeB3 | Miami soils, 2 to 6 percent slopes, severely eroded. | Similar to Miami silt loam except that all or nearly all of surface layer has been lost | | | | |
| MeC3 | Miami soils, 6 to 12 percent slopes, severely eroded. | | | | | |
| MeD3 | Miami soils, 12 to 18 percent slopes, severely eroded. | | | | | |
| MhE1 | Miami and Hennepin silt loams, 18 to 25 percent slopes. | Deep | 1½ | More than 5. | Well-drained, sloping to steep upland; 1 to 2 feet of silt and silty-sandy clay of medium plasticity; underlain by silty-sandy and clayey-sandy glacial till. | 0–6<br>6–18<br>18+ |
| MhE2 | Miami and Hennepin silt loams, 18 to 25 percent slopes, moderately eroded. | | | | | |
| MpE3 | Miami and Hennepin soils, 18 to 25 percent slopes, severely eroded. | Similar to Miami and Hennepin silt loams except that surface layer has been lost | | | | |
| MdA0 | Millsdale silty clay loam | Less than 1 | 3 | 3 | Poorly drained silty clay, clayey silt, and clay; underlain by limestone or dolomite at shallow depths. | 0–12<br>12–36 |
| MnA1 | Milton silt loam, 0 to 2 percent slopes. | Deep | 3½ to 5 | 3½ to 5 | Well drained, nearly level to strong slopes; about 4 feet of silt and medium plastic silty clay; underlain by limestone or dolomite. | 0–10<br>10–48 |
| MnB1 | Milton silt loam, 2 to 6 percent slopes. | | | | | |
| MnB2 | Milton silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| MnC2 | Milton silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| MnD2 | Milton silt loam, 12 to 18 percent slopes, moderately eroded. | | | | | |
| MtB1 | Milton silt loam, shallow, 2 to 6 percent slopes. | Deep | Less than 2 | Less than 2. | Well-drained, gentle to very steep slopes; less than 2 feet of silt and silt-clay; underlain by limestone or dolomite. | 0–10<br>10–20 |
| MtC2 | Milton silt loam, shallow, 6 to 12 percent slopes, moderately eroded. | | | | | |
| MtD2 | Milton silt loam, shallow, 12 to 18 percent slopes, moderately eroded. | | | | | |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Permeability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Loam | ML | A-4 | 98-100 | 92-98 | 65-80 | 0. 5-3. 0 | 1. 8-3. 0 | 6. 5-7. 4 | Moderate. |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 92-98 | 60-88 | . 1-3. 0 | 1. 2-2. 2 | 7. 0-7. 9 | |
| Silt loam | ML | A-4 | 100 | 95-100 | 75-88 | . 2-2. 5 | 2. 0-3. 5 | 6. 5-7. 4 | Moderate. |
| Silt loam | ML, CL | A-4, A-6 | 99-100 | 92-98 | 60-88 | . 1-3. 0 | 1. 2-2. 2 | 7. 0-7. 9 | |
| Silt loam | ML | A-4 | 97-100 | 95-98 | 72-88 | . 2-2. 0 | 2. 0-3. 0 | 5. 6-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 97-100 | 92-98 | 70-88 | . 08- . 8 | 1. 2-2. 2 | 5. 1-7. 0 | |
| Loam | ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| through erosion. | | | | | | | | | |
| Silt loam | ML | A-4 | 97-100 | 95-98 | 72-88 | . 2-2. 0 | 2. 0-3. 0 | 5. 6-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 97-100 | 92-98 | 70-88 | . 08- . 8 | 1. 2-2. 2 | 5. 1-7. 0 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| through erosion. | | | | | | | | | |
| Silty clay loam | CL, MH | A-6, A-7 | 100 | 98-100 | 85-95 | . 2-1. 5 | 2. 0-3. 5 | 6. 5-7. 2 | High. |
| Silty clay | CH | A-7 | 100 | 98-100 | 85-95 | . 02- . 25 | 1. 5-2. 5 | 6. 6-7. 6 | |
| Silt loam | ML | A-4 | 98-100 | 95-99 | 75-90 | . 2-2. 0 | 2. 0-3. 0 | 6. 0-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98-100 | 95-99 | 73-90 | . 08- . 8 | 1. 2-2. 2 | 5. 6-7. 4 | |
| Silt loam | ML | A-4 | 98-100 | 95-98 | 72-88 | . 2-2. 0 | 2. 0-3. 0 | 6. 2-7. 2 | Moderate. |
| Silty clay loam | CL | A-6 | 97-100 | 92-98 | 70-88 | . 08-. 8 | 1. 2-2. 2 | 5. 8-7. 4 | |

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol [1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| MtE2 | Milton silt loam, shallow, 18 to 25 percent slopes, moderately eroded. | | | | | |
| MtF2 | Milton silt loam, shallow, 25 to 50 percent slopes, moderately eroded. | | | | | |
| MsD3 | Milton soils, shallow, 12 to 18 percent slopes, severely eroded. | Deep | Less than 2 | Less than 2. | Similar to shallow phases of Milton silt loam except that surface layer has been lost through erosion. | 0–6<br>6–18 |
| MsF3 | Milton soils, shallow, 25 to 50 percent slopes, severely eroded. | | | | | |
| OcA1 | Ockley silt loam, 0 to 2 percent slopes. | Deep | 4 | More than 10. | Well-drained, nearly level to moderately sloping terrace or outwash areas; silt and silty, sandy, and gravelly clay; underlain at approximately 4 feet by gravel and sand. | 0–12<br>12–48<br>48+ |
| OcB1 | Ockley silt loam, 2 to 6 percent slopes. | | | | | |
| OcB2 | Ockley silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| OcC2 | Ockley silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| OmA1 | Ockley silt loam, mixed substratum, 0 to 2 percent slopes. | Indefinite | 3–3½ | More than 10. | Well-drained, nearly level to moderately sloping areas of glacial outwash; about 3½ feet of silt, sandy or clayey silt, and sandy clay; underlain by poorly assorted clay, silt, sand, and gravel. | 0–12<br>12–40<br>40+ |
| OmB1 | Ockley silt loam, mixed substratum, 2 to 6 percent slopes. | | | | | |
| OmB2 | Ockley silt loam, mixed substratum, 2 to 6 percent slopes, moderately eroded. | | | | | |
| OmC2 | Ockley silt loam, mixed substratum, 6 to 12 percent slopes, moderately eroded. | | | | | |
| RaA0 | Ragsdale silt loam | Less than 1 | 4 | More than 10. | Poorly drained upland depressions; 3 to 5 feet of silt, clayey silt, and silty clay; substratum is a thin layer of silt over silty-sandy and clayey-sandy glacial till. | 0–16<br>16–60<br>60+ |
| RgA0 | Ragsdale silty clay loam | Less than 1 | 4 | More than 10. | Similar to Ragsdale silt loam except that the surface layer has more clay and less silt. | 0–16<br>16–60<br>60+ |
| RbA1 | Raub silt loam | Less than 1 | 4 | More than 10. | Imperfectly drained, nearly level upland; about 4 feet of silt and silt-clay; substratum is silty-sandy and clayey-sandy glacial till. | 0–16<br>16–48<br>48+ |
| ReA1 | Reesville silt loam, 0 to 2 percent slopes. | Less than 1 | 3 | More than 10. | Imperfectly drained upland; 3 feet of silt, clayey silt, and silty clay over a stratum of silt of variable thickness; underlain by silty-sandy and clayey-sandy glacial till below depths of 5 or 6 feet. | 0–12<br>12–36<br>36–60<br>60+ |
| ReB1 | Reesville silt loam, 2 to 6 percent slopes. | | | | | |
| RoA0 | Ross loam | Less than 1 | 4 | More than 10. | Well-drained alluvium; silty-sandy and silt-clay; underlain by stratified silty sand, sandy silt, and silt-clay mixtures at a depth of 4 feet or more. | 0–16<br>16–48<br>48+ |
| RsA0 | Ross silt loam | Less than 1 | 4 | More than 10. | Well-drained alluvium; silt and silty-clay; underlain by stratified silty sand, sandy silt, and silt-clay mixtures at a depth of 4 feet or more. | 0–16<br>16–48<br>48+ |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Perme-ability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam, silty clay loam. | ML, CL | A-4, A-6 | 98–100 | 95–98 | 72–88 | 0. 1–2. 0 | 1. 5–2. 5 | 6. 2–7. 2 | Moderate. |
| Silty clay loam | CL | A-6 | 97–100 | 92–98 | 70–88 | . 08– . 8 | 1. 2–2. 2 | 5. 8–7. 4 | |
| Silt loam | ML | A-4 | 98–100 | 93–100 | 60–95 | . 3–2. 5 | 1. 8–3. 0 | 5. 5–6. 5 | Moderately low in subsoil; almost none in substratum. |
| Clay loam | ML, CL | A-6 | 93–99 | 75–98 | 45–75 | . 1–1. 5 | 1. 0–2. 2 | 5. 1–7. 0 | |
| Gravel and sand | GW, GP | A-1 | 70–90 | 10–60 | 5–25 | 5+ | . 1–0. 5 | 7. 5–8. 5 | |
| Silt loam | ML | A-4 | 100 | 95–100 | 70–95 | . 2–2. 0 | 2. 0–3. 2 | 5. 5–6. 5 | Moderate in subsoil; low in substratum. |
| Silty clay loam | ML, CL | A-4, A-6 | 98–100 | 93–99 | 60–90 | . 08– . 8 | 1. 0–2. 0 | 5. 5–7. 0 | |
| Loam, sandy loam | CL, SC, SM. | A-4 | 90–98 | 70–93 | 15–75 | . 1–2. 5 | . 2–1. 2 | 7. 3–8. 0 | |
| Silt loam | ML, OL | A-4, A-5 | 100 | 99–100 | 93–99 | . 3–2. 0 | 2. 5–3. 8 | 6. 0–7. 4 | Moderate to high. |
| Silty clay loam, silt loam. | CL, MH, ML. | A-6, A-7, A-4. | 100 | 98–100 | 90–98 | . 05– . 8 | 1. 8–2. 5 | 6. 6–8. 4 | |
| Silt loam, loam | ML | A-4 | 97–100 | 85–98 | 65–95 | . 08–1. 0 | 1. 2–2. 5 | 7. 5–8. 5 | |
| Silty clay loam | MH, OH | A-7 | 100 | 99–100 | 93–99 | . 3–1. 8 | 2. 5–3. 8 | 6. 0–7. 4 | High. |
| Silty clay loam, silt loam. | CL, MH, ML. | A-6, A-7, A-4. | 100 | 98–100 | 90–98 | . 05– . 1 | 1. 8–2. 5 | 6. 6–8. 4 | |
| Silt loam, loam | ML | A-4 | 97–100 | 85–98 | 65–95 | . 08–1. 0 | 1. 2–2. 5 | 7. 5–8. 5 | |
| Silt loam | ML | A-4 | 98–100 | 97–100 | 80–95 | . 2–2. 0 | 2. 0–3. 0 | 5. 8–7. 2 | Moderate. |
| Silty clay loam | CL | A-6 | 98–100 | 95–100 | 78–93 | . 08– . 8 | 1. 2–2. 2 | 5. 4–6. 8 | |
| Loam | SC, ML | A-4 | 93–99 | 80–93 | 50–80 | . 1– . 8 | 1. 0–2. 2 | 7. 4–8. 0 | |
| Silt loam | ML | A-4, A-5 | 100 | 99–100 | 93–99 | . 3–2. 0 | 2. 2–3. 5 | 5. 5–7. 3 | Moderate. |
| Silty clay loam | CL | A-6 | 100 | 98–100 | 93–98 | . 1–1. 0 | 1. 8–2. 5 | 5. 0–6. 8 | |
| Silt loam | ML | A-4 | 100 | 95–99 | 88–95 | . 05–1. 0 | 2. 0–2. 5 | 7. 0–8. 4 | |
| Silt loam, loam | ML | A-4 | 97–100 | 85–97 | 60–90 | . 1–1. 0 | 1. 2–2. 5 | 7. 5–8. 5 | |
| Loam | SM, SC, ML. | A-4 | 98–100 | 90–98 | 50–75 | . 5–3. 5 | 1. 5–3. 0 | 7. 0–7. 5 | Moderate. |
| Loam, silty clay loam | ML, CL | A-4, A-6 | 99–100 | 95–100 | 70–90 | . 2–2. 5 | 1. 5–2. 2 | 7. 0–7. 5 | |
| Loam | SC, CL | A-4, A-6 | 98–100 | 90–99 | 50–88 | . 1–3. 5 | 1. 0–2. 2 | 7. 2–8. 0 | |
| Silt loam | ML | A-4 | 100 | 95–100 | 75–88 | . 2–2. 5 | 2. 0–3. 5 | 7. 0–7. 5 | Moderate to high. |
| Silty clay loam | CL | A-6 | 99–100 | 95–100 | 75–93 | . 1–2. 0 | 1. 5–2. 5 | 7. 0–7. 5 | |
| Loam | SC, CL | A-4, A-6 | 98–100 | 90–99 | 50–88 | . 1–3. 5 | 1. 0–2. 2 | 7. 0–8. 0 | |

