SOIL SURVEY OF

Ashtabula County, Ohio

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

Issued May 1973

Major fieldwork for this soil survey was done in the period 1953–64. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1964. This survey was made cooperatively by the Ohio Department of Natural Resources, Division of Lands and Soil; the United States Department of Agriculture, Soil Conservation Service; and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Ashtabula Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased, on individual order, from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and in the discussions of the interpretive grouping.

Land use planners, county commissioners, and others interested in broad land use planning will find information about use of the soils for selected nonfarm purposes in the section "Town and Country Planning."

Engineers and builders will find under "Engineering Uses of the Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

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

Students, teachers, and others will find information about soils and their management in various parts of the text, depending on their particular interests.

Newcomers in Ashtabula County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Facts About the County," which gives additional information about the county.

***Cover picture:* Dairy cattle grazing birdsfoot trefoil on Sheffield silt loam; woodland in background is typical of that on Sheffield soils.**

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SOIL SURVEY OF ASHTABULA, OHIO

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

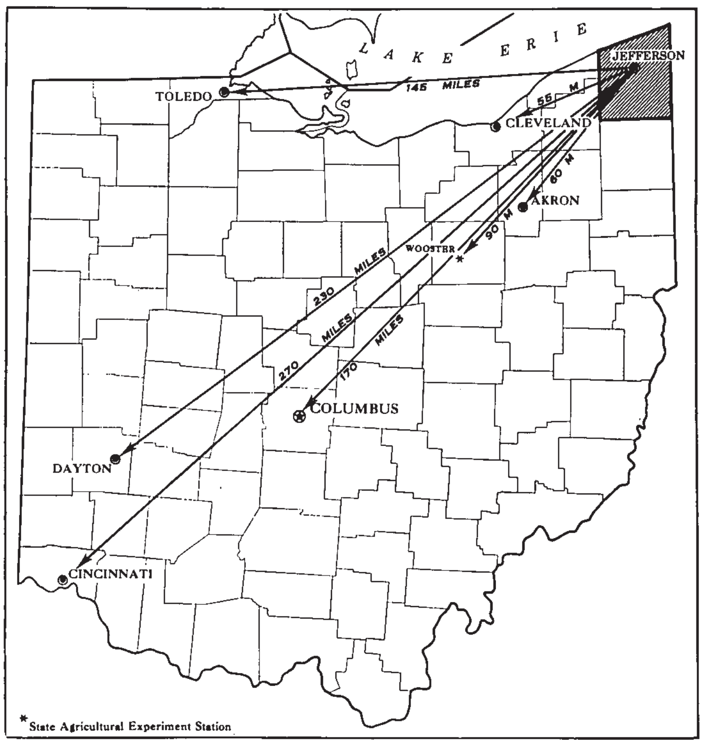

***Figure 1.*—Location of Ashtabula County in Ohio.**

ASHTABULA COUNTY, in the northeastern corner of Ohio (fig. 1), occupies 705 square miles or 451,340 acres. Jefferson, located near the center of the county, is the county seat. Ashtabula, the largest city, is followed in size by Conneaut and Geneva.

In 1960 the population of the county was 93,067; of this total about 53 percent was urban and about 47 percent was rural. Farm families made up 7.8 percent of the total population.

Dairying accounts for more than 60 percent of the gross farm income of the county. The main crops grown are those used for dairy feed, mainly hay and pasture and some oats and corn. Nurseries and small fruits are important on the sandy soils on the lake plain and beach ridges.

More than 30 percent of the county is wooded as defined by the 1967 Conservation Needs Inventory. Products from woodland are used to supplement the income of farmers and part-time farmers. Woodland also is used for many recreational facilities, such as camps, campgrounds, and hunting areas. Some areas included as wooded are former cropland and pasture that are reverting to woodland.

Most of the soils in the county formed on glacial till deposited during the Wisconsin glacial age. Some of the soils formed on glacial outwash materials, lake-laid sediments, or beach ridges. All of these are related to the Wisconsin glacial age. Soils on the flood plains formed in recently deposited alluvium.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Ashtabula County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots. Most of the soils in this county are described to a depth of 60 inches.

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

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Chenango and Venango,

[1] Others assisting with the field survey were W. A. MEYERS, H. R. FINNEY, D. H. TOUVELL, A. RITCHIE, and P. E. BALDRIDGE, Ohio Department of Natural Resources.

for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soil by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Platea silt loam, 0 to 2 percent slopes, is one of several phases within the Platea series.

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

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

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

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Canadice-Caneadea silt loams, 0 to 2 percent slopes, is an example of a soil complex.

An undifferentiated group is made up of two or more soils that perhaps could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Pierpont and Platea soils, 12 to 18 percent slopes, moderately eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Quarries is a land type in Ashtabula County.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management. Such groups are the capability units and woodland suitability groups in this publication.

General Soil Map

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

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

The nine soil associations shown on the general soil map are described in the following pages. These associations join associations in other counties that have the same, or similar landscapes, but they do not necessarily have the same dominant soils or the same proportion of dominant soils. The terms for texture used in the descriptive title for the associations apply to the surface layer. For example, in the descriptive title for association 1, the word "loamy" refers to texture of the surface layer.

1. Venango-Frenchtown-Cambridge Association

Deep, nearly level to moderately steep, poorly drained to moderately well drained loamy soils on glaciated uplands

This soil association consists mostly of nearly level to gently sloping soils (fig. 2), though the soils are sloping and moderately steep in some areas along streams. In a small area north of Andover, the soils are rolling and have complex slopes. The soil association is entirely in the southeastern corner of the county.

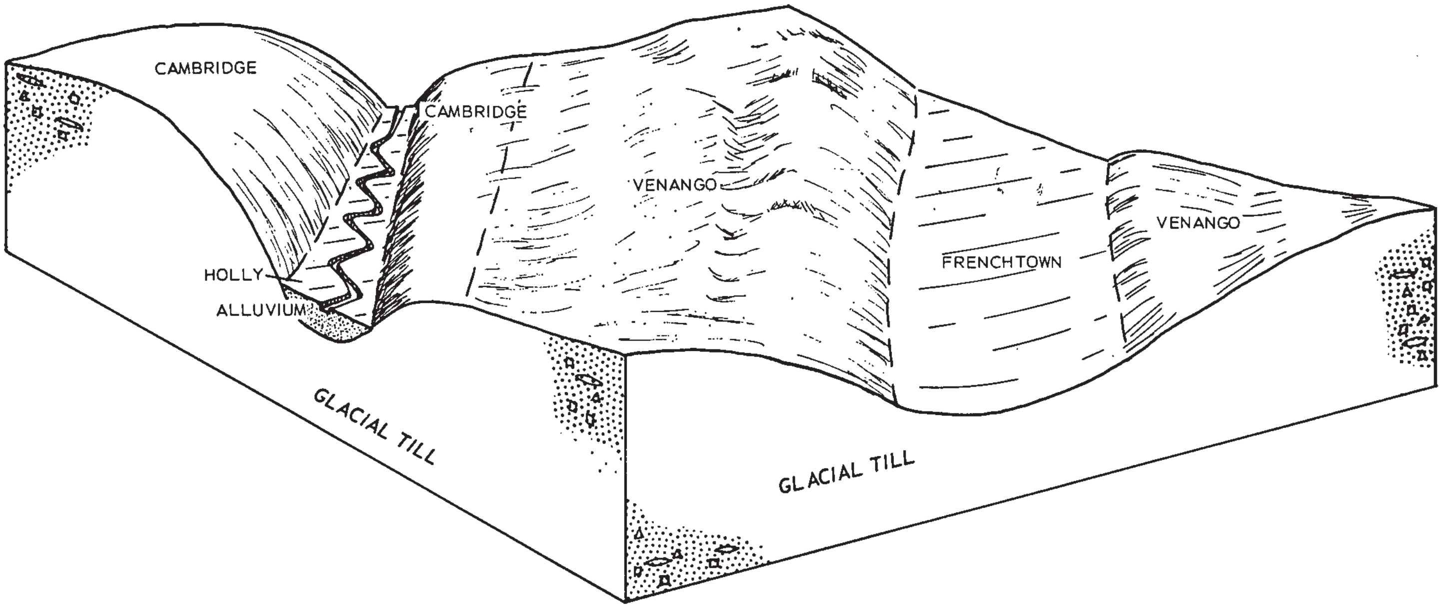

Figure 2.—**Soil pattern in the Venango-Frenchtown-Cambridge soil association.**

This association occupies about 9 percent of the county. About 40 percent of this is Venango soils, 35 percent Frenchtown soils, 20 percent Cambridge soils, and the remaining 5 percent other soils.

The Venango soils are somewhat poorly drained, and the Frenchtown soils are poorly drained. Both kinds of soil need artificial drainage for optimum crop growth. In most places the Frenchtown soils are nearly level and occur along small drainageways. Cambridge soils are moderately well drained and are sloping enough that an erosion hazard is their major limitation for farming.

Other soils in this association are the Holly and Orrville soils on flood plains and the Chenango soils on outwash terraces.

The Venango, Frenchtown, and Cambridge soils have a root zone that generally is strongly acid to extremely acid and low in natural fertility. In the lower part of the subsoil, these soils have a very dense, compact layer that restricts the movement of water and the penetration of plant roots. Because of this layer, these major soils have a seasonally high water table during winter and spring.

Dairying is the major source of farm income in this association. A high proportion of the cultivated acreage is in forage crops, and the rest generally is planted to corn, oats, and wheat. Adjacent to the Pymatuning Reservoir are large areas of summer cottages and areas no longer farmed that probably will be used for recreational purposes. Seasonal wetness is a limitation for many nonfarm uses in this association.

2. Platea-Sheffield Association

Deep, nearly level to sloping, somewhat poorly drained to poorly drained silty soils on glaciated uplands

This is the largest soil association in the county. The soils are mostly nearly level to gently sloping (fig. 3) though in some areas along streams, they are sloping to steep.

This association occupies about 39 percent of the county. About 50 percent of this is Platea soils, 35 percent is Sheffield soils, and the remaining 15 percent is other soils.