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| RmA1 | Rossmoyne silt loam, 0 to 2 percent slopes. | Shallow to indefinite. | 6–9 | More than 8. | Moderately well drained, level to strongly sloping upland; silt and plastic silty clay; compact glacial till may occur below 6 feet; limestone or shale bedrock may occur below 7 feet. | 0–10<br>10–60<br>60–96 |
| RmB1 | Rossmoyne silt loam, 2 to 6 percent slopes. | | | | | |
| RmB2 | Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| RmC2 | Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| RmD2 | Rossmoyne silt loam, 12 to 18 percent slopes, moderately eroded. | | | | | |
| RnC3 | Rossmoyne soils, 6 to 12 percent slopes, severely eroded. | | | | | |
| RuB1 | Russell silt loam, 2 to 6 percent slopes. | Deep | 3½ | More than 10. | Well-drained, gently sloping to steep upland; 3 to 3½ feet of silt and silt-clay; substratum is silty-sand and clayey-sandy glacial till. | 0–10<br>10–42<br>42+ |
| RuB2 | Russell silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| RuC1 | Russell silt loam, 6 to 12 percent slopes. | | | | | |
| RuC2 | Russell silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| RuD1 | Russell silt loam, 12 to 18 percent slopes. | | | | | |
| RuD2 | Russell silt loam, 12 to 18 percent slopes, moderately eroded. | | | | | |
| RuE1 | Russell silt loam, 18 to 25 percent slopes. | | | | | |
| RuE2 | Russell silt loam, 18 to 25 percent slopes, moderately eroded. | | | | | |
| RvB3 | Russell soils, 2 to 6 percent slopes, severely eroded. | | | | | |
| RvC3 | Russell soils, 6 to 12 percent slopes, severely eroded. | | | | | |
| RvD3 | Russell soils, 12 to 18 percent slopes, severely eroded. | | | | | |
| RvE3 | Russell soils, 18 to 25 percent slopes, severely eroded. | | | | | |
| RhF1 | Russell and Hennepin silt loams, 25 to 50 percent slopes. | Deep | 3; less than 3 in local areas. | More than 10. | Well-drained, steep upland; about 3 feet of silt to silt-clay; underlain by silty-sandy and clayey-sandy glacial till. | 0–8<br>8–36<br>36+ |
| RhF2 | Russell and Hennepin silt loams, 25 to 50 percent slopes, moderately eroded. | | | | | |
| RxF3 | Russell and Hennepin soils, 25 to 50 percent slopes, severely eroded. | | | | | |
| SaA1 | Sardinia silt loam, 0 to 2 percent slopes. | 4 | 4 | More than 10. | Moderately well drained, level to gently sloping terraces; 4 feet of silt and lean clay; underlain by stratified gravelly and clayey sand and sand-silt mixture. | 0–18<br>18–48<br>48+ |
| SaB1 | Sardinia silt loam, 2 to 6 percent slopes. | | | | | |
| SaB2 | Sardinia silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| ShA0 | Shoals silt loam | Less than 1 | 3 | More than 10. | Imperfectly drained alluvium; 9 feet of silt, clayey silt, sandy clay, and silty clay; underlain by stratified sand, silt, and silty clay. | 0–12<br>12–36<br>36+ |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Permeability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam | ML | A-4 | 100 | 99-100 | 85-97 | 0. 15-1. 0 | 2. 0-3. 0 | 5. 0-6. 2 | High. |
| Silty clay loam, silty clay. | CL | A-6, A-7 | 100 | 98-100 | 85-97 | . 01- . 2 | 1. 2-2. 2 | 4. 5-5. 5 | |
| Silty clay loam | CL, CH | A-6, A-7 | 98-100 | 92-100 | 70-92 | . 01- . 5 | 1. 2-2. 2 | 6. 0-7. 5 | |
| Silt loam | ML | A-4 | 98-100 | 97-100 | 78-93 | . 2-1. 7 | 2. 0-3. 0 | 5. 4-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98-100 | 95-100 | 75-90 | . 08- . 8 | 1. 2-2. 2 | 5. 2-6. 5 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| Silt loam | ML | A-4 | 98-100 | 97-100 | 75-95 | . 2-2. 0 | 2. 0-3. 0 | 5. 4-7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98-100 | 93-100 | 70-93 | . 08- . 8 | 1. 2-2. 2 | 5. 2-6. 5 | |
| Loam | SC, ML | A-4 | 93-98 | 80-93 | 50-80 | . 1- . 8 | 1. 0-2. 2 | 7. 4-8. 0 | |
| Silt loam | ML | A-4 | 100 | 97-100 | 85-98 | . 2-1. 5 | 2. 0-3. 0 | 5. 0-6. 2 | Moderate. |
| Clay loam | ML, CL | A-4, A-6 | 100 | 95-100 | 70-98 | . 05- . 8 | 1. 5-2. 2 | 4. 8-5. 6 | |
| Sandy loam | SM, SC, SP. | A-3, A-4 | 93-99 | 80-95 | 15-75 | . 1-3. 0 | . 2-1. 2 | 6. 2-7. 2 | |
| Silt loam, silty clay loam. | ML, CL | A-4, A-6 | 100 | 95-100 | 78-90 | . 2-2. 0 | 2. 0-3. 2 | 6. 3-7. 4 | Moderate. |
| Clay loam | ML, CL | A-4, A-5, A-6. | 100 | 97-100 | 80-92 | . 1-1. 5 | 1. 5-2. 5 | 6. 5-7. 5 | |
| Clay loam | ML, CL | A-4, A-6 | 99-100 | 92-100 | 70-90 | . 08-2. 5 | 1. 2-2. 2 | 7. 0-7. 9 | |

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TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| StA1 | Sleeth silt loam | Indefinite | 4 | More than 10. | Imperfectly drained, nearly level terrace or outwash areas; silt and silty, sandy, and gravelly clay; underlain by gravel and sand at a depth of 4 feet or more. | 0–12<br>12–50<br>50+ |
| SmA1<br>SmB1 | Sleeth silt loam, mixed substratum, 0 to 2 percent slopes.<br>Sleeth silt loam, mixed substratum, 2 to 6 percent slopes. | Less than 1 | 3–4 | More than 10. | Imperfectly drained, glacio fluvial outwash areas; 3 to 4 feet of silt, sand or clayey silt, and sandy clay; substratum consists of poorly assorted clay, silt, sand, and gravel. | 0–12<br>12–42<br>42+ |
| SnA0<br>SnA+ | Sloan silt loam<br>Sloan silt loam, overwashed. | Less than 1 | 3 | More than 10. | Poorly drained alluvium; 1 foot of organic silt over 2 feet of silt, clayey silt, and silty clay; underlain by stratified sand, silt, and silty clay. | 0–12<br>12–36<br>36+ |
| SyA0 | Sloan silty clay loam | Less than 1 | 3 | More than 10. | Similar to Sloan silt loam except for more clay and less silt in the upper 1 to 2 feet. | 0–12<br>12–36<br>36+ |
| ThA1<br>ThB1 | Thackery silt loam, 0 to 2 percent slopes.<br>Thackery silt loam, 2 to 6 percent slopes. | Deep | 4 | More than 10. | Moderately well drained, nearly level to gently sloping terrace or outwash areas; silt and silty, sandy, and gravelly clay; underlain by gravel and sand at a depth below 4 feet. | 0–12<br>12–50<br>50+ |
| TmA1<br>TmB1 | Thackery silt loam, mixed substratum, 0 to 2 percent slopes.<br>Thackery silt loam, mixed substratum, 2 to 6 percent slopes. | Less than 3 | 3–4 | More than 10. | Moderately well drained glaciofluvial outwash consisting of silt, sandy or clayey silt, and sandy clay; underlain by poorly assorted clay, silt, sand, and gravel. | 0–12<br>12–42<br>42+ |
| UnA1<br>UnB2 | Uniontown silt loam, 0 to 2 percent slopes.<br>Uniontown silt loam, 2 to 6 percent slopes, moderately eroded. | Indefinite | 3½ | More than 10. | Moderately well drained, nearly level to gentle slopes; slack-water sediment of glacial origin consisting of silt and silty clay. | 0–10<br>10–42<br>42+ |
| WeA0<br>WeA+ | Westland silt loam<br>Westland silt loam, overwashed. | Less than 1 | 4 | More than 10. | Poorly drained, nearly level on depressed terrace or outwash areas; silt, clayey silt, silty clay, and clay; underlain by gravel and sand below 4 feet. | 0–12<br>12–50<br>50+ |
| WtA0 | Westland silty clay loam | Less than 1 | 4 | More than 10. | Similar to Westland silt loam except that the surface layer has more clay and less silt. | 0–12<br>12–50<br>50+ |
| WmA+ | Westland silt loam, mixed substratum, overwashed. | Less than 1 | 3½ | More than 10. | Poorly drained lake sediment; 4½ feet of silt, sandy clay, and silty clay; substratum consists of poorly assorted clay, silt, and silty or clayey sand and gravel. | 0–18<br>18–42<br>42+ |
| WnA0 | Westland silty clay loam, mixed substratum. | Less than 1 | 3½ | More than 10. | Similar to Westland silt loam, mixed substratum, overwashed, except that surface layer has more clay and less silt and sand. | 0–16<br>16–40<br>40+ |
| WbA1<br>WbB1<br>WbB2 | Williamsburg silt loam, 0 to 2 percent slopes.<br>Williamsburg silt loam, 2 to 6 percent slopes.<br>Williamsburg silt loam, 2 to 6 percent slopes, moderately eroded. | Deep | 4 | More than 10. | Well-drained, nearly level to steep terrace areas; 4 feet of silt and lean clay; underlain by stratified gravelly and clayey sand and sand-silt mixture. | 0–12<br>12–48<br>48+ |