The Platea soils are somewhat poorly drained. They are gently sloping and occur on the convex slopes of knolls. The Sheffield soils are poorly drained. They are nearly level or depressional and occur along draingeways.

The Platea and Sheffield soils have a root zone that is mainly strongly acid to extremely acid and low in natural fertility. They have a dense, compact layer in the lower part of the subsoil. This layer restricts the downward movement of water and the penetration of plant roots. Also, because of this dense layer, these soils have a seasonally high water table in winter and spring. Both kinds of soils need artificial drainage if crop growth is to be optimum.

Among the other soils in this association are the sloping to steep Pierpont soils on the crests and side slopes of ridges; soils such as the Holly soils on small flood plains; and the Mahoning soils, shale substratum.

Dairying is the major source of farm income in this association. Forage crops, corn, oats, and wheat are the dominant crops. Seasonal wetness and very slow permeability are soil limitations for many nonfarm uses in this association.

3. Sheffield-Platea Association

Deep, nearly level, poorly drained to somewhat poorly drained silty soils on glaciated uplands

Nearly level soils in broad areas that are several square miles in size characterize this soil association (fig. 4). Small convex knolls occur within these areas.

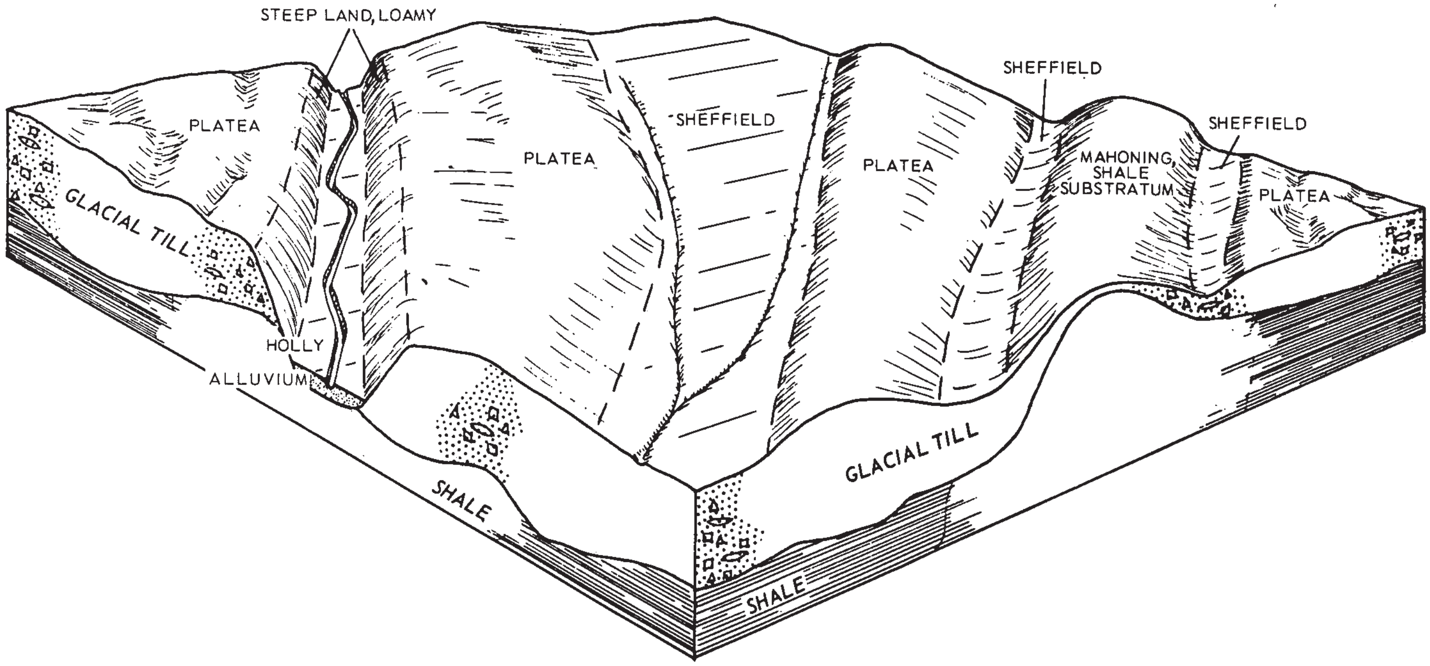

Figure 3.—**Soil pattern in the Platea-Sheffield soil association.**

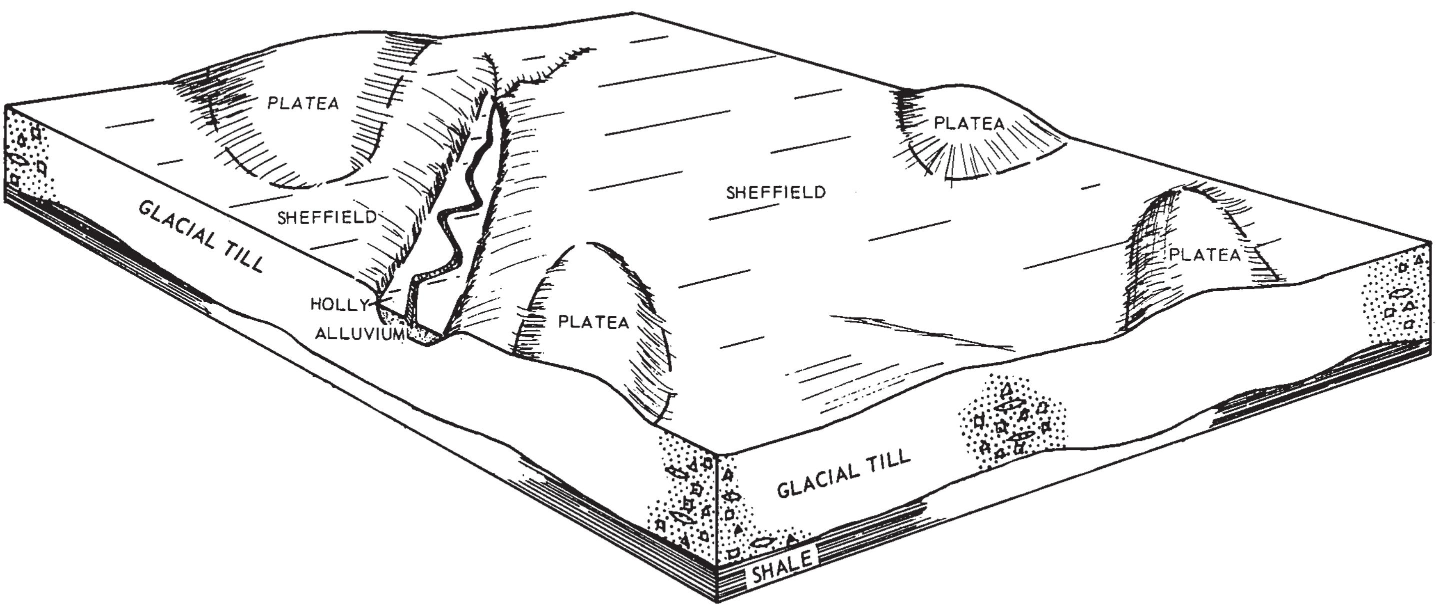

Figure 4.—**Soil pattern in the Sheffield-Platea soil association.**

This soil association occupies about 24 percent of the county. About 68 percent of this is Sheffield soils, 25 percent is Platea soils, and the remaining 7 percent is other soils.

The Sheffield soils are poorly drained and occupy the broad areas. The Platea soils are somewhat poorly drained and occupy the convex knolls.

Among the other soils in this association are the Holly and Orrville soils in small areas of the flood plain.

The soils in this association have a root zone that is generally strongly acid to extremely acid and low in natural fertility. They have a dense compact layer in the lower part of the subsoil. This layer restricts the movement of water and the penetration of plant roots. Extensive ponding occurs in this association in spring and after thunderstorms. Artificial drainage is needed to remove the excess water.

The major enterprise on farms in this association is dairying. Forage crops and feed grains are the dominant crops. Very slow permeability and seasonal wetness are limitations to many nonfarm uses in this association.

4. Platea-Pierpont Association

Deep, nearly level to moderately steep, somewhat poorly drained to moderately well drained silty soils on glaciated uplands

This soil association is in two areas in the northern part of the county. Both areas are undulating to hilly, but steep soils occur along the rivers and other streams. The Grand and Ashtabula Rivers flow through this association and have cut deep very steep gorges into the shale bedrock (fig. 5).

This association occupies about 6 percent of the county. About 65 percent of this is Platea soils, 10 percent is Pierpont soils, and the remaining 25 percent is other soils.

The Platea soils are somewhat poorly drained and are less steep than the moderately well drained, moderately steep Pierpont soils. The Platea and Pierpont soils have a root zone that is strongly acid to extremely acid. They have a dense, compact layer in the lower part of the subsoil that restricts the downward movement of water and the penetration of plant roots. Erosion is a major hazard in all except the more nearly level areas. A seasonal high water table is also a soil limitation in this association.

Among the less extensive soils in this association are the poorly drained Sheffield soils along small waterways; the Chagrin, Orrville, and Lobdell soils on the flood plains; and Chenango and Braceville soils on stream terraces. A miscellaneous land type steep land, loamy, occupies the steep parts of the river gorges.

Grapes and small fruits are grown where the climate is suitable, particularly where air drainage is good. Farming is declining in the association, and urban-fringe development is increasing, particularly near the town of Ashtabula. Very slow permeability, slope, and seasonal wetness are limitations for many nonfarm uses in this association.

5. Chenango-Red Hook-Atherton Association

Deep, nearly level to moderately steep, well-drained to poorly drained loamy and gravelly soils on terraces and kames

The largest area of this soil association is adjacent to Pymatuning Creek in the southeastern part of the county. The association consists of nearly level to moderately steep soils.

This association occupies about 2 percent of the county. About 55 percent of this is Chenango soils, 15 percent is Red Hook soils, 15 percent is Atherton soils, and the remaining 15 percent is other soils. The proportion of Red Hook and Atherton soils varies greatly from area to area.

The major soils in this association formed mostly on sandy and gravelly glacial outwash. The Chenango soils are well drained and commonly droughty. The somewhat poorly drained Red Hook soils and the poorly drained Atherton soils have a seasonal high water table. All of the major soils are very strongly acid to strongly acid.

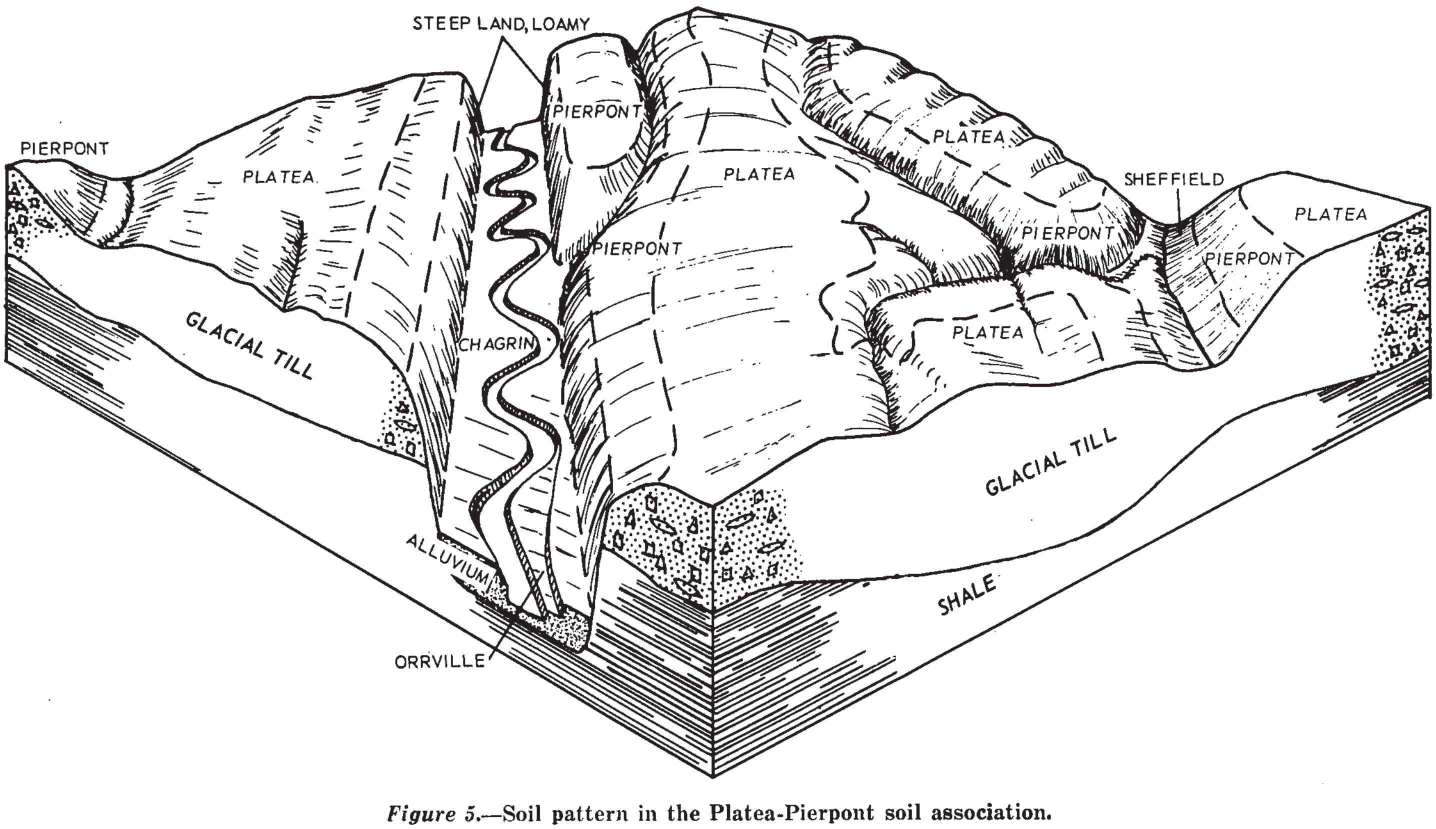

Figure 5.—**Soil pattern in the Platea-Pierpont soil association.**

Among the other soils in this association are the poorly drained Holly soils. These soils are mostly on the flood plains along Pymatuning Creek.

The major soils in this association are suited to farming if they are well managed. Dairying is the major farm enterprise. Alfalfa is commonly grown on the Chenango soils in Cherry Valley and Wayne Townships. The Chenango soils are potentially good sources of sand and gravel. The Red Hook and Atherton soils are less well suited as sources for sand and gravel. Many areas of Atherton soils are used as woodland or for pasture. Other than slope and droughtiness, the well-drained Chenango soils have few limitations for many nonfarm uses. Seasonal wetness is a limitation of Red Hook and Atherton soils for many nonfarm uses.

6. Canadice-Caneadea Association

Deep, nearly level to moderately steep, poorly drained to somewhat poorly drained clayey soils on old glacial lake beds

This soil association occupies areas of the county that were lakebeds during the Wisconsin glacial period. The major soils in the association formed on clayey and silty sediments that were deposited in the old lakebeds. In most places these soils are nearly level to gently sloping, but moderately steep to steep soils occur on valley walls along the Grand River.

This association occupies 7 percent of the county. About 40 percent of this is Canadice soils, 20 percent is Caneadea soils, 20 percent is Chagrin, Holly, and Orrville soils and the remaining 20 percent is less extensive soils, mostly in the Williamson and Sheffield series.

The major soils in this association have a moderately fine textured to fine textured subsoil and a water table that is seasonally high. Unless they have been limed, these soils are mostly strongly acid in the upper part of their root zone. The erosion hazard is severe on the valley sides along the Grand River. The steeper soils in these areas are unstable and are subject to slippage. The part of this association in Richmond Township is commonly flooded in spring.

Cultivated areas of this association are used mostly for feed crops for dairy cattle. Much of the area along the Grand River is wooded. Limitations for farm and many nonfarm uses of these soils are seasonal wetness, very slow permeability, and the moderately fine texture to fine texture.

7. Elnora-Colonie-Kingsville Association

Deep, nearly level to moderately steep, well-drained to poorly drained sandy soils on beach ridges and low dunes

This soil association occupies an area of the county where the major soils formed in deposits of fine sand. These sandy areas mark the location of old beach ridges, deltas, and low dunes that formed during the glacial period of Wisconsin age (fig. 6). Near Ashtabula, the Whittlesey beaches reach a height of 70 feet, which is far greater than that of any other beach in Ohio (*5*).[2] The soils in this association range from nearly level to moderately steep.

This association occupies about 4 percent of the county. About 30 percent of this is Elnora soils, 17 percent is

[2] Numbers in parentheses refer to Literature Cited, p. 112.

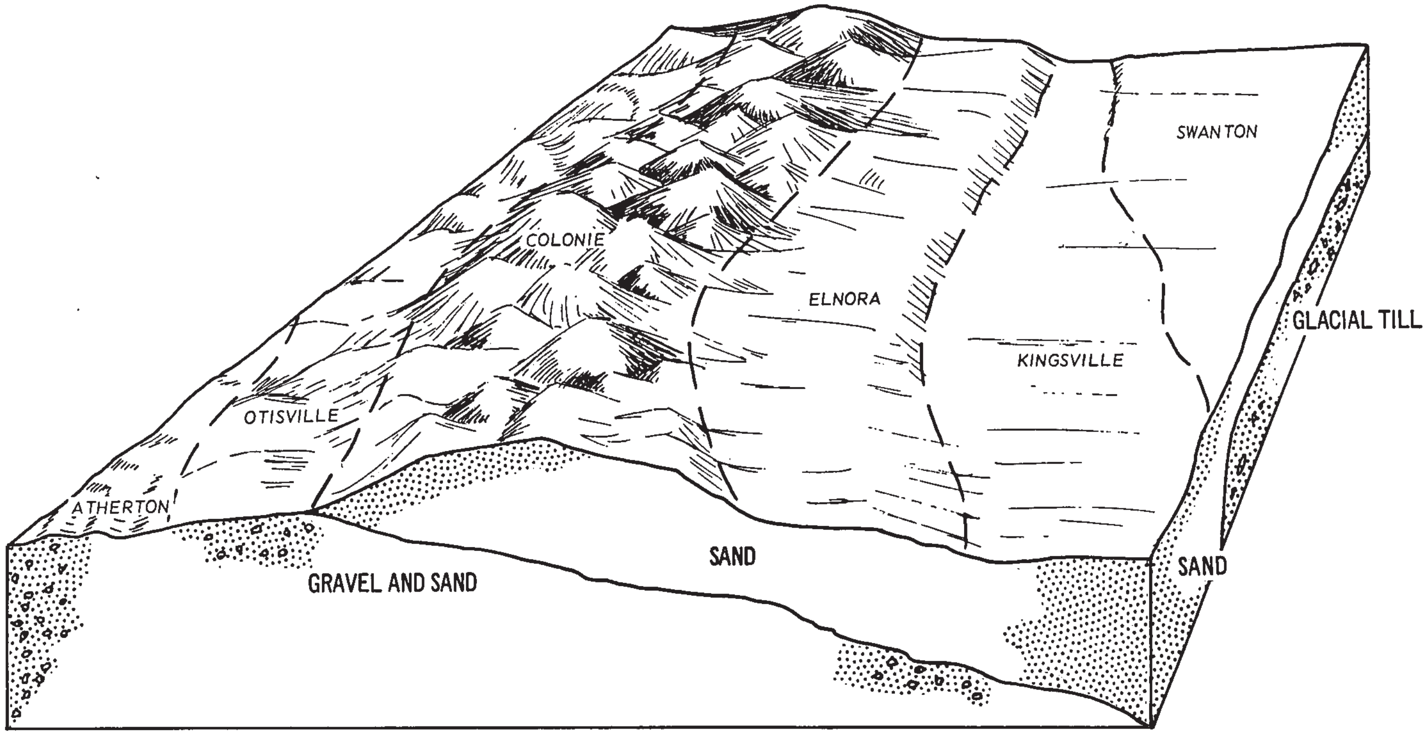

Figure 6.—Soil pattern in the Elnora-Colonie-Kingsville soil association.

Colonie soils, 11 percent is Kingsville soils, and the remaining 42 percent is other soils.