See footnotes at end of table.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Perme-ability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam | ML | A-4 | 98–100 | 93–100 | 60–95 | 0. 3–2. 5 | 1. 8–3. 0 | 5. 5–6. 5 | Moderate in subsoil; almost none in substratum. |
| Clay loam | CL | A-6 | 93–99 | 75–98 | 50–75 | . 1–1. 5 | 1. 0–2. 2 | 5. 0–6. 8 | |
| Gravel and sand | GW, GP | A-1 | 70–90 | 15–60 | 10–25 | 5+ | . 1–0. 5 | 7. 5–8. 5 | |
| Silt loam | ML | A-4 | 100 | 95–100 | 75–95 | . 2–1. 8 | 2. 0–3. 2 | 5. 5–6. 5 | Moderate in subsoil; low in substratum. |
| Silty clay loam | ML, CL | A-4, A-6 | 98–100 | 93–99 | 60–90 | . 08–. 8 | 1. 0–2. 0 | 5. 5–7. 0 | |
| Loam, sandy loam | CL, SC, SM. | A-4, A-2 | 90–98 | 70–93 | 15–75 | . 1–2. 5 | . 2–1. 2 | 7. 3–8. 0 | |
| Silt loam | ML, OL | A-4, A-5 | 100 | 97–100 | 78–95 | . 1–2. 0 | 2. 0–3. 5 | 6. 6–7. 4 | Moderate to high. |
| Silt loam, silty clay loam. | ML, CL | A-4, A-6 | 100 | 97–100 | 80–95 | . 08–1. 0 | 1. 5–2. 5 | 6. 6–7. 5 | |
| Clay loam | ML, CL, MH. | A-4, A-6, A-7. | 99–100 | 92–100 | 70–95 | . 08–2. 0 | 1. 2–2. 5 | 7. 0–7. 9 | |
| Silty clay loam | CL, OH | A-6, A-7 | 100 | 97–100 | 80–95 | . 1–1. 5 | 2. 0–3. 5 | 6. 6–7. 4 | High. |
| Silty clay loam | CL, MH | A-6, A-7 | 100 | 97–100 | 80–95 | . 08–1. 0 | 1. 5–2. 5 | 6. 6–7. 5 | |
| Clay loam | ML, CL, MH. | A-4, A-6, A-7. | 99–100 | 92–100 | 70–95 | . 08–2. 0 | 1. 2–2. 5 | 7. 0–7. 9 | |
| Silt loam | ML | A-4 | 98–100 | 93–100 | 60–95 | . 3–2. 5 | 1. 8–3. 0 | 5. 5–6. 5 | Moderate in subsoil; almost none in substratum. |
| Clay loam | CL | A-6 | 93–99 | 75–98 | 45–75 | . 1–1. 5 | 1. 0–2. 2 | 5. 1–7. 0 | |
| Gravel and sand | GW, GP | A-1 | 70–90 | 10–60 | 5–25 | 5+ | . 1–0. 5 | 7. 5–8. 5 | |
| Silt loam | ML | A-4 | 100 | 95–100 | 73–95 | . 2–2. 0 | 2. 0–3. 2 | 5. 5–6. 5 | Moderate in subsoil; low in substratum. |
| Silty clay loam | ML, CL | A-4, A-6 | 98–100 | 93–99 | 60–90 | . 08–. 8 | 1. 0–2. 0 | 5. 5–7. 0 | |
| Loam, sandy loam | CL, SC, SM, GC. | A-4, A-2 | 90–98 | 70–93 | 15–75 | . 1–2. 5 | . 2–1. 2 | 7. 3–8. 0 | |
| Silt loam | ML | A-4 | 100 | 95–100 | 75–90 | . 2–1. 8 | 2. 0–3. 0 | 5. 8–6. 8 | Moderate. |
| Silty clay loam | CL | A-6 | 100 | 93–100 | 60–85 | . 05–. 8 | 1. 2–2. 2 | 5. 1–7. 4 | |
| Silt loam | ML, CL | A-4, A-6 | 99–100 | 93–99 | 50–85 | . 1–1. 0 | 1. 0–2. 2 | 7. 0–8. 0 | |
| Silt loam | ML | A-4 | 98–100 | 93–100 | 60–95 | . 2–2. 5 | 2. 0–3. 5 | 6. 2–7. 2 | High in subsoil; almost none in substratum. |
| Silty clay loam | CL, CH | A-6, A-7 | 95–100 | 85–98 | 50–90 | . 08–1. 5 | 1. 2–2. 5 | 6. 6–7. 4 | |
| Gravel and sand | GW, GP | A-1 | 75–93 | 20–60 | 12–25 | 4+ | . 2–0. 5 | 7. 5–8. 5 | |
| Silty clay loam | CL, MH | A-6, A-7 | 98–100 | 93–100 | 60–95 | . 2–2. 5 | 2. 0–3. 5 | 6. 2–7. 2 | High in subsoil; almost none in substratum. |
| Silty clay loam | CL, CH | A-6, A-7 | 95–100 | 85–98 | 50–90 | . 08–1. 5 | 1. 2–2. 5 | 6. 6–7. 4 | |
| Gravel and sand | GW, GP | A-1 | 75–93 | 20–60 | 12–25 | 4+ | . 2–0. 5 | 7. 5–8. 5 | |
| Silt loam | ML, OL | A-4, A-5 | 100 | 95–100 | 75–95 | . 2–2. 0 | 2. 0–3. 0 | 6. 5–7. 4 | Moderate in subsoil; low in substratum. |
| Clay loam | ML, CL | A-4, A-6 | 98–100 | 93–100 | 60–90 | . 08–. 8 | 1–2–2. 2 | 6. 8–7. 8 | |
| Loam, sandy loam | SC, SM, GC. | A-4, A-2 | 90–98 | 70–93 | 15–75 | . 1–2. 5 | . 2–1. 2 | 7. 9–8. 5 | |
| Silty clay loam | CL, MH | A-6, A-7 | 100 | 95–100 | 75–95 | . 2–1. 8 | 2. 0–3. 0 | 6. 5–7. 4 | Moderate in subsoil; low in substratum. |
| Clay loam | ML, CL | A-4, A-6 | 98–100 | 93–100 | 60–90 | . 08–. 8 | 1. 2–2. 2 | 6. 8–7. 8 | |
| Loam, sandy loam | SC, SM, GC. | A-4, A-2 | 90–98 | 70–90 | 15–75 | . 1–2. 5 | . 2–1. 2 | 7. 9–8. 5 | |
| Silt loam | ML, CL | A-4, A-6 | 100 | 97–100 | 85–98 | . 2–1. 5 | 2. 0–3. 0 | 5–2–6. 2 | Moderate. |
| Clay loam | ML, CL | A-4, A-6 | 100 | 95–100 | 70–98 | . 05–. 8 | 1. 5–2. 2 | 5. 1–5. 8 | |
| Sandy loam | SM, SC, SP. | A-3, A-4 | 93–99 | 80–95 | 15–75 | . 1–3. 0 | . 2–1. 2 | 6. 2–7. 2 | |

TABLE 6.—*Descriptions of Clinton County soils and their estimated*

| Soil symbol[1] | Soil name | Depth to seasonally high water table | Approximate depth to substratum | Normal depth to bedrock | Site and soil description | Depth of layers from surface |
|---|---|---|---|---|---|---|
| | | *Feet* | *Feet* | *Feet* | | *Inches* |
| WbC1 | Williamsburg silt loam, 6 to 12 percent slopes. | | | | | |
| WbC2 | Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| WbD2 | Williamsburg silt loam, 12 to 18 percent slopes, moderately eroded. | | | | | |
| WbE2 | Williamsburg silt loam, 18 to 25 percent slopes, moderately eroded. | | | | | |
| XeA1 | Xenia silt loam, 0 to 2 percent slopes. | Indefinite | 3½ | More than 10. | Moderately well drained, nearly level to moderately sloping upland; 3 to 3½ feet of silt to silt-clay; underlain by silty-sandy and clayey-sandy glacial till. | 0–10<br>10–42<br>42+ |
| XeB1 | Xenia silt loam, 2 to 6 percent slopes. | | | | | |
| XeB2 | Xenia silt loam, 2 to 6 percent slopes, moderately eroded. | | | | | |
| XeC1 | Xenia silt loam, 6 to 12 percent slopes. | | | | | |
| XeC2 | Xenia silt loam, 6 to 12 percent slopes, moderately eroded. | | | | | |
| XnB3 | Xenia soils, 2 to 6 percent slopes, severely eroded. | | | | | |
| XnC3 | Xenia soils, 6 to 12 percent slopes, severely eroded. | | | | | |

[1] The soil symbol identifies the soil on the detailed map at the back of report. The first two letters (a capital letter and a small letter) identify the soil series; the second capital letter shows the class of slope; and the Arabic number shows the degree of erosion. A plus sign following these symbols indicates an overwashed soil.

Permeability values are the estimated ranges in rates of the downward movement of water in saturated soil that is situated above a true water table and can drain freely. Estimates are based on soil texture and structure, on permeability and infiltration tests on some of the soils, and on drainage observations. In soils or soil horizons that are high in clay or high in organic matter, permeability rates under unsaturated conditions are considerably higher than the values given in table 6. Percolation of water through the surface layer of soils varies considerably, depending on management, land use, and initial moisture conditions.

Water-holding capacity data in table 6 refer to the estimated maximum amount of moisture a soil layer can hold for use by growing plants. The values shown are based on the difference in percentage of moisture retained at 1/3 of an atmosphere and at 15 atmospheres pressure.

Interpretations of engineering properties of the soils in Clinton County are given in table 7. Additional information can be obtained in the section "Descriptions of the Soils."

Table 7 lists all the soil series of the county, and it describes and rates selected characteristics of the soils that might affect their engineering usage. These descriptions, recommendations, and ratings are based on the soil test data in table 5, on mechanical analyses of the other soils in the county, and on field experience. Explanations of the data in the columns of table 7 follow.

*Adaptability to grading in winter.*—Because of wetness, plasticity, or susceptibility to frost action, many of the soils are not adapted to grading during parts of the winter season. Such soils are rated as poor or very poor.

*Susceptibility to frost action.*—Silty and clayey soils that are wet most of the winter because of slow internal or surface drainage are the ones that are most susceptible to frost action.

*Suitability for road subgrade.*—Fine-grained, plastic, organic, and poorly graded nongranular soil materials are very poor or are unsuitable for use as subgrades. Gravel and sandy gravel are the best subgrade materials.

*Suitability for road fill.*—Well-graded, coarse-grained materials or mixtures of clay and coarse-grained materials are very desirable for road fill. Highly plastic clayey soils, poorly graded silty soils, and organic soils are difficult to compact and are low in stability; consequently they are undesirable for road fill.