The Kingsville soils are poorly drained and are the most nearly level soils in the association. They are naturally wet, and they tend to be unstable when they are saturated. The Colonie soils are well drained and are the steepest soils in the association. They tend to be droughty. The Elnora soils are moderately well drained and occur in intermediate sites. They have slopes of 1 to 5 percent. Like Colonie soils, the Elnora soils tend to be droughty. All of the dominant soils in this association typically are very strongly acid and low in natural fertility.

The other soils in this association are mostly Atherton, Otisville, Conneaut, Claverack, and Swanton soils. Most of these soils have a sandy surface layer similar to that of the major soils in the association.

Cultivated areas of this association are used for fruits, vegetables, and nursery crops. Many areas near the towns of Conneaut and Kingsville are being developed for housing. Seasonal wetness in the Elnora and Kingsville soils is a limitation to some nonfarm uses.

8. Otisville-Chenango Association

Deep, nearly level to steep, well-drained gravelly soils on beach ridges

This soil association occupies scattered areas of beach ridges that in many places parallel the ridges in the Elnora-Colonie-Kingsville association. The topography in both associations is similar, but the pattern of major soils is different. The soils in the Otisville-Chenango association range from nearly level to steep.

This association occupies about 2 percent of the county. About 44 percent of this is Otisville soils, 34 percent is Chenango soils, and the remaining 22 percent is other soils.

The Otisville and Chenango soils are well drained. They formed on gravelly and sandy material. The Otisville soils are thinner and more gravelly than the Chenango soils. Both kinds of soils are strongly acid to extremely acid. They are droughty but are suited to irrigation.

Among the other soils in this association are the less well drained Atherton, Red Hook, and Braceville soils.

Cultivated areas of this association are commonly used for fruits, vegetables, and nursery crops. Many areas are being developed for housing. Many of the commercial gravel pits in this county are in this association. Slope and droughtiness are soil limitations for some nonfarm uses.

9. Conneaut-Swanton-Claverack Association

Deep, nearly level to sloping, poorly drained and moderately well drained silty and sandy soils on the lake plain

Most of this soil association is between Lake Erie and and the beach ridges of the Otisville-Chenango and the Elnora-Colonie-Kingsville associations. This association occupies areas that were covered with water following the retreat of the Wisconsin glacial ice from Ohio. The soils on this old lake plain are mostly level to gently sloping, but some steeper soils are on breaks along streams (fig. 7).

This association occupies about 7 percent of the county. About 55 percent of this is Conneaut soils, 19 percent is Swanton soils, 13 percent is Claverack soils, and the remaining 13 percent is other soils.

The major soils in this association formed in silt loam material that was deposited in the old glacial lake or in fine sandy deposits overlying silty material that is glacial till or lake sediments. These soils have a root zone that is strongly acid or very strongly acid, or both.

The Conneaut soils are poorly drained, loamy, and mostly nearly level. The upper part of these soils formed in silt loam material that was deposited over glacial till. These soils are seasonally wet and require artificial drainage to improve crop yields. Many areas have been drained.

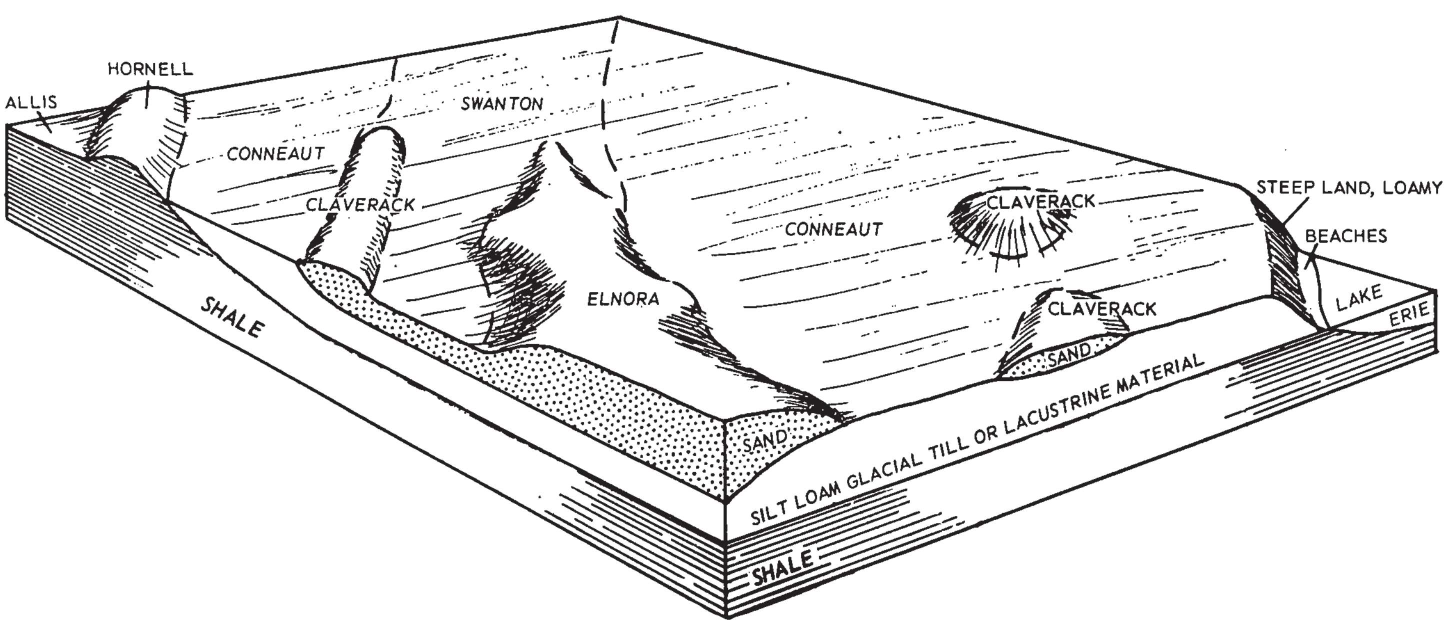

Figure 7.—**Soil pattern in the Conneaut-Swanton-Cloverack soil association.**

The Swanton soils also are poorly drained, seasonally wet, and mostly nearly level. They require artificial drainage to improve crop yields, and many areas have been drained. Swanton soils are sandy in the upper part.

The Claverack soils are moderately well drained and also are sandy in the upper part. They have slopes of 0 to 12 percent.

Minor soils include the Holly soils, which are subject to flooding; the sandy Elnora soils; and the Allis and Hornell soils.

Cultivated areas of this association are used mainly for fruits, vegetables, and nursery crops. A few dairy farms are in the association, but much of the acreage is not used for crops. Some areas, near the towns of Ashtabula and Geneva, are being developed for housing. Seasonal wetness and slow to very slow permeability are limitations for many nonfarm uses.

Use and Management of the Soils

The soils of Ashtabula County are used mostly for pasture and crops used to feed livestock. A large acreage is woodland. This section discusses the use of the soil for these main purposes, and it gives estimated yields of principal crops. It also discusses use of soils for wildlife and for building roads, ponds, terraces, and other engineering structures. A section on land-use planning gives information about the use of soils in town and country planning.

General Management for Crops and Pasture

The various soils in Ashtabula County differ in their suitability for different uses, and in their management needs. Some general management needs, however, are common to all the soils or to large groups of them. The main field crops grown in the county are corn, soybeans, and small grains, such as wheat and oats. The management of specialty crops is discussed in the subsection of that name.

Management of the soils for crops

Almost all soils in the county require the management practices discussed in the following paragraphs:

Maintenance of adequate levels of fertility.—Many of the soils in the county are naturally strongly acid or very strongly acid and are low in content of plant nutrients. The Elnora, Venango, Hornell, Williamson, Wallington, Otisville, and similar soils may be extremely acid in the upper layers. The Platea, Pierpont, Caneadea, and other soils are difficult to lime adequately because they have a high content of free aluminum. The coarser textured soils, such as the Otisville, Elnora, and Colonie soils, hold and retain only small amounts of plant nutrients. On these soils additions of lime and fertilizer are needed. These additions should be based on the results of soil tests, on the needs of the crop, and on the level of yield desired. For assistance in determining the kinds and amounts of fertilizer and lime to apply, the farmer should consult the Ohio Cooperative Extension Service.

Use of crop residue.—Many of the soils in the county are not naturally low in organic-matter content. This is particularly true of the Platea, Cambridge, Pierpont, and similar soils. The surface layer of most of the lighter colored soils are 1.0 to 3.5 percent organic matter. The surface layer of dark-colored soils, such as the Ilion, is 3.0 to 6.0 percent organic matter. To offset a deficiency in organic matter, all crop residues should be incorporated into the soil. If soybeans or other crops that supply small amounts of crop residues are grown, the cropping systems should provide cover or sod crops.

Drainage.—In Ashtabula County, wetness is a hazard on about 85 percent of the acreage. Water stands too long after periods of wet weather on nearly all of the soils that are somewhat poorly drained, poorly drained, or very poorly drained. Because these wet soils warm up slowly in spring, tillage and crop growth are delayed. Crops grow well on these soils, however, if excess water is removed by surface drains, tile, or both.

The Pierpont, Cambridge, Braceville, and other moderately well drained or well drained soils ordinarily do not require drainage. Because these soils commonly occur in areas that are adjacent to soils that need to be drained, they commonly are included in the plans for drainage. Drainage of wet seepy spots in large areas of the moderately well drained soils makes some fields easier to farm.

Land smoothing, surface drains, and subsurface drains are used to remove excess water from soils that need drainage (fig. 8). Surface drains are broad shallow ditches that generally are farmed the same as the rest of the field. They are placed in low areas or across the slope. In many places they are used to intercept surface water at the boundary of a field or farm. Subsurface drains are mostly lines of buried tile. Both surface drains and subsurface drains empty into deeper outlet ditches. These outlets provide additional subsurface drainage, depending on the permeability of the soil. To prevent erosion, structures that change the grade and slow the water are provided where water enters outlet ditches.