*engineering soil classifications and physical and chemical properties*—Continued

| Texture (USDA)[2] | Estimated engineering soil classifications | | Percentage passing sieve— | | | Permeability | Water-holding capacity | pH | Shrink-swell potential |
|---|---|---|---|---|---|---|---|---|---|
| | Unified | AASHO | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 200 (0.074 mm.) | | | | |
| | | | | | | *In. per hr.* | *In. per ft.* | | |
| Silt loam | ML | A-4 | 98–100 | 97–100 | 78–93 | 0. 2 –1. 7 | 2. 0–3. 0 | 5. 4–7. 0 | Moderate. |
| Silty clay loam | CL | A-6 | 98–100 | 95–100 | 75–90 | . 08– . 8 | 1. 2–2. 2 | 5. 2–6. 5 | |
| Loam | SC, ML | A-4 | 93–98 | 80–93 | 50–80 | . 1 – . 8 | 1. 0–2. 2 | 7. 4–8. 0 | |

Degrees of erosion are shown by the following Arabic numbers: 0, not eroded; 1 slightly eroded; 2, moderately eroded; and 3, severely eroded.

[2] Soil Survey Manual (*18*).

*Suitability as source of topsoil.*—The thickness, texture, and inherent fertility of the surface layer of soil determine its suitability for use as a topdressing.

*Suitability as source of sand and gravel.*—The amount, quality, and accessibility of granular (coarse-grained) materials are the most important considerations.

*Effects of soil features on the vertical alinement of highways.*—The statements refer to the need for fill on soils associated with low-lying, flat, depressional areas and to the likelihood of encountering bedrock in cuts. Where there is little or no likelihood of encountering either of those limitations, "no severe limitations" or "essentially no limitations" is stated.

*Features that affect drainage practices in construction of highways.*—The presence of a seasonal high water table, the susceptibility of the soil to flooding, the surface-drainage conditions, and the normal drainage of the in-place soil are noted.

The following paragraphs explain the columns relating to "Soil features that affect use in—".

*Farm ponds.*—Under the "reservoir area" subheading, consideration is given primarily to the sealing potential of the reservoir. In addition, shallowness to bedrock and the susceptibility to overflow in flood plains are also noted. Under the "embankment" subheading, the soils are rated according to the stability and permeability of the materials when used in the construction of pond embankments.

*Agricultural drainage.*—The soils are described relative to their natural drainage, their in-place permeability, and the presence of a high seasonal water table.

*Irrigation.*—The relative ease with which water normally infiltrates into, percolates through, and drains from each of the soils, and the water-holding capacity of the soils is noted.

*Terraces and diversions.*—The slope of the land and the relative erodibility of the soil materials are the main considerations. Nearly level soils need no terracing; steep soils are not well adapted to terracing. Highly erodible soils require special care in the construction of diversions.

*Waterways.*—Slope of the land and erodibility of the soil materials are the main considerations.

*Suitability for disposal of effluent.*—Topographic relief, permeability of the soils, surface and internal drainage, and depth to bedrock are major factors that affect the performance of septic tanks and leaching fields.

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TABLE 7.—*Interpretations of engineering*

| Soil map symbols | Soil series | Adaptability to grading in winter | Susceptibility to frost action | Suitability for— Road subgrade: Subsoil | Suitability for— Road subgrade: Substratum | Suitability for— Road fill: Subsoil | Suitability for— Road fill: Substratum | Suitability as source of— Topsoil [1] | Suitability as source of— Sand and gravel | Effect of soil features on vertical alinement of highways |
|---|---|---|---|---|---|---|---|---|---|---|
| AgA0 | Algiers | Very poor because of wetness and nature of soil material. | Medium to very high. | Unsatisfactory to very poor. | Poor | Unsatisfactory; stability poor. | Poor to fair. | Good; very good at a depth of 1½ to 2½ feet. | Not suitable. | Fill required. |
| AvA1, AvB1, AvB2. | Avonburg | Very poor because of wetness and high silt content. | High | Very poor to poor. | Poor to fair.[2] | Poor | Poor to fair.[2] | Fair | Not suitable. | Fill required in low areas. |
| BbA1, BbB1, BbB2. | Birkbeck | Poor because of wetness and high silt content. | High | Poor | Poor to fair. | Poor to fair. | Poor to fair. | Good | Not suitable. | No severe limitations. |
| BcA0 | Blanchester | Very poor because of wetness, silt, and clay. | High | Very poor | Poor to fair.[2] | Poor | Poor to fair.[2] | Good | Not suitable. | Fill required. |
| PaA+, PcA0 | Bonpas | Very poor because of wetness, silt, and clay. | High | Very poor to poor. | Poor to fair | Poor | Fair | Excellent | Not suitable. | Fill required. |
| BrA0, BsA0, BsA+. | Brookston | Very poor because of wetness, silt, and clay. | High | Very poor to poor. | Poor to fair | Poor | Fair | Excellent | Not suitable. | Fill required. |
| CfF2, CgE2 | Casco and Rodman; Casco, Rodman, and Fox. | Good | Slight in subsoil; none in substratum. | Fair | Excellent | Good | Excellent | Poor to fair | Excellent for gravel; good for sand. | Essentially no limitations. |
| CeA1, CeB1, CeB2, CeC2. | Celina | Poor because of silt and clay in subsoil. | Medium to high. | Poor | Poor to fair | Fair | Fair | Good | Not suitable. | No severe limitations. |
| CcB1, CcB2, CcC1, CcC2. | Cincinnati | Poor because of silt and clay in subsoil. | Medium to high. | Poor | Poor to fair.[2] | Poor | Poor to fair.[2] | Fair | Not suitable. | No severe limitations. |
| CtA1 | Clermont | Very poor because of wetness, silt, and clay. | High | Very poor | Poor to fair.[2] | Poor | Poor to fair.[2] | Fair | Not suitable. | Fill required in low areas. |
| CrA1, CrB1, CrB2. | Crosby | Poor because of wetness, silt, and clay. | High | Poor | Poor to fair. | Fair | Fair | Fair | Not suitable. | Fill required in low areas. |

See footnotes at end of table.

*properties of the soils*

| Features that affect drainage practice and material in construction of highways | Soil features that affect use in— | | | | | | | Suitability for disposal of effluent | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | Dikes or levees | Farm ponds | | Agricultural drainage | Irrigation | Terraces and diversions | Waterways | | |
| | | Reservoir area | Embankment | | | | | | |
| Seasonal high water table; subject to flooding. | Poor stability | Possibility of seepage when excavated below 5 feet. | Poor stability; slowly permeable. | Slowly permeable; poor natural drainage. | Requires provision for adequate drainage. | Nearly level | Nearly level; slightly erodible. | Very poor; slowly permeable; poor drainage; low relief. | |
| Limited internal drainage; moderate surface runoff. | Poor to fair stability and compaction. | Essentially impermeable. | Fair stability; slowly permeable. | Slowly permeable; seasonal high water table. | Slow infiltration and percolation. | Nearly level to gently sloping; slowly permeable; susceptible to erosion. | Highly erodible on unprotected slopes. | Very poor; slow drainage because of silt and clay. | |
| Adequate drainage. | Fair stability and compaction. | Slow rate of seepage. | Fair stability; slowly permeable. | Moderately permeable; moderately good natural drainage. | Adequate infiltration, percolation, and drainage. | Nearly level to gently sloping; moderately erodible. | Moderately susceptible to erosion. | Generally suitable; moderately permeable sandy silt; adequate natural drainage. | |
| Poor internal and surface drainage. | Poor to fair stability and compaction. | Essentially impermeable. | Poor to fair stability; slowly permeable. | Slowly permeable; poor natural drainage; seasonal high water table. | Slow infiltration; poor drainage. | Nearly level | Erodible on cuts or slopes. | Poor; slowly permeable; slow drainage; low relief. | |
| Poor internal and surface drainage; low relief. | Poor to fair stability and compaction. | Very slow rate of seepage. | Fair stability; slowly permeable. | Slowly permeable; poor natural drainage. | Moderate infiltration; poor drainage. | Nearly level | Slightly susceptible to erosion. | Very poor; slowly permeable; poor drainage; depressional relief. | |
| Poor drainage; in low or depressed areas. | Fair stability and compaction. | Very low rate of seepage. | Fair stability; slowly permeable. | Moderately to slowly permeable; poor natural drainage. | Good infiltration; poor natural drainage. | Nearly level; slightly erodible. | Slightly susceptible to erosion. | Poor; depressional relief; impeded drainage. | |
| Excellent drainage. | Very stable; permeable. | Excessive rate of seepage. | Adequate strength and stability; permeable. | Gravel and sand; excellent drainage. | Rapid infiltration if runoff is controlled on steep slopes; low water-holding capacity. | Steep; highly permeable. | Steeply sloping | Excellent because of gravelly and sandy substratum. | |
| Adequate drainage. | Stable; fair compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Moderately permeable; moderately good natural drainage. | Moderately good infiltration and water-holding capacity. | Gently to moderately sloping; moderately erodible. | Moderately susceptible to erosion. | Limited; moderately permeable; adequate relief. | |
| Adequate drainage. | Poor to fair stability and compaction. | Essentially impermeable. | Fair stability; slowly permeable. | Moderately permeable; good natural drainage. | Moderate infiltration; good water-holding capacity. | Gently to moderately sloping; highly erodible. | Highly susceptible to erosion. | Poor; moderately permeable; good relief. | |
| Poor internal and surface drainage. | Poor to fair stability and compaction. | Essentially impermeable. | Fair stability; slowly permeable. | Slowly permeable; poor natural drainage; seasonal high water table. | Slow infiltration, percolation, and drainage. | Nearly level | Erodible on cuts and slopes. | Very poor; slowly permeable; slow drainage; low relief. | |
| Limited internal drainage; moderate surface runoff. | Stable; fair compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Moderately permeable; poor natural drainage. | Moderately slow infiltration and drainage. | Nearly level to gently sloping; moderately erodible. | Slightly susceptible to erosion. | Poor; moderately slowly permeable; slow drainage; low relief. | |

TABLE 7.—*Interpretations of engineering*

| Soil map symbols | Soil series | Adaptability to grading in winter | Susceptibility to frost action | Suitability for— | | | | Suitability as source of— | | Effect of soil features on vertical alinement of highways |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Road subgrade | | Road fill | | Topsoil [1] | Sand and gravel | |
| | | | | Subsoil | Substratum | Subsoil | Substratum | | | |
| DeA1 | Delmar | Very poor because of wetness, silt, and clay. | High | Very poor to poor. | Poor to fair | Poor to fair | Fair | Fair | Not suitable. | Fill required in low areas. |
| EdB2, EdC2, EdD2, EsC3, EsD3, EfE2, EfE3, EfF2. | Edenton; Edenton and Fairmount. | Poor because of silt and clay in subsoil. | Medium to high. | Poor to very poor. | Poor to fair.[2] | Poor | Poor to fair.[2] | Poor to fair. | Not suitable. | Bedrock may occur at depths of 2 to 10 feet.[3] |
| EeA0, EmA0. | Eel | Very poor because of wetness. | High | See remarks. | Poor to fair. | See remarks. | Fair | Good | Not suitable. | Below grade line; fill required. |
| FnA1, FnB1, FnB2. | Fincastle | Poor because of wet silt and clay. | High | Poor | Poor to fair | Fair | Fair | Fair to good. | Not suitable. | Fill required in low areas. |
| FxA1, FxB1, FxB2, FxC2. | Fox | Good | Slight to medium in subsoil; none in substratum. | Fair | Excellent | Fair to good. | Excellent | Fair | Excellent for gravel; good for sand. | Essentially no limitations. |
| FcD2, FdD3 | Fox and Casco; Fox, Casco, and Rodman. | Good | Slight to medium in subsoil; none in substratum. | Fair | Excellent | Fair to good. | Excellent | Poor to fair. | Excellent for gravel; good for sand. | Essentially no limitations. |
| GeA0, GnA0 | Genesee | Poor to very poor because of wetness. | Medium to high. | See remarks. | Poor to fair. | See remarks. | Fair | Good | Not suitable. | Fill required. |
| GmA0, GsA0, | Genesee, sandy substratum. | Poor to very poor because of wetness. | Medium | See remarks. | Fair | See remarks. | Fair | Good | Not suitable. | Below grade line; fill required. |
| Gu | Gullied land | Poor | Medium to high. | See remarks. | Poor to fair. | See remarks. | Fair | Not suitable; see remarks. | Not suitable. | No severe limitations. |
| HeF1, HeF2, HeF3. | Hennepin and Miami. | Poor | Medium to high. | Poor | Poor to fair. | Fair | Fair | Poor to fair. | Not suitable. | Shallow to bedrock in places. |
| HnA1 | Henshaw | Very poor because of wetness, silt, and clay. | High | Poor | Poor to fair. | Fair | Fair | Good | Not suitable. | No severe limitations. |

See footnotes at end of table.