On soils that are slowly or very slowly permeable, such as the Canadice, Frenchtown, Platea, and Sheffield soils, either random or systematic surface drains are used to remove excess water. These soils are drained very slowly if tile is used. The Swanton and Kingsville soils are difficult to drain because the sand in these soils, when it is saturated, tends to flow and plug the tile. The Carlisle, Ilion, Holly, and other soils in depressional and low-lying areas are commonly difficult to drain because outlets are difficult to establish. Many of the soils in the county that need drainage require a combination of land smoothing and surface drains. If only one practice is used where both are needed, the drainage generally is not effective.

Although excess water needs to be removed from many soils in the county, also needed is the conservation of water for the growth of crops. Many of the soils are likely to be too dry during part of a growing season. The Colonie, Elnora, and Otisville soils especially require additional moisture during dry weather. A good program of soil management helps to conserve soil moisture.

Erosion Control.—Control of water erosion is needed on the soils in the county that have slopes much over 2 percent. Also, on the sandier soils, such as the Colonie and Elnora, soil blowing is a hazard if the soils are bare. On about 10 percent of acreage suitable for cultivation, water erosion is a hazard. Erosion control practices commonly used are grassing waterways, use of diversions, contour tillage, minimum tillage, use of crop residues, and maintenance of close-growing crops for cover.

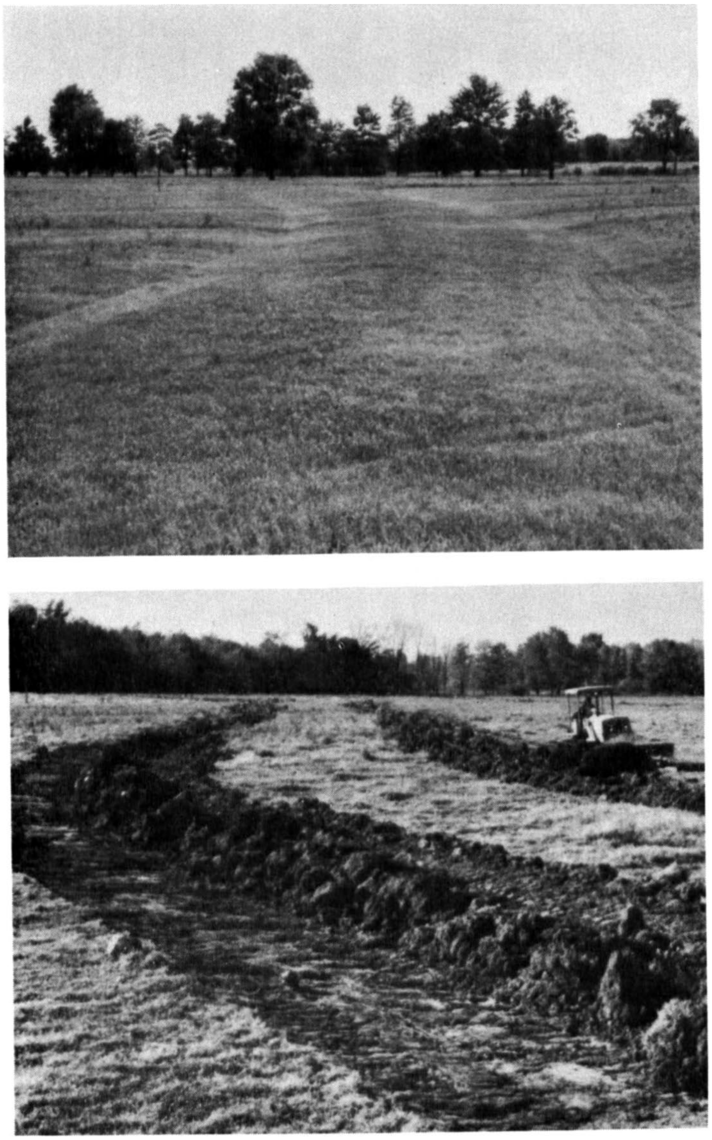

Figure 8.—**Surface drainage on Sheffield silt loam. *Top,* Completed W-type drainageway, *Bottom,* W-type drainageway under construction.**

Tillage.—The texture of the surface layer of the soils in Ashtabula County ranges from loamy fine sand to silty clay. For planning tillage, all of the mineral soils can be placed into one of three general groups, which are discussed in the following paragraphs.

Soils that have a loam or coarser textured than loam surface layer include those in the Braceville, Chenango, Claverack, Colonie, Elnora, Kingsville, Otisville, and Swanton series. These soils can be tilled safely through a wide range of moisture content. Some of the soils, such as Kingsville fine sandy loam and Swanton fine sandy loam, have poor trafficability when they are wet, but they are not seriously damaged if they are tilled when wet. The soils that have a loam surface layer are more susceptible to damage than the coarser textured soils.

Soils that have a thick silt loam surface layer are in the Atherton, Cambridge, Conneaut, Chenango, Chagrin, Frenchtown, Holly, Lobdell, Orrville, Pierpont, Platea, Red Hook, Sheffield, Venango, Wallington, and Williamson series. These soils have a narrower range of optimum moisture for tillage than the soils that have a loam or coarser textured surface layer. Also, they tend to dry out more slowly than the coarser textured soils. Most of the soils in this group are low in organic-matter content, and they are less well drained than the coarser textured soils. Freezing and thawing in winter tend to eliminate ruts caused by harvesting when the soil contains more water than optimum. The soils in this general group have a weak or moderate structure in the surface layer. If these soils are cultivated within the range of optimum moisture for tillage, harmful effects on the soil structure are few and do not last long. Even if severe rutting occurs, there are no apparent long-lasting, harmful effects.

Soils that have a thin silt loam or finer textured surface layer are in the Allis, Canadice, Caneadea, Hornell, Ilion, Kingsville, and Mahoning series. This group of soils has the narrowest range of optimum moisture for tillage. The clay content in these soils generally is high enough to cause serious clodding if the soils are tilled when wet. If these soils are worked when too wet, there generally is a decrease in grade, or distinctness, and in the size of structural units.

For all of the soils, tillage within the range of optimum moisture content damages the soil structure least.

Cropping systems.—Cropping systems can be defined as a sequence of crops grown under needed management practices. Cropping systems include the use of rotations that contain grasses and legumes, as well as sequences in which the desired benefits are achieved without the use of grasses and legumes.

A satisfactory cropping system meets the needs of the soil for improvement or maintenance of good tilth; protects the soil during critical periods when erosion usually occurs; aids in the control of weeds, insects, and diseases; and fulfills the needs and desires of the farmer for an economic return.

As the intensity of growing row crops in the cropping system increases, the need for use of conservation measures or intensive management increases accordingly.

If contour stripcropping is used on sloping soils, a 4-year rotation of a row crop, a small grain, and 2 years of meadow may be satisfactory. If the contour strips were not used, the row crop would not be satisfactory in the cropping system because of susceptibility to excessive erosion. Listing all of the suitable cropping systems for a certain soil is not practical.

General management for pasture

Some of the pasture in the county is on soils that are subject to erosion. These soils generally are eroded, are low in fertility, and commonly have poor tilth. Most pasture is on soils that require drainage. Soils that require drainage for maximum growth of row crops also require drainage for maximum growth of pasture plants. Pasture and hay plants commonly grown in the county include alfalfa, Ladino clover, red clover, timothy, birdsfoot trefoil, orchardgrass, and bromegrass. Important in managing pasture are erosion control, drainage, additions of lime and fertilizer, and reducing compaction.

Erosion control.—This is important because some of the soils used for pasture are already eroded. Control of erosion is particularly important during seeding. Use of a nurse or companion crop helps to prevent erosion when pasture is seeded.

Drainage.—If drainage is needed, it must be as good as that provided for row crops.

Lime and fertilizer.—The need for lime and fertilizer should be determined by soil tests, and adequate amounts should be applied to meet the requirements of the pasture plants grown and the needs of the farmer.

Reducing compaction.—Soil compaction, caused by grazing when the soils are wet, can be a major factor in the production of forage and feed crops. Good harvesting methods for hay, silage, or soilage help to increase plant growth and to reduce soil compaction. For seeding, tillage within the optimum range of moisture content also helps to reduce soil compaction.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

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

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

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

Class I soils have few limitations that restrict their use. (No class I soils were mapped in Ashtabula County.)

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (No class V soils were mapped in Ashtabula County.)

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

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

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreational facilities, wildlife habitat, or water supply, or to esthetic purposes. (No class VIII soils were mapped in Ashtabula County.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Ashtabula County, shows 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 limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreational facilities.

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

Management by capability units

In the following pages, each capability unit is described and some information for its use and management is given. The soil series represented in each capability unit are mentioned in describing the unit. This does not mean, however, that all the soils of a series are in the capability unit. The names of all the soils in a unit can be found by referring to the "Guide to Mapping Units" at the back of this survey. Beaches, Gravel and sand pits, Made land, and Riverwash were not assigned to capability units.

The soils in a given capability unit are approximately alike in the management they need and in their response to that management. In some capability units, however, one or two soils are included that differ from the rest in one or more properties or qualities that affect some aspect of their management. These soils have been included because (1) they are of such small acreage that placing them in a separate capability unit is not justified, or (2) they are like the other units in *most* aspects of management and response to that management. These exceptional soils are mentioned in describing a capability unit, and their differences in management are explained.

In the descriptions of capability units, depth of root zone means the depth to which roots can penetrate the soil to a restricting layer, such as a fragipan or a layer of dense clay, compact till, or bedrock. The references to *low*, *medium*, or *high* available moisture capacity relate to moisture capacity in the root zone of commonly grown field crops, as for example, corn or small grain.

In this section, specific practices for overcoming the limitations of the soils are not suggested. Many different methods of combinations of practices are suitable for controlling erosion or achieving artificial drainage on any given kind of soil, and the same is true for other management practices. For specific information regarding erosion control, artificial drainage, recommended crop varieties, or other management practices, the reader should contact the nearest office of the Soil Conservation Service or the Ohio Cooperative Extension Service.