*properties of the soils*—Continued

| Features that affect drainage practice and material in construction of highways | Soil features that affect use in— Dikes or levees | Farm ponds: Reservoir area | Farm ponds: Embankment | Agricultural drainage | Irrigation | Terraces and diversions | Waterways | Suitability for disposal of effluent | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Poor internal and surface drainage. | Fair stability and compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Moderately to slowly permeable; poor natural drainage. | Moderately slow infiltration and drainage. | Nearly level--- | Slightly susceptible to erosion. | Poor; moderately slowly permeable; poor drainage; low relief. | |
| Good drainage; rapid surface runoff. | Shallow to bedrock. | Shallow to bedrock. | Fair stability. | Good natural drainage. | Moderately slow infiltration; rapid runoff. | Generally steep; highly erodible; slowly permeable. | Highly susceptible to erosion. | Poor; high relief; very slowly permeable; bedrock hazard. | |
| Seasonal high water table; subject to flooding. | Fair stability and compaction. | Possibility of seepage; subject to flooding. | Fair stability; somewhat permeable. | Very permeable; fair natural drainage. | Good infiltration and percolation; moderately good drainage. | Nearly level--- | Slightly susceptible to erosion. | Limited; permeable; seasonal high water table and occasional floods. | No definite subsoil development; surface soil grades into substratum. |
| Limited internal drainage; moderate surface runoff. | Stable; fair compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Moderately permeable; poo r natural drainage. | Moderately slow infiltration and drainage. | Nearly level to gently sloping; moderately erodible. | Slightly susceptible to erosion. | Poor; moderately slowly permeable; moderate drainage; low relief. | |
| Excellent drainage. | Very stable; permeable. | Excessive rate of seepage. | Adequate strength and stability; permeable. | Excellent natural drainage. | Good infiltration; moderate to low water-holding capacity. | Gently to strongly sloping; rapidly permeable. | Gently to strongly sloping; moderately erodible. | Excellent because of gravelly and sandy substratum. | |
| Excellent drainage. | Very stable; permeable. | Excessive rate of seepage. | Adequate strength and stability; permeable. | Excellent natural drainage. | Rapid infiltration if runoff is controlled on steep slopes; low water-holding capacity. | Steep; rapidly permeable. | Steep------------ | Excellent because of gravelly and sandy substratum. | |
| Normally good drainage; seasonal high water table; subject to flooding. | Fair stability and compaction. | Possibility of seepage; subject to flooding. | Fair stability; somewhat permeable. | Very permeable; good natural drainage. | Good infiltration, permeability, and drainage. | Nearly level--- | Slightly susceptible to erosion. | Generally suitable; permeable; seasonal high water table and occasional floods. | No definite subsoil development; surface soil grades into substratum. |
| Normally good drainage; seasonal high water table; subject to flooding. | Fair to good stability and compaction. | Seepage likely; subject to flooding. | Fair to good stability; permeable. | Very permeable; good natural drainage. | Good infiltration and drainage; permeable. | Nearly level--- | Slightly susceptible to erosion. | Suitable; very rapidly permeable; seasonal high water table; occasional floods. | No definite subsoil development; surface soil grades into substratum. |
| Adequate drainage. | Fair stability and compaction. | Slow rate of seepage. | Stable; slowly permeable. | Good natural drainage. | Low fertility; moderate infiltration. | High erodibility. | Highly erodible. | Limited; moderately slowly permeable; suitable relief. | Surface soil and subsoil have been removed through erosion. |
| Good drainage; rapid surface runoff. | Stable; shallow to bedrock in places. | Shallow to bedrock. | Good stability; slowly permeable. | Good natural drainage. | Moderate infiltration if runoff is controlled on steep slopes. | Steep; moderately permeable. | Highly susceptible to erosion. | Moderately suitable; high relief; moderately permeable. | |
| Somewhat poor drainage; slow surface runoff. | Fair stability and compaction. | Slow rate of seepage. | Fair stability; slowly permeable. | Poor natural drainage. | Slow infiltration; poor drainage. | Nearly level--- | Slightly susceptible to erosion. | Poor; slowly permeable; restricted drainage; low relief. | |

TABLE 7.—*Interpretations of engineering*

| Soil map symbols | Soil series | Adaptability to grading in winter | Susceptibility to frost action | Suitability for— | | | | Suitability as source of— | | Effect of soil features on vertical alinement of highways |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Road subgrade | | Road fill | | Topsoil [1] | Sand and gravel | |
| | | | | Subsoil | Substratum | Subsoil | Substratum | | | |
| KoA + | Kokomo | Very poor because of wetness, silt, and clay. | High | Very poor | Poor to fair | Poor | Fair | Excellent | Not suitable | Fill required. |
| MwA0, MyA0. | Medway | Poor to very poor because of wetness. | Medium to high. | See remarks | Poor to fair | See remarks | Fair | Good | Not suitable | Fill required. |
| MmB1, MmB2, MmC1, MmC2, MmD1, MmD2, MeB3, MeC3, MeD3. | Miami | Poor because of silt and clay in subsoil. | Medium to high. | Poor | Poor to fair | Fair | Fair | Fair to good | Not suitable. | No severe limitations. |
| MhE1, MhE2, MpE3. | Miami and Hennepin. | Poor | Medium to high. | Poor | Poor to fair | Fair | Fair | Poor to fair | Not suitable | Shallow to bedrock in some areas.[3] |
| MdA0 | Millsdale | Very poor because of wetness, silt, and clay. | High | Very poor | See remarks | Poor | See remarks | Good to excellent. | Not suitable | Fill required; bedrock below 3 feet. |
| MnA1, MnB1, MnB2, MnC2, MnD2. | Milton | Poor because of silt and clay in subsoil. | Medium to high. | Poor | See remarks | Fair | See remarks | Fair to good | Not suitable. | Bedrock below 2 to 5 feet.[3] |
| MsD3, MsF3, MtB1, MtC2, MtD2, MtE2, MtF2. | Milton, shallow phases. | Poor because of silt and clay in subsoil. | Medium to high. | Poor | See remarks | Fair | See remarks | Poor to fair | Not suitable. | Bedrock below 1 to 2 feet.[3] |
| OcA1, OcB1, OcB2, OcC2. | Ockley | Fair to good | Medium in subsoil; none in substratum. | Poor | Excellent | Fair to good | Excellent | Good | Excellent for gravel; good for sand. | Essentially no limitations. |
| OmA1, OmB1, OmB2, OmC2. | Ockley, mixed substratum phases. | Good to poor | Medium in subsoil; slight to medium in substratum. | Poor to fair | Fair to good | Fair to good | Very good | Fair to good | Stratified gravel, sand, silt, and clay. | Essentially no limitations. |
| RaA0, RgA0 | Ragsdale | Very poor because of wetness, silt, and clay. | High | Very poor | Poor to fair | Poor | Poor to fair | Excellent | Not suitable. | Fill required. |
| RbAl | Raub | Poor because of wet silt and clay. | High | Poor | Poor to fair. | Fair | Fair | Very good | Not suitable. | Fill required in low areas. |
| ReA1, ReBl | Reesville | Poor because of wetness and high silt content. | High | Poor | Poor to fair. | Poor to fair. | Poor to fair. | Good | Not suitable. | Fill required in low areas. |

See footnotes at end of table.

*properties of the soils*—Continued

| Features that affect drainage practice and material in construction of highways | Soil features that affect use in— | | | | | | | Suitability for disposal of effluent | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | Dikes or levees | Farm ponds | | Agricultural drainage | Irrigation | Terraces and diversions | Waterways | | |
| | | Reservoir area | Embankment | | | | | | |
| Very poor drainage; located in depressions. | Poor stability above 4 feet; stable below 4 feet. | Very slow rate of seepage. | Fair stability; slowly permeable. | Very poor natural drainage. | Good infiltration; poor natural drainage. | Nearly level; slightly erodible. | Slightly susceptible to erosion. | Poor; depressional relief; impeded drainage. | |
| Seasonal high water table; subject to flooding. | Fair stability and compaction. | Subject ro flooding; slow rate of seepage. | Fair stability; slowly permeable. | Moderately permeable; moderate natural drainage. | Moderately good infiltration and drainage; permeable. | Nearly level | Slightly susceptible to erosion. | Limited; moderately permeable; seasonal high water table; occasional floods. | No definite subsoil development; surface soil grades into substratum. |
| Good drainage; rapid surface runoff. | Stable; fair to good compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Good natural drainage. | Moderate infiltration; good drainage. | Gently to strongly sloping; erodible. | Moderately to highly susceptible to erosion. | Moderate; moderately permeable; adequate relief. | |
| Good drainage; rapid surface runoff. | Stable; fair to good compaction. | Slow rate of seepage unless shallow to bedrock. | Good stability; slowly permeable. | Good natural drainage. | Strong to steep slopes; moderate infiltration; good drainage. | Strongly to steeply sloping. | Highly susceptible to erosion. | Moderate; high relief; moderately permeable. | |
| Very poor drainage. | Poor stability | Shallow to bedrock. | Poor stability. | Poor natural drainage. | Slowly permeable; slow drainage. | Nearly level | Slightly susceptible to erosion. | Very poor suitability; poor drainage; slowly permeable; low relief; bedrock hazard. | Bedrock may occur at a depth of 3 feet. |
| Good drainage. | Shallow to bedrock. | Shallow to bedrock. | Fair stability; slowly permeable. | Good natural drainage. | Moderate infiltration; slow to moderately rapid runoff. | Nearly level to strongly sloping. | Slightly to moderately erodible. | Poor; moderately permeable; high relief; shallow to bedrock. | Bedrock is at depths of 2 to 5 feet. |
| Good drainage. | Very shallow to bedrock. | Very shallow to bedrock. | Fair stability; slowly permeable. | Good natural drainage. | Moderate infiltration; medium to rapid runoff. | Gently to steeply sloping. | Moderately to highly erodible. | Very poor; very shallow to bedrock. | Bedrock is at depths of 1 to 2 feet. |
| Excellent drainage. | Very stable; permeable. | Excessive rate of seepage. | Good stability; permeable. | Excellent natural drainage. | Good infiltration, water-holding capacity, and drainage. | Nearly level to moderately sloping; rapidly permeable. | Slightly to moderately susceptible to erosion. | Excellent because of gravelly and sandy substratum. | |
| Very good to excellent drainage. | Stable; good compaction. | Excessive rate of seepage. | Good stability; moderately permeable. | Very good natural drainage. | Good infiltration and drainage; moderately good water-holding capacity. | Nearly level to moderately sloping; moderately to rapidly permeable. | Moderately to slightly susceptible to erosion. | Very good because of coarse-textured substratum; good natural drainage. | |
| Poor drainage; low or depressional relief. | Poor to fair stability and compaction. | Slow rate of seepage. | Fair stability; slowly permeable. | Poor natural drainage. | Moderate infiltration; very poor drainage; slowly permeable. | Nearly level | Slightly susceptible to erosion. | Poor because of slow drainage; depressional relief. | |
| Limited internal drainage; medium surface runoff. | Stable; fair compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Moderately permeable; poor natural drainage. | Moderate infiltration; moderately slow drainage. | Nearly level | Slightly susceptible to erosion. | Poor; slowly permeable silt and clay; low relief. | |
| Limited internal drainage; medium surface runoff. | Fair stability and compaction. | Slow rate of seepage. | Fair stability; slowly permeable. | Moderately permeable; poor natural drainage. | Moderate infiltration, percolation, and drainage. | Nearly level to gently sloping. | Slightly to moderately susceptible to erosion. | Limited; moderately permeable; low relief in some places. | |

TABLE 7.—*Interpretations of engineering*

| Soil map symbols | Soil series | Adaptability to grading in winter | Susceptibility to frost action | Suitability for— | | | | Suitability as source of— | | Effect of soil features on vertical alinement of highways |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Road subgrade | | Road fill | | Topsoil [1] | Sand and gravel | |
| | | | | Subsoil | Substratum | Subsoil | Substratum | | | |
| RoA0, RsA0 | Ross | Very poor because of wetness. | Moderately high. | Poor to fair. | Poor to good. | Fair | Fair | Excellent | Not suitable. | Fill required. |
| RmA1, RmB1, RmB2, RmC2, RmD2, RnC3, | Rossmoyne | Very poor because of wetness, silt, and clay. | High | Very poor to poor. | Poor to fair.[2] | Poor | Poor to fair.[2] | Fair | Not suitable. | No severe limitations. |
| RuB1, RuB2, RuC1, RuC2, RuD1, RuD2, RuE1, RuE2, RvB3, RvC3, RvD3, RvE3. | Russell | Poor because of silt and clay in subsoil. | Medium to high. | Poor | Poor to fair. | Fair | Fair | Good | Not suitable. | No severe limitations. |
| RxF3, RhF1, RhF2. | Russell and Hennepin. | Poor | Medium to high. | Poor | Poor to fair | Fair | Fair | Fair | Not suitable. | Some areas shallow to bedrock.[3] |
| SaA1, SaB1, SaB2; | Sardinia | Poor because of silt and clay in subsoil. | High in subsoil; slight in substratum. | Poor | Fair | Poor to fair | Fair to good. | Good | Very limited for sand; not suitable for gravel. | No severe limitations. |
| ShA0 | Shoals | Poor because of wetness, silt, and clay. | High | See remarks. | Poor to fair. | See remarks. | Poor to fair. | Good | Not suitable. | Fill required. |
| StA1 | Sleeth | Poor because of silt and clay in subsoil. | Medium to high in subsoil; almost none in substratum. | Poor | Excellent | Fair to good. | Excellent | Good | Excellent for gravel; good for sand. | No severe limitations. |
| SmA1, SmB1. | Sleeth (mixed substratum phases). | Poor because of wetness. | Medium to high in subsoil; medium in substratum. | Poor to fair. | Fair to good. | Poor to good. | Very good | Good | Stratified gravel, sand, silt, and clay. | Fill required in low areas. |
| SnA0, SnA+, SyA0. | Sloan | Very poor because of wetness, silt, and clay. | High to very high. | See remarks. | Very poor to fair. | See remarks. | Poor to fair. | Excellent | Not suitable. | Fill required. |
| ThA1, ThB1 | Thackery | Fair | Medium in subsoil; none in substratum. | Poor | Excellent | Fair to good. | Excellent | Good | Not suitable or very limited. | Essentially no limitations. |
| TmA1, TmB1 | Thackery (mixed substratum phases). | Fair to poor | Moderate | Poor to fair. | Fair to good. | Poor to good. | Very good | Good | Stratified gravel, sand, silt, and clay. | No severe limitations. |

See footnotes at end of table.

*properties of the soils*—Continued

| Features that affect drainage practice and material in construction of highways | Soil features that affect use in— Dikes or levees | Farm ponds: Reservoir area | Farm ponds: Embankment | Agricultural drainage | Irrigation | Terraces and diversions | Waterways | Suitability for disposal of effluent | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Normally good drainage; seasonal high water table; subject to flooding. | Fair stability and compaction. | Subject to flooding; seepage in some areas. | Fair stability; slowly permeable. | Very permeable; good natural drainage. | Good infiltration, water-holding capacity, and drainage. | Nearly level | Slightly susceptible to erosion. | Generally suitable; permeable, but hazard of seasonal high water table and occasional floods. | |
| Moderately good drainage. | Poor to fair stability and compaction. | Essentially impermeable material. | Fair stability; slowly permeable. | Slowly permeable; slightly restricted natural drainage. | Slow infiltration and percolation. | Nearly level to strongly sloping; slowly permeable. | Highly erodible | Poor; slowly permeable silt and clay; generally adequate relief. | |
| Good drainage; rapid surface runoff. | Stable; good compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Good natural drainage. | Moderate infiltration; good drainage. | Gently to steeply sloping. | Moderately to highly susceptible to erosion. | Moderate; moderately permeable; adequate relief. | |
| Good drainage; rapid surface runoff. | Stable; good compaction; bedrock hazard in some places. | Slow rate of seepage unless shallow to bedrock. | Good stability; slowly permeable. | Good natural drainage. | Moderate infiltration if runoff is controlled on steep slopes; good drainage. | Steep | Highly susceptible to erosion. | Moderate; high relief; moderately permeable. | |
| Moderately good drainage. | Fair stability; good compaction. | Seepage likely when excavated below depth of 4 feet. | Adequate stability; slow permeability. | Moderately good drainage; has permeable substratum. | Adequate infiltration, water-holding capacity, and drainage. | Nearly level to gently sloping; moderately erodible. | Moderately susceptible to erosion. | Good; sandy material below depth of 4 or 5 feet. | |
| Restricted drainage; subject to flooding. | Fair stability and compaction. | Subject to flooding; slow rate of seepage. | Fair stability; slowly permeable. | Poor natural drainage; moderately permeable. | Good infiltration and water-holding capacity; restricted natural drainage. | Nearly level | Slightly susceptible to erosion. | Limited to poor; moderately permeable; seasonal high water table; occasional floods. | No definite B horizon; surface soil grades into substratum. |
| Good drainage when outlets are provided. | Stable; permeable. | Excessive rate of seepage. | Good stability; permeable. | Poor natural drainage; good potential drainage. | Adequate permeability and water-holding capacity. | Nearly level | Slightly susceptible to erosion. | Generally good; coarse-textured substratum; low relief. | |
| Fair drainage | Stable; good compaction. | Rapid rate of seepage. | Fair to good stability; moderately permeable. | Moderately permeable; poor natural drainage. | Moderately good infiltration and water-holding capacity; somewhat poor drainage. | Nearly level to gently sloping; moderately permeable. | Slightly susceptible to erosion. | Generally suitable; coarse-textured substratum; low relief in some areas. | |
| Poor drainage; subject to flooding. | Poor to fair stability and compaction. | Subject to flooding; slow rate of seepage. | Fair stability; slowly permeable. | Poor natural drainage. | Good infiltration; very poor drainage. | Nearly level | Slightly susceptible to erosion. | Very poor; slowly permeable; slow drainage; seasonal high water table; occasional floods. | No definite subsoil; surface soil grades into substratum. |
| Very good drainage. | Very stable; permeable. | Excessive rate of seepage. | Good stability; permeable. | Good natural drainage. | Good infiltration and drainage. | Nearly level to gently sloping. | Slightly susceptible to erosion. | Good; permeable substratum; generally adequate relief. | |
| Moderately good drainage. | Stable; good compaction. | High rate of seepage. | Fair to good stability; moderately permeable. | Moderately permeable; moderately good natural drainage. | Moderately good infiltration, drainage, and water-holding capacity. | Nearly level to gently sloping; moderately permeable. | Slightly susceptible to erosion. | Good because of coarse-textured substratum. | |

TABLE 7.—*Interpretations of engineering*

| Soil map symbols | Soil series | Adaptability to grading in winter | Susceptibility to frost action | Suitability for— Road subgrade: Subsoil | Suitability for— Road subgrade: Substratum | Suitability for— Road fill: Subsoil | Suitability for— Road fill: Substratum | Suitability as source of— Topsoil [1] | Suitability as source of— Sand and gravel | Effect of soil features on vertical alinement of highways |
|---|---|---|---|---|---|---|---|---|---|---|
| UnA1, UnB2 | Uniontown | Poor | Medium to high. | Poor | Poor to fair | Fair | Fair | Good | Not suitable. | No severe limitations. |
| WeA0, WeA+, WtA0. | Westland | Very poor because of wetness, silt, and clay. | High in subsoil; slight in substratum. | Poor | Good to excellent. | Fair | Excellent | Excellent | Good to excellent. | Fill required. |
| WmA+, WnA0 | Westland, mixed substratum phases. | Very poor because of wetness, silt, and clay. | High | Poor to fair | Fair to good | Poor to good. | Very good | Excellent | Stratified gravel, sand, silt, and clay. | Fill required. |
| WbA1, WbB1, WbB2, WbC1, WbC2, WbD2, WbE2. | Williamsburg | Poor because of silt and clay in subsoil. | High in subsoil; slight in substratum. | Poor | Fair | Poor to fair | Fair to good | Good | Not suitable or very limited. | Essentially no limitations. |
| XeA1, XeB1, XeB2, XeC1, XeC2, XnB3, XnC3. | Xenia | Poor because of silt and clay in subsoil. | Medium to high. | Poor | Poor to fair | Fair | Fair | Good | Not suitable. | No severe limitations. |

[1] Rating generally applies only to the natural soil surface layer.
[2] The substratum is poor for subgrade and road fill except in areas of glacial till in which loam material is encountered. Loam substratum is fair for road fill and poor to fair for subgrade.

## *Additional Facts About Clinton County*

The first white settlers came to Clinton County in 1797. By 1820 the population had grown to 8,085, and by 1880 it was 23,292. In 1950 the population was 25,572. Wilmington, the county seat, was laid out in 1810. Most of the early settlers came from Kentucky, Pennsylvania, and North Carolina, and many descendants of these early families are living in the county (*6*).

Before the white man arrived, Indian tribes occupied some of the better drained sites along the streams. Major Indian trails crossed the county, generally following the crests of the glacial moraines, which were higher and better drained than most of the surrounding land.