CAPABILITY UNIT IIe-1

In this capability unit are well drained or moderately well drained soils that are underlain by sand and gravel. These gently sloping soils are in the Braceville and Chenango series. They occupy beach ridges or areas of glacial outwash. Slopes range from 2 to 6 percent. The root zone of these soils is mostly moderately deep. The Braceville loam in this unit has a dense, compact layer in the subsoil that restricts the downward movement of water and the penetration of plant roots. Permeability of this soil is moderately slow. Water movement through the Chenango soils in this unit is moderately rapid to rapid. The soils in this unit have a medium to low available moisture capacity.

The hazard of erosion is moderate on these soils if they are cultivated. The gravelly Chenango soil is less subject to erosion than the other soils. On all the soils erosion is difficult to control by practices other than vegetative practices because most of the slopes are short. These soils are naturally very strongly or strongly acid and generally low in plant nutrients. The Chenango silt loam is more subject to surface crusting than the Braceville loam. Both the Braceville and Chenango soils tend to be droughty, but they are well suited to irrigation.

The soils are suited to field crops that are commonly grown in the county. They also are suited to many specialized crops and to use for hayland or pasture.

CAPABILITY UNIT IIe-2

This capability unit consists of loamy, moderately well drained soils in the Cambridge, Pierpont, and Williamson series. These soils are gently sloping, and they have a dense, compact fragipan in the subsoil. This layer restricts the downward movement of water and the growth of plant roots. Slopes range from 2 to 6 percent. All of these soils have a moderately deep root zone and medium available moisture capacity. Because some of the soils in this unit are moderately eroded, they have a lower available moisture capacity than the soils in the unit that are uneroded. The moderately eroded soils also generally have lower organic-matter content and poorer tilth than the uneroded soils. All the soils are naturally very strongly acid above the fragipan. The Williamson soils are extremely acid in some places.

The major limitation to use of these soils for cultivated crops is a moderate erosion hazard. The soils tend to erode easily, partly because they have a high silt content in the upper layers. They have a seasonally high water table in winter and early in spring. Except in local seep areas, however, drainage generally is not needed for growing crops. The maintenance of an adequate level of lime and of plant nutrients are major concerns in managing these soils.

If intensive management is used, this group of soils is suited to the field crops commonly grown in the county. In local areas, they are used for fruits, mainly grapes and apples. Intensive management is needed to produce satisfactory growth of row crops or specialty crops. These soils also are suited to use as hayland or pasture.

CAPABILITY UNIT IIw-1

This capability unit consists of nearly level, somewhat poorly drained soils in the Orrville series. These soils occupy low areas of the flood plains. They are flooded infrequently in summer, but they are commonly flooded for short periods early in spring. They have a seasonally high water table during winter and spring. Their root zone is moderately deep when the water table is low. These soils have moderate permeability and a high available moisture capacity.

The major limitations to use of these soils for cultivated crops are flooding and a seasonally high water table. Drainage is needed to help these soils dry out earlier in spring. But drainage does nothing to lessen flooding and does little to reduce the seasonally high water table because the soils are in low positions on the flood plains. Improving drainage is the major management concern on these soils. Many areas of these soils are subject to ponding for short periods, because they have no well-established natural outlets.

These soils are suited to the field crops that are commonly grown in the county during summer. Winter crops, such as wheat, can be severely damaged by flooding or ponding. These soils also are suited to hay or pasture plants that are tolerant of seasonal wetness.

CAPABILITY UNIT IIw-2

The soils in this capability unit are nearly level or gently sloping and moderately well drained. These soils are in the Braceville and Williamson series, the Claverack series, silty subsoil variant, and the Claverack series, moderately shallow variant. In or under the subsoil, all of the soils have a firm layer that tends to restrict downward movement of water and penetration of plant roots. As a result, the soils have a moderately deep root zone and a medium to low available moisture capacity. The Braceville and Claverack soils have a higher content of sand than Williamson soils and generally have good tilth. The Williamson soil has a silt loam surface layer and is more subject to crusting.

The major limitation to use of these soils for cultivated crops is seasonal wetness during winter and spring. The soils are droughty at times in summer. The surface layer tends to dry out quickly in spring, and soil blowing is a definite hazard to the Claverack soils. Small unmapped areas of wetter soils occur along drainageways in areas of the Braceville soil. These inclusions can be drained to hasten spring cultivation. All of these soils are very strongly acid to strongly acid and generally are low in plant nutrients. The Williamson soil is extremely acid in some places.

These soils are suited to the field crops that are commonly grown in the county. Tree fruits, berries, nursery stock, potatoes, and sweet corn are grown in some areas of the Braceville soil. Irrigation is generally needed for satisfactory growth of specialty crops. These soils are well suited to grasses and legumes commonly grown in the county.

CAPABILITY UNIT IIw-3

Red Hook silt loam, 0 to 4 percent slopes, is the only soil in this capability unit. It is a loamy, somewhat poorly drained soil that is underlain with sand and gravel. This soil has a seasonally high water table during winter and spring. It has only a moderately deep root zone, for the lower part of the subsoil tends to restrict root development. In this soil the downward movement of water is slow, and the available moisture capacity is medium within the root zone. Plant growth is seldom slowed, because this soil obtains moisture from seepage.

The major limitation to the use of this soil for cultivated crops is seasonal wetness. Drainage benefits most crops, and tile drains work satisfactorily. Erosion is a hazard where this soil is gently sloping.

This soil is suited to the field crops commonly grown in the county if it is drained. Undrained areas generally are too wet for good crop growth. The soil naturally is very strongly acid or strongly acid, and its content of plant nutrients is moderately low. It is well suited to grasses and legumes grown for hay or pasture if species tolerant of wetness are used. Drainage is needed for satisfactory growth of hay or pasture plants.

CAPABILITY UNIT IIw-4

In this capability unit are well drained Chagrin and moderately well drained Lobdell soils. These soils occupy areas of flood plains that are subject to occasional flooding. They are infrequently flooded during summer, but they are periodically flooded in winter or early in spring. These soils have a deep root zone and a high available moisture capacity. They are strongly acid or medium acid to neutral. Their surface layer generally has good tilth, and they are easy to farm.

The major limitation to use of these soils for cultivated crops is the hazard of flooding. Although the choice of crops is limited, the soils are well suited to field crops or specialty crops that are commonly grown in summer. A crop such as wheat, which grows through winter, may be severely damaged by flooding. These soils can be cultivated to row crops year after year if intensive management is used.

The soils of this unit are well suited to grasses or legumes commonly used for pasture or hay crops. Flooding usually does not last long, and it normally does not damage hay or pasture crops. If flooding is severe locally, a permanent cover of grass or trees helps to prevent scouring.

CAPABILITY UNIT IIs-1

This unit consists of Chenango soils that are nearly level and have a silt loam or gravelly loam surface layer. These soils are well drained and are underlain with sand and gravel at a moderate depth. Their root zone is moderately deep in most places. Slopes range from 0 to 2 percent. These soils have a low available moisture capacity and moderately rapid to rapid permeability. They dry out earlier in spring than most of the soils in the county.

The major limitation to the use of these soils for farming is a low available moisture capacity. The soils are droughty but are well suited to irrigation. They are strongly acid to very strongly acid and are low in content of plant nutrients.

These Chenango soils are suited to all crops commonly grown in the county, but growth of crops in summer is likely to be slow unless irrigation water is available. Row crops can be grown year after year if intensive management that provides irrigation is used. If less than intensive management is used, the erosion hazard is little or none, but crops are likely to grow slowly. In the northern part of the county, these soils are used for tree fruits, small fruits, berries, and nursery stock.

The soils in this unit are well suited to the deep-rooted legumes and grasses commonly grown in the county for pasture and hay. Pasture plants generally have slow growth in midsummer.

CAPABILITY UNIT IIIe-1

In this capability unit are Braceville and Chenango soils and a Claverack soil, silty subsoil variant. These soils are well drained or moderately well drained. Slopes range from 6 to 12 percent. The Bracevile and Chenango soils are moderately eroded. All of these soils are on sandy and gravelly beach ridges or are in outwash areas. Their surface layer is loamy or sandy, and in most places they are underlain by sand and gravel at a moderate depth. The Claverack soil, silty subsoil variant, lacks sand and gravel in the substratum. The soils in this unit generally have a moderately deep root zone and mostly a low available moisture capacity. These soils generally have good tilth. They are only slightly susceptible to surface crusting. The Braceville and Claverack soils have a slowly permeable to very slowly permeable subsoil that restricts the downward movement of water. Because of this, Braceville and Claverack soils have more rapid surface runoff than the Chenango soils and remain wet longer in spring.

A severe erosion hazard is the major limitation to the use of the soils in this unit for cultivated crops. Surface runoff is medium to rapid. These soils are droughty in summer, but they are well suited to irrigation if erosion is controlled. These soils are naturally strongly acid or very strongly acid and are low in plant nutrients, but crops respond well to additions of lime and fertilizer. Plant nutrients leach readily from these soils.

These soils are suited to the field crops commonly grown in the county. In years when rainfall is not timely, however, summer crops are likely to grow slowly unless they are irrigated. If intensive management is used, these soils can be cultivated frequently. If management is less than intensive, excessive erosion losses are likely. In the northern part of the county, some areas of these soils are used for tree fruits, berries, and nursery stock. These soils are well suited to grasses and deep-rooting legumes in hayland or pasture.

CAPABILITY UNIT IIIe-2

This capability unit consists of sloping, moderately well drained and somewhat poorly drained soils in the

Cambridge, Pierpont, Platea, Venango, and Williamson series. Slopes range from 6 to 12 percent. They have a dense, compact fragipan in the subsoil. This pan slows the downward movement of water and limits the penetration of plant roots. As a result, their root zone is moderately deep in most places. Some roots, however, do extend deeper along vertical cracks in the fragipan. The available moisture capacity of these soils is medium, and permeability is slow to very slow. The somewhat poorly drained soils have a seasonally high water table for longer periods than the moderately well drained soils, which dry out more rapidly in spring.

The major limitation to the use of these soils for cultivated crops is a severe erosion hazard. These soils have a high content of silt in the surface layer, and they erode easily. Since water cannot move freely downward in the soil, surface runoff is rapid and is high in volume as well. The soils in this unit are especially susceptible to erosion if they are bare in winter. Most of the soils are moderately eroded. These moderately eroded soils generally contain smaller amounts of plant nutrients and organic matter than the less eroded soils, and have less moisture holding capacity. The soils in this unit are extremely acid to strongly acid above the fragipan. They are very low in content of available plant nutrients. Acidity and lack of plant nutrients constitute major management problems. The lime requirement for most of these soils is high.