The early trails and roads of the white settlers also generally followed the higher, better drained ground. The early settlers first cultivated the higher ground of the moraines, the well-drained terraces, and the sloping uplands adjacent to streams. They cleared forests and drained the best soils for farming. Gradually the flatter, more poorly drained parts of the county were also used for agriculture.

Considerable tile and open-ditch drainage is being installed to supplement or replace the older systems that are now inadequate or are no longer functioning properly.

### Industries

There are several small- to medium-size industrial establishments in the county. They do not employ large numbers of people, but industrial employment is available in the adjoining counties. The Clinton County Air Force Base near Wilmington employs a substantial number of civilians.

### Transportation

The county has a complete network of all-weather county, State, and Federal highways. Several railroads cross the county and provide good shipping facilities. Scheduled airline service is not available in the county, but several small landing strips are available for the owners of small planes and for planes used in treating crops.

### Community Facilities

The quality of housing is generally good in the county. Most homes have electricity, plumbing, telephone, radio, television, and other modern conveniences.

Churches, schools, and granges are well distributed throughout the county. Wilmington College, with an en-

*properties of the soils*—Continued

| Features that affect drainage practice and material in construction of highways | Soil features that affect use in— | | | | | | | Suitability for disposal of effluent | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | Dikes or levees | Farm ponds | | Agricultural drainage | Irrigation | Terraces and diversions | Waterways | | |
| | | Reservoir area | Embankment | | | | | | |
| Adequate drainage. | Fair to good stability and compaction. | Slow rate of seepage. | Stable; slowly permeable. | Moderately well drained. | Moderate infiltration and drainage. | Nearly level to gently sloping. | Slightly to moderately susceptible to erosion. | Poor; slowly permeable; low relief in some areas. | |
| Poor natural drainage; good response to artificial drainage. | Good stability and compaction. | Probable excessive rate of seepage. | Stable; permeable. | Poor natural drainage. | Good infiltration and water-holding capacity. | Nearly level | Slightly susceptible to erosion. | Limited to poor; low relief and poor natural drainage; relatively porous substratum. | |
| Poor drainage; low relief. | Fair to good stability and compaction. | High seepage losses in some areas a possibility. | Good stability; slowly permeable. | Poor natural drainage. | Good infiltration; poor drainage; slowly to moderately permeable. | Nearly level | Slightly susceptible to erosion. | Limited to poor because of poor natural drainage and low relief. | |
| Good drainage | Fair stability; good compaction. | Seepage likely when excavated below depth of 4 feet. | Adequate stability; slowly permeable. | Good natural drainage. | Adequate infiltration, water-holding capacity, and drainage. | Nearly level to rather steeply sloping. | Moderately to highly susceptible to erosion. | Very good; sandy substratum; adequate relief. | |
| Moderate to good drainage. | Stable; good compaction. | Slow rate of seepage. | Good stability; slowly permeable. | Moderately well drained; moderately permeable. | Moderate infiltration and drainage. | Nearly level to moderately sloping. | Moderately susceptible to erosion. | Limited; moderately permeable; adequate relief. | |

[3] Rock excavation may be required in cut sections because of shallowness to bedrock.

rollment of about 600, is located in Wilmington. Hospital facilities are also available in Wilmington.

Lake Cowan State Park, a short distance southwest of Wilmington, furnishes opportunities for various outdoor recreational activities.

## Climate

The county has a continental climate characterized by moderately cold winters and warm summers. Winters have frequent periods of cold weather and moderate snowfall. Summers have periods of hot, humid weather, which are usually of short duration. Precipitation is fairly evenly distributed throughout the year. The periods of least precipitation are late in summer and early in fall. Short to moderately long droughts occasionally occur. Serious droughts are infrequent.

The county is so situated that its climate is influenced by many general storm areas, and thunderstorms, hailstorms, windstorms, heavy rainstorms, and other local disturbances occur. The heaviest rains and strongest winds are usually accompanied by thunderstorms, and any part of the county may expect 40 to 50 thunderstorms a year. However, storms causing severe destruction rarely occur. The lowlands along streams are flooded to some extent nearly every year.

Temperatures are much the same over the county. Seasonal changes are gradual. The commonly grown crops are seldom damaged by late frosts in spring or early frosts in fall. The average date of the last killing frost in spring is May 7, and that of the first killing frost in fall is October 9. The average frost-free period is 155 days, which is usually enough to grow and mature field crops.

About half the annual precipitation falls during the growing season. Extended rainy periods during the spring months sometimes make the preparation of land for planting a problem.

At times enough snow falls to protect the soil from deep freezing. The cover of snow reduces the possibility of severe freezing and heaving of the soil. Fall-sown small grain, clover, and alfalfa are damaged by the heaving soil.

The prevailing winds and weather fronts generally move across the county in an easterly direction. The weather fronts move across with considerable frequency and account for many changes in the weather.

Climatic data from the U.S. Weather Bureau Station at Wilmington is summarized in table 8.

TABLE 8.—*Temperature and precipitation at Wilmington, Clinton County, Ohio*

[Elevation, 1,026 feet]

| Month | Temperature [1] | | | Precipitation [2] | | | |
|---|---|---|---|---|---|---|---|
| | Average | Absolute maximum | Absolute minimum | Average | Driest year (1930) | Wettest year (1929) | Average snowfall |
| | °F. | °F. | °F. | Inches | Inches | Inches | Inches |
| December | 33.2 | 71 | −22 | 3.36 | 1.30 | 3.83 | 7.2 |
| January | 30.1 | 74 | −22 | 3.69 | 6.32 | 5.74 | 8.3 |
| February | 32.6 | 76 | −14 | 2.94 | 2.33 | 4.64 | 6.9 |
| Winter | 32.0 | 76 | −22 | 9.99 | 9.95 | 14.21 | 22.4 |
| March | 42.0 | 88 | −3 | 4.51 | 3.31 | 3.12 | 4.1 |
| April | 51.7 | 92 | 10 | 4.27 | 2.04 | 4.22 | 1.0 |
| May | 61.6 | 97 | 25 | 4.29 | 1.35 | 7.25 | .1 |
| Spring | 51.8 | 97 | −3 | 13.07 | 6.70 | 14.59 | 5.2 |
| June | 71.4 | 104 | 36 | 4.13 | 1.25 | 4.51 | 0 |
| July | 74.9 | 111 | 41 | 4.58 | .88 | 9.62 | 0 |
| August | 73.2 | 105 | 37 | 4.23 | 1.74 | 5.07 | 0 |
| Summer | 73.2 | 111 | 36 | 12.94 | 3.87 | 19.20 | 0 |
| September | 67.3 | 104 | 26 | 3.29 | 1.58 | 4.62 | 0 |
| October | 55.6 | 92 | 12 | 2.83 | .04 | 3.71 | .3 |
| November | 43.1 | 82 | −4 | 3.13 | 1.60 | 5.28 | 2.4 |
| Fall | 55.3 | 104 | −4 | 9.25 | 3.22 | 13.61 | 2.7 |
| Year | 53.1 | 111 | −22 | 45.25 | 23.74 | 61.61 | 30.3 |

[1] Average temperature based on a 38-year record, through 1955; highest and lowest temperatures on a 36-year record, through 1952.
[2] Average precipitation based on a 43-year record, through 1955; wettest and driest years based on a 44-year record, in the period 1884–1955; snowfall based on a 36-year record, through 1952.

## Agriculture

According to the 1954 United States Census of Agriculture, Clinton County had 1,594 farms and 234,349 acres of land in farms. About 68 percent of the farms were operated by owners and part owners, and the rest by managers and tenants. Land in farms was 88.9 percent of the county area, but it has decreased in recent years because of urban developments, recreational needs, and military and highway construction. The average size of farms, however, has increased. As an example, in 1950 the average size of farms was 133.6 acres; in 1954 it was 147 acres. The increase has been caused by economic conditions and the impact of modern agricultural technology. Much of the land in Clinton County is well suited to large-scale farming.

About 96 percent of the operators live on the land they farm. Some farmers, however, combine farming with off-the-farm employment. This practice is most common in the southwestern part of the county where the land is poorly drained and infertile and crop failures are more frequent. Some of the younger men, who want to start farming, take outside work to increase their income and to buy equipment. The large industrial areas in the Miami River Valley provide employment to the farmers who want it.

Livestock raising is the most important type of farming in Clinton County. In 1954 livestock and livestock products accounted for about 78 percent of the value of all farm products sold in Clinton County. In 1949 they accounted for about 83 percent.

Farms were classified as follows:

| | 1950 | 1954 |
|---|---|---|
| | Number | Number |
| Field-crop, other than vegetable and fruit-and-nut | 93 | 276 |
| Fruit-and-nut | 5 | 5 |
| Dairy | 138 | 86 |
| Poultry | 26 | 10 |
| Livestock, other than dairy and poultry | 1,088 | 866 |
| General | 133 | 140 |
| Miscellaneous and unclassified | 344 | 211 |

The principal kinds of livestock on farms in Clinton County were as follows:

| | 1950 | 1954 |
|---|---|---|
| | Number | Number |
| Cattle and calves | 29,043 | 28,374 |
| Milk cows | 7,290 | 6,725 |
| Horses and mules | 1,561 | 625 |
| Hogs and pigs | 141,493 | 126,831 |
| Sheep and lambs | 14,444 | 19,942 |
| Chickens, 4 months old and over | 111,976 | 103,443 |
| Turkeys raised | 10,086 | 17,591 |

Yields per acre of corn, small grains, soybeans, and hay have increased because of improved tillage, fertilization, and drainage practices and the use of better seed, especially of hybrid corn. According to the Ohio Cooperative Crop Reporting Service (*8*, *13*), the average acre yields in the county in 1954 were corn, 69.3 bushels; wheat, 26.6; oats, 47.1; soybeans, 25.7; and all hay, 1.60 tons.

Acreages of the principal crops were as follows in stated years:

| | 1949 | 1954 |
|---|---|---|
| | Acres | Acres |
| Corn, all purposes | 69,212 | 68,992 |
| Wheat, threshed or combined | 42,141 | 29,310 |
| Oats, threshed or combined | 4,431 | 7,298 |
| Barley, threshed or combined | 352 | 3,561 |
| Rye, threshed or combined | 78 | 1,424 |
| Soybeans, all purposes | 4,779 | 4,795 |
| Hay crops, excluding soybeans | 14,072 | 24,279 |
| Red clover seed harvested | 1,784 | 598 |
| Timothy seed harvested | 2,919 | 1,124 |

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## *Glossary*

Definitions of technical terms are given here for the convenience of readers who cannot refer to them readily elsewhere.

**Alluvial soils.** Soils developing from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes.

**Alluvium.** Sand, mud, and other sediment deposited on land by streams.

**Azonal soils.** Soils without distinct genetic horizons. A soil order.

**Base exchange capacity.** The sum total of exchangeable cations absorbed by a soil, expressed in milliequivalents per 100 grams of soil. Measured values of cation-exchange capacity depend somewhat on the method used for determination.

**Bottom land.** Low land formed by alluvial deposits along a river. (See Alluvial soils.)

**Calcareous soil.** A soil containing enough lime or calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly to the naked eye when treated with dilute hydrochloric acid. A soil alkaline in reaction because of the presence of calcium carbonate.