If intensive management is used, these soils are suited to the field crops that are commonly grown in the county. Row crops can be grown frequently if erosion is controlled, but erosion is hard to control on slopes of more than 4 percent. Because these soils are low in organic-matter content and are highly susceptible to crusting, good tilth is difficult to maintain where cultivated crops are grown. In some areas these soils are used for grapes and tree fruits such as apples and pears. They are well suited to the grasses and deep-rooted legumes that are commonly grown for hay and pasture.

CAPABILITY UNIT IIIw-1

This capability unit consists of nearly level, somewhat poorly drained soils in the Platea, Venango and Wallington series. These soils occupy small areas of low convex knolls within larger areas of poorly drained soils. They generally are similar to and are managed the same way as the adjacent poorly drained soils. The soils in this unit have a fragipan that slows the downward movement of water and the penetration of plant roots. Because water moves slowly or very slowly in these soils, drainage with tile is slow and the soils are seasonally wet for fairly long periods during winter and spring. Some areas of these soils are subject to surface ponding. Their root zone is mostly moderately deep, but some roots extend downward in cracks and along structural faces in the fragipan. The available moisture capacity is medium. These soils are naturally extremely acid to strongly acid and are low in content of plant nutrients.

The major limitation to the use of these soils for cultivated crops is seasonal wetness. Surface drains help to remove excess surface water. These soils are low in organic-matter content and are highly susceptible to surface crusting.

If the soils of this unit are drained, they are suited to the field crops that are commonly grown in the county. These soils dry out slowly in spring if they are not drained. They also are suited to grasses and legumes that are commonly grown in the county for hay or pasture. Shallow-rooted forage plants generally grow slowly on these soils during periods of limited rainfall. The soils are better suited to deep-rooted forage crops that can stand some wetness.

CAPABILITY UNIT IIIw-2

The soils in this capability unit are in the Platea, Venango, and Wallington series. These soils are gently sloping and somewhat poorly drained. Some of them are moderately eroded. These eroded soils have a lower moisture-holding capacity, lower fertility, and lower organic-matter content than the uneroded soils and require more careful management for good crop growth. Water moves slowly or very slowly in all of the soils because they have a fragipan in the subsoil. Consequently, these soils have a seasonally high water table during winter and spring, and drainage by tile is slow. The fragipan also restricts the growth of plant roots, but some roots do extend downward along cracks and structural faces in the pan. These soils have a medium available moisture capacity, even though the bulk of the root system is above the dense, compact fragipan. The soils of this unit are extremely acid to very strongly acid above the fragipan. They are low in content of plant nutrients. The lime requirements on these soils are high.

The major limitation to the use of these soils for cultivated crops is seasonal wetness. Drainage helps the soils to dry out in spring. Drainage is generally adequate because the soils are gently sloping. These soils are low in organic-matter content and are susceptible to erosion. They are highly susceptible to surface crusting. The moderately eroded soils are most susceptible to crusting and sealing at the surface.

The soils in this unit are suited to field crops that are commonly grown in the county. Planting dates are delayed in spring, and in some years the soils are too wet for crop production unless they are drained. Satisfactory crop growth can be obtained if intensive management is used. Crop growth generally is slow if only average management is used. Locally, these soils are used for fruits, mainly grapes and apples. They also are suited to the grasses and legumes that are commonly grown for hay or pasture. Deep-rooted forage plants generally are best adapted to these soils. The varieties grown should be those that can stand some wetness.

CAPABILITY UNIT IIIw-3

In this capability unit are nearly level, poorly drained soils in the Conneaut, Frenchtown, and Sheffield series. Slopes are 0 to 2 percent. All of the soils except Conneaut silt loam have a fragipan in the subsoil. The Conneaut soil has a firm subsoil. In the other soils the fragipan greatly restricts the downward movement of soil water and penetration by plant roots, but some roots penetrate downward along structural faces of the pan. Unless they are drained, all of the soils have a seasonally high water table for long periods during winter and spring. They are all subject to surface ponding because they are nearly level and have slow to very slow permeability. Above the fragipan, these soils are very strongly acid. They are low in natural fertility.

The major limitation to use of these soils for farming is severe wetness. Drainage is needed for satisfactory crop growth but tile drainage generally is not suitable on these soils. All of the soils are highly susceptible to surface crusting because they have a low organic-matter content. Conneaut silt loam is less likely to crust than the other soils because it has a slightly higher content of organic matter. All of these soils dry out slowly in spring.

If these soils are drained, they are suited to the field crops that are commonly grown in the county. Crop growth generally is poor if management is average, but crops grow satisfactorily if management is intensive. Adequate drainage is difficult on these soils. The soils are suited to species of grasses and legumes that are commonly grown for hay and pasture. Plant species selected for these uses should be adapted to the degree of drainage obtained.

CAPABILITY UNIT IIIw-4

The soils in this capability unit have a thin, dark-colored surface layer and are mostly poorly drained. These soils are Atherton silt loam and Ilion silt loam. The Atherton soil is underlain with sand and gravel, and the Ilion soil is underlain with glacial till. The Ilion soil occurs in depressional areas of the glacial till plain. These areas are commonly small potholes. The Ilion soil is considered to be in subclass IVw, but it occurs in such small areas and has such a small total acreage that it is included in this capability unit with Atherton silt loam. Unless they are drained, both soils have a seasonally high water table until late in spring. Both soils receive high amounts of seepage water from adjacent, higher soils. As a result, large amounts of water are supplied for plant use. The root zone in these soils is restricted by free water until late in spring unless the water table is lowered by drainage. Surface ponding is common on these soils.

The major limitation to the use of these soils for farming is a high water table. Drainage is needed before crops can be successfully grown. In some areas, particularly on the Ilion soils, finding suitable outlets for drainage is difficult.

Undrained areas of these soils are generally too wet for cultivated crops. The Atherton soil is strongly acid in the upper part of the root zone, but the Ilion soils are neutral. Crop growth on both soils is satisfactory if they are adequately drained. Large cultivated areas of either soil are not common.

Drained areas of these soils are suited to the field crops that are commonly grown in the county. Because of frost heaving and wetness in winter, small grains generally are not grown on the Ilion soil. Both soils can be used for continuous row crops if the soils are drained. They can be used for species of grasses or legumes tolerant of wetness that are grown for hay or pasture.

CAPABILITY UNIT IIIw-5

This capability unit consists of very poorly drained mucks in the Carlisle and Willette series. Unless they are drained, these soils have a high water table for long periods. Drainage is needed before they are suited to cultivated crops. Controlling the ground water level helps to minimize subsidence of the muck following drainage. Subsidence caused by oxidation of the organic material reduces the thickness of the muck. Drained areas of these muck soils have an adequate root zone and a high available moisture capacity. When the surface layer of the muck is dry, it is highly susceptible to both soil blowing and damage by fire.

The major limitation to the use of these soils for farming is a very high water table. Some areas of these soils are impractical or too difficult to drain well enough for crop production. These areas are generally left in their natural swampy condition.

If they are drained, these soils are suited to the field crops commonly grown in the county and to vegetable crops. Drained areas are used intensively for vegetable crops. Weed control is a major problem on these soils, and crops are susceptible to frost damage because the soils are in low positions. These soils are seldom used for pasture or hay crops.

CAPABILITY UNIT IIIw-6

This capability unit consists of soils that have a moderately fine textured to fine textured subsoil and are somewhat poorly drained. These soils are nearly level to gently sloping. The slopes range from 0 to 6 percent. The soils are in the Caneadea, Hornell, and Mahoning series. Their root zone is moderately deep, and permeability is very slow. The moderately eroded Mahoning soil in this unit is harder to till than the other soils. Its range of optimum moisture for tillage is narrower than that of the other soils. The soils in this unit have a medium or low available moisture capacity. They have a seasonally high water table during winter and spring.

The major limitation to the use of these soils for farming is the seasonally high water table. These soils dry out slowly in spring even if drained. They are not well suited to tile drainage, because they are very slowly permeable. The gently sloping soils are susceptible to surface runoff and erosion. Erosion is a serious hazard because these soils have a relatively thin surface layer that is easy to farm.

The soils in this unit are suited to the field crops that are commonly grown in the county. They are strongly acid to extremely acid in the uppermost 18 to 24 inches and are low in fertility. These soils are also suited to permanent or semipermanent grasses and legumes crops that are grown for hay or pasture. Frost heaving is a serious threat to alfalfa.

CAPABILITY UNIT IIIw-7

Holly silt loam is the only soil in this capability unit. It is a nearly level, poorly drained soil that is subject to flooding. This soil occurs along streams in low areas where the water table is generally high during winter and spring. Surface ponding occurs in some areas following heavy rains or flooding. The permeability of this soil is moderately slow. The soil has a high available moisture capacity and is medium acid to slightly acid in the root zone.

The major limitations to the use of this soil for farming are flooding and other seasonal wetness. Drainage is needed for successful growth of crops. In some areas tile outlets are difficult to establish because the soil occupies areas that are low in relation to streams. Exess surface water from adjacent higher soils generally accumulates on this soil.

Drained areas of this soil are suited to summer row crops. Flooding and freezing are serious threats to small grains during winter and spring. This soil also is suited to grasses and legumes that tolerate some flooding and seasonal wetness.

Areas of this soil that are subject to frequent damaging floods should be kept in permanent grass or trees for protection against scouring by streams.

CAPABILITY UNIT IIIw-8

This capability unit consists of Kingsville and Swanton soils that have a dark-colored surface layer and are poorly drained. The Kingsville soils formed mostly in deep sand deposits, but Kingsville silty clay has a thin layer of clayey material on top of the sand. This clayey layer causes tillage and tilth problems that the other soils in this unit do not have. The Swanton soil formed in moderately deep sand deposits that are underlain with silt loam glacial till or, locally, shale. The Kingsville soils are rapidly permeable. The Swanton soil is rapidly permeable in its upper part, but it is slowly permeable in the underlying materials. The Kingsville and Swanton soils supply adequate moisture to plants because they accumulate seepage and ground water from adjacent areas. These soils are naturally very strongly acid to medium acid in the uppermost 2 feet. They are low in content of plant nutrients.