**Catena, soil.** A group of soils, within a specific soil zone, developed from similar parent material but with unlike soil characteristics because of differences in relief or drainage.

**Clay.** As a soil separate, the small mineral soil particles less than 0.002 millimeter in diameter (approximately 0.00008 of an inch). Clay particles are the chemically active part of the soil. (See Texture, soil.)

**Consistence, soil.** The relative mutual attraction of the particles in the whole soil mass, or their resistance to separation or deformation. Consistence determines the degree of difficulty that will be encountered in maintaining the soil in a porous condition under cultivation, or the degree of compaction and load bearing one can obtain in construction. Terms commonly used to describe consistence are as follows:

*Loose.* Noncoherent.

*Friable.* Soil material crushes easily under gentle to moderate pressure between thumb and forefinger and coheres when pressed together.

*Firm.* Aggregates are stable and cannot be crumbled easily between the fingers.

*Soft.* Soil mass is very weakly coherent and fragile; breaks to powder or individual grains under very slight pressure.

*Plastic.* Soil mass is capable of being molded without rupture.

*Sticky.* Soil material is cohesive and does not separate easily.

*Hard.* Moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and forefinger.

*Cemented.* Soil material is hard and brittle because of some cementing substance other than clay minerals.

**Drainage, natural.** Natural drainage is the combined effect of surface and internal water on the soil under natural conditions. Seven different classes of natural drainage are recognized.

*Excessively drained* soils are commonly very porous and rapidly permeable, and have low water-holding capacity.

*Somewhat excessively drained* soils are also very permeable and are free from mottling throughout their profile.

*Well-drained* soils are nearly free from mottling and are commonly 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 C horizons.

*Imperfectly drained* soils are wet for significant periods but not all the time, and in podzolic soils commonly have mottlings below a depth of 6 to 16 inches, in the lower A and in the B and C horizons.

*Poorly drained* soils are wet for long periods of time and in their region 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. In their region they have dark-gray or black surface layers and are gray or light gray, with or without mottling, in the deeper parts of the profile.

**Drainage, internal.** The quality of a soil that allows the downward flow of excess water through it.

**Drainage, surface.** Runoff, or the surface flow of water from an area.

**Eluviation.** The movement of soil material from one place to another within the soil, in solution or in suspension, when there is an excess of rainfall over evaporation. Horizons that have lost material through eluviation are referred to as eluvial, and those that have received material as illuvial. Eluviation may take place downward or sidewise according to the direction of water movement.

**Erosion.** The wearing away of the land surface by running water, wind, or other geological agents.

*Normal.* The erosion characteristics of the land surface in its natural environment, undisturbed by human activity, as under the protective cover of the native vegetation. This type of erosion is sometimes referred to as geological erosion, and it is not mapped in soil surveys.

*Accelerated.* Erosion of the soil or rock, at a rate higher than normal erosion, caused by changes in the natural cover or ground condition, including those caused by human activity. It may consist of sheet, rill, or gully erosion. This type of erosion is identified and mapped in soil surveys.

**Flood plain.** The nearly flat land along streams subject to overflow.

**Glaciofluvial deposits.** Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice.

**Glacial outwash.** Crossbedded gravel, sand, and silt deposited by melt water as it flowed from the ice.

**Glacial till.** A deposit of earth, sand, gravel, and boulders transported by glaciers. It is not stratified.

**Granule.** A single mass, or cluster, of soil consisting of many soil particles held together.

**Horizon, soil.** A layer of soil approximately parallel to the surface having distinct characteristics produced by soil-forming processes. The relative positions of the several soil horizons in a typical soil profile and their nomenclature follow.

- $A_0$ Organic debris, partly decomposed or matted.
- $A_1$ A dark-colored horizon having a fairly high content of organic matter mixed with mineral matter.
- $A_2$ A light-colored horizon, often representing the zone of maximum leaching where podzolized; absent in wet, dark-colored soils.
- $A_3$ Transitional to B horizon but more like A than B; sometimes absent.
- $B_1$ Transitional to B horizon but more like B than A; sometimes absent.
- $B_2$ A usually stronger colored horizon, which often represents the zone of maximum illuviation where podzolized.
- $B_3$ Transitional to C horizon.
- C Slightly weathered parent material; absent in some soils.
- D Underlying substratum.

The A horizons make up a zone of eluviation, which is a leached zone. The B horizons make up a zone of illuviation, in which clay or other materials have accumulated. The A and B horizons, taken together, are called the solum, or true soil.

**Illuviation.** (See eluviation.)

**Infiltration.** The downward entry of water into soil.

**Infiltration velocity.** The volume of water moving downward into the soil surface per unit of area per unit of time.

**Moisture-supply capacity.** This term, as used in this report, refers to the estimated maximum amount of moisture, expressed in terms of inches, that the soil can supply to growing plants. Very high, more than 12 inches; high, 9 to 12 inches; medium, 6 to 9 inches; low, 3 to 6 inches; very low, less than 3 inches.

**Nutrients, plant.** The elements taken in by the plant, essential to its growth, and used by it in the elaboration of its food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil, and carbon, hydrogen, and oxygen obtained largely from the air and water, are plant nutrients.

**Parent material.** The unconsolidated mass of rock material (or peat) from which the soil profile develops.

**Ped.** An individual natural soil aggregate such as a crumb, a prism, or a block, in contrast to a clod, which is a mass of soil brought about by digging or other disturbance.

**Percolation.** The downward movement of water through soil.

**Permeability, soil.** The quality of a soil horizon that enables water or air to move through it. It can be measured quantitatively in terms of rate of flow of water through a unit cross section in unit time under specified temperature and hydraulic conditions. Values for saturated soils usually are called hydraulic conductivity. The permeability of a soil may be limited by the presence of one nearly impermeable horizon, even though the others are permeable.

**Phase, soil.** The subdivision of a soil type or other classificational unit having variations in characteristics not significant to the classification of the soil in its natural landscape but significant to the use and management of the soil. Examples of the variations recognized by phases or soil types include differences in slope, stoniness, and thickness because of accelerated erosion.

**Plastic.** (See Consistence.)

**Porosity, soil.** The degree to which the soil mass is permeated with pores or cavities. It is expressed as the percentage of the whole volume of the soil that is unoccupied by solid particles.

**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 mass, expressed in either pH value or in words, as follows:

| | *pH* | | *pH* |
|---|---|---|---|
| Extremely acid | Below 4.5 | Neutral | 6.6–7.3 |
| Very strongly acid | 4.5–5.0 | Mildly alkaline | 7.4–7.8 |
| Strongly acid | 5.1–5.5 | Moderately alkaline | 7.9–8.4 |
| Medium acid | 5.6–6.0 | Strongly alkaline | 8.5–9.0 |
| Slightly acid | 6.1–6.5 | Very strongly alkaline | 9.1 and higher. |

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Sand.** Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Usually sand grains consist chiefly of quartz, but they may be of any mineral composition. (See Texture, soil.)

**Series, soil.** A group of soils that have soil horizons similar in differentiating characteristics and arrangements in the soil profile, except for the texture of the surface soil, and are formed from a particular type of parent material. Soil series is an important category in detailed soil classification. Individual series are given proper names from place names near the first recorded occurrence.

**Silt.** (1) Individual mineral particles of soil that range in diameter between the upper size of clay, 0.002 millimeter, and the lower size of very fine sand, 0.05 millimeter. (2) Sediment deposited from water in which the individual grains are approximately the size of silt, although the term is sometimes applied loosely to sediments containing considerable sand and clay. (See Texture, soil.)

**Soil.** The natural medium for the growth of land plants. The collection of natural bodies occupying parts of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter acting upon 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 soils includes the A and B horizons. Usually the characteristics of the material in these horizons are quite unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

**Sticky.** (See Consistence.)

**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, prismatic, columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain—each grain by itself, as in dune sand, or (2) massive—the particles adhering together without any regular cleavage as in many claypans and hardpans. (Good or bad tilth are terms for the general structural condition of cultivated soils according to particular plants or sequences of plants.)

**Subsoil.** Roughly that part of the solum below plow depth. In many soils, the B horizon.

**Substratum.** Any layer lying beneath the solum or true soil. The substratum may be unweathered parent material, or dissimilar material, such as a D horizon.

**Surface soil.** Technically, the A horizon; commonly, the upper part of the soil profile usually stirred by plowing.

**Terrace.** An embankment or ridge constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff in order to retard it for infiltration into the soil so that any excess may flow slowly to a prepared outlet without harm.

**Terrace, geological.** A nearly flat or undulating plain, commonly rather narrow and usually with a steep front, bordering a river, a lake, or the sea. Although many old terraces have become more or less hilly through dissection by streams, they are still regarded as terraces.

**Texture, soil.** The relative proportions of the various size groups of individual soil grains in a mass of soil. Specifically, it refers to the proportions of sand, silt, and clay. Verbal definitions of the soil textural classes are as follows.

*Sand.* Soil material that contains 85 percent or more of sand; percentage of silt, plus 1½ times the percentage of clay, shall not exceed 15.

*Loamy sand.* Soil material that contains at the upper limit 85 to 90 percent sand, and the percentage of silt plus 1½ times the percentage of clay is not less than 15; at the lower limit it contains not less than 70 to 85 percent sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

*Sandy loam.* Soil material that contains either 20 percent clay or less, and the percentage of silt plus twice the percentage of clay exceeds 30, and 52 percent or more sand; or less than 7 percent clay, less than 50 percent silt, and between 43 percent and 52 percent sand.

*Loam.* Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

*Silt loam.* Soil material that contains (1) 50 percent or more of silt and 12 to 27 percent of clay or (2) 50 to 80 percent of silt and less than 12 percent of clay.

*Silt.* Soil material that contains 80 percent or more of silt and less than 12 percent clay.

*Sandy clay loam.* Soil material that contains 20 to 35 percent clay, less than 28 percent silt, and 45 percent or more sand.

*Clay loam.* Soil material that contains 27 to 40 percent clay and 20 to 45 percent sand.

*Silty clay loam.* Soil material that contains 27 to 40 percent clay and less than 20 percent sand.

*Sandy clay.* Soil material that contains 35 percent or more clay and 45 percent or more sand.

*Silty clay.* Soil material that contains 40 percent or more clay and 40 percent or more silt.

*Clay.* Soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

*Gravelly loam.* A loam soil material that contains from 20 to 50 percent of gravel in the whole soil mass. Gravel is fragments of rock up to 3 inches in diameter.

*Gravelly clay loam.* A clay loam soil material altered by a content of about 20 percent or more gravel in the whole soil mass.

**Tilth, soil.** The physical condition of a soil in respect to its fitness for the growth of a specified plant or sequence of plants. Ideal soil tilth is not the same for each kind of crop, nor is it uniform for the same kind of crop growing on contrasting kinds of soil.

**Type, soil.** A subgroup or category under the soil series based on the texture of the surface soil. A soil type is a group of soils having horizons similar in differentiating characteristics and arrangement in the soil profile and developed from a particular type of parent material. The name of a soil type consists of the name of the soil series plus the textural class name of the upper part of the soil equivalent to the surface soil. Thus Avonburg silt loam is the name of a soil type within the Avonburg series.

**Uplands.** Ground elevated above the lowlands along rivers or between hills.

**Water table.** The upper limit of the 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.

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