The major limitation to the use of these soils for farming is a high water table that lasts for long periods. The water table must be lowered before growth of crops is satisfactory. These soils are difficult to drain by tile because, when they are saturated, the sand tends to flow into and plug tile lines.

Undrained areas of these soils generally are so wet that they cannot be used for crops. Adequately drained areas are suited to both field crops and specialty crops. Among the specialty crops commonly grown are melons, vegetables, and nursery stock. Plant nutrients tend to leach readily from these soils. Drained areas can be used for hay or pasture, but very little acreage is used for these purposes.

CAPABILITY UNIT IIIs-1

The soils in this capability unit are sandy, well drained or moderately well drained, and nearly level to moderately steep. These soils are in the Colonie and Elnora series. They formed in deep sandy material. Slopes range from 1 to 18 percent. Water moves rapidly in these soils, and they tend to be droughty. Also, they are subject to soil blowing when they are bare. The Colonie soil that has slopes of 6 to 18 percent is particularly subject to soil blowing. It is also susceptible to water erosion, especially on the steeper slopes.

The soils in this unit are naturally strongly acid to extremely acid, and they are very low in natural fertility. The maintenance of fertility is a major problem because plant nutrients tend to leach readily from these soils. These soils dry out quickly in spring.

Droughtiness is the main limitation to use for farming, but the soils are well suited to irrigation. Because the available water capacity is low, irrigation water must be applied frequently.

These soils are suited to the field crops commonly grown in the county. Row crops generally grow slowly in summer unless they are irrigated. These soils are well suited to specialty crops, such as tree fruits, berries, and nursery stock. They also are suited to the grasses and legumes commonly grown for hay or pasture, but these plants generally grow slowly unless they are irrigated.

CAPABILITY UNIT IVe-1

The Cambridge, Platea, Pierpont, and Williamson soils are in this capability unit and are moderately well drained or somewhat poorly drained. These soils have slopes of 6 to 18 percent. The Platea soil has slopes of 6 to 12 percent and is severely eroded. The other soils are moderately eroded. All of these soils have, in the subsoil, a fragipan that restricts the downward movement of water and penetration of plant roots. Permeability is slow to very slow, the root zone is moderately deep, and the available moisture capacity is medium to low. The severely eroded Platea soil has a thinner root zone than the other soils and a lower available moisture capacity.

The major limitation to the use of these soils for farming is a severe erosion hazard. These soils have a silt loam surface layer in most places, and they erode very easily. Surface runoff is rapid. All of these soils are naturally strongly acid to extremely acid, and they have a very low content of available plant nutrients. Acidity and very low fertility are a major management concern. Cultivated areas are highly susceptible to surface crusting.

These soils are suited to occasional cultivation of the field crops commonly grown in the county, but crop growth generally is slow even where management is intensive. The soils are better suited to grasses than to field crops. A thick plant cover helps to control erosion.

CAPABILITY UNIT IVe-2

This capability unit consists of somewhat poorly drained Hornell and Caneadea soils. These soils have a clayey subsoil. The Hornell soil is underlain by shale at a depth of 20 to 40 inches. Both soils have a moderately deep root zone, very slow permeability, and a medium available moisture capacity. Slopes range from 6 to 12 percent, and the soils are moderately eroded.

The major limitation to the use of these soils for farming is a very severe erosion hazard if they are cultivated. They are naturally strongly acid to extremely acid in the uppermost 12 to 18 inches, and they are low in fertility. These soils tend to dry out slowly in spring, and they have a narrow range of optimum moisture for tillage. Surface crusting is a serious concern on these soils. Unless these soils are worked at the optimum moisture content for tillage, they are cloddy.

These soils are suited to occasional cultivation of the field crops that are commonly grown in the county, but crop growth generally is slow even if management is intensive. The soils generally are better suited to grasses than to cultivated crops. They are poorly suited to alfalfa because it is damaged by severe frost heave. A thick plant cover on pasture helps to control erosion.

CAPABILITY UNIT IVe-3

Chenango silt loam, 12 to 18 percent slopes, moderately eroded, is the only soil in this unit. It is a well-drained soil that formed in sandy and gravelly material. This soil has moderately rapid to rapid permeability, a moderately deep root zone, and a low available moisture capacity. It is moderately eroded, strongly to very strongly acid, and low in content of plant nutrients.

In cultivated areas the erosion hazard is severe. This soil also is very droughty. It is suited to irrigation, but erosion is difficult to control.

This soil is suited to occasional cultivation of the field crops commonly grown in the county, but crop growth generally is slow even if management is intensive. Locally, this soil is used for tree fruits and nursery stock. It is well suited to the grasses and legumes that are commonly grown in the county for hay or pasture.

CAPABILITY UNIT IVw-1

In this capability unit are nearly level soils that are mostly poorly drained and have a clayey subsoil. These soils are in the Allis, Canadice, and Caneadea series. Because of the clayey subsoil and slopes of 0 to 2 percent, these soils have a water table that is seasonally high for long periods during winter and spring. All of the soils except mucky variants of Canadice soils have a thin silt loam surface layer over a more clayey subsoil. Canadice soils, mucky variants, have a muck surface layer 8 to 12 inches thick. The surface layer of the Canadice variants is dark colored, but that of the other soils is not. There is soft shale under the Allis soil at a depth of 24 to 42 inches. All of these soils have slow to very slow permeability and a moderately deep root zone. The root zone has a low or medium available moisture capacity, but additional moisture is available to these soils through seepage and runoff from adjacent higher areas.

The major limitation to the use of these soils for farming is excessive wetness. Drainage is needed for optimum crop production. Drainage by tile is slow, but surface drains help remove excessive water. The soils in this unit normally are very strongly or strongly acid and moderately low in content of plant nutrients. Except for Canadice soils, mucky variants, they are subject to surface crusting.

Drained areas of these soils are suited to the field crops that are commonly grown in the county, but crop growth generally is unsatisfactory if management is less than intensive. Undrained areas normally are too wet for cultivated crops. These soils are suited to grasses and legumes that tolerate seasonal wetness.

CAPABILITY UNIT IVs-1

The soils in this capability unit are sandy and gravelly and have slopes of 1 to 12 percent. They are in the Otisville series. These soils have a shallow to moderately deep root zone, rapid to very rapid permeability, and a low to very low available moisture capacity. The root zone is strongly acid to extremely acid, and natural fertility is very low.

The low to very low available moisture capacity is the major limitation to the use of these soils for crops. The drought hazard is very severe. These soils are suited to irrigation, but erosion is a hazard on the steeper slopes. Plant nutrients leach readily from these soils. Wear on tillage implements is excessive because of the high content of gravel in these soils.

The soils in this unit are suited to occasional cultivation of the field crops that are commonly grown in the county. They are, however, seldom used for field crops. They are suited to and used for specialty crops, such as sweet corn, potatoes, melons, vegetables, and nursery stock. Irrigation is necessary for satisfactory growth of these specialty crops. Unless these soils are irrigated they are poorly suited to grasses and legumes that are grown for hay or pasture.

CAPABILITY UNIT VIe-1

This capability unit consists of Caneadea and Hornell soils that are somewhat poorly drained, moderately steep, and moderately eroded. These soils have a thin silt loam surface layer and a clayey subsoil. Slopes range from 12 to 18 percent. The Hornell soil is underlain by shale at a depth of 20 to 40 inches. Both soils have a moderately deep root zone, very slow permeability, and a medium available moisture capacity. They have rapid surface runoff, but they are wet for long periods and dry slowly in spring. Slopes are short and tend to be seepy.

These soils generally are too steep and eroded for cultivated crops. The plow layer is partly in the clayey subsoil. The soils are better suited to hay or pasture than to cultivated crops. Except for alfalfa, these soils are suited to grasses or legumes commonly grown in the county. Frost heave is severe in fields of alfalfa.

CAPABILITY UNIT VIs-1

This capability unit consists of soils in the Otisville and Chenango series. These soils are sandy and gravelly, have rapid permeability, and have a very low available moisture capacity. Slopes range from 6 to 25 percent.

Because these soils are very droughty and sloping to steep, they are poorly suited to cultivated crops. They are strongly acid to extremely acid. Grasses and legumes are suitable for pasture, but pasture plants grow slowly in summer. Although these soils are suited to irrigation, the slopes make irrigation difficult and erosion difficult to control.

CAPABILITY UNIT VIIe-1

This capability unit consists of Steep land, loamy, and Steep land, silty and clayey. Both of these land types occupy escarpmentlike areas and are severely susceptible to erosion and highly susceptible to land slippage.

Most areas of these land types are not cultivated or pastured but are used as woodland. Some of the less sloping areas are used for permanent pasture. A thick plant cover helps to control erosion.

Estimated yields

Table 1 shows for the soils in the county estimated yields of principal crops that can be expected over a period of years under two levels of management, improved and optimum. In columns A are estimates of yields obtained under the improved management commonly practiced in the county in 1962.

In columns B are estimates of yields obtained under optimum management, or the application of the best information available. The following management practices must be carried out nearest the highest level to obtain the yields given for optimum management:

1. Water relationship within the soil is maintained at the optimum level for crop growth. Measures are used to increase water intake and the available moisture capacity of the soil. An excessive water problem is corrected by appropriate practices, including installation of tile drains or surface drains, land smoothing, or a combination of these practices.
2. If erosion is a hazard, or if some erosion has already occurred, such practices of erosion control as installing diversions, terracing, contour farming, and contour stripcropping are applied.

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

[Yields in columns A can be expected under improved management and yields in columns B can be expected under optimum management. See the text for explanation of the two levels of management. Absence of a yield figure means that the crop is not commonly grown under the management level indicated or that the soil is not suited to the crop. The miscellaneous land types in the county are not considered suited to the crops specified and are not listed in the table]

Soil	Corn		Wheat		Oats		Legume-grass hay	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Allis silt loam	------	70	18	28	56	70	1.5	2.9
Atherton silt loam	50	90	------	------	------	------	2.0	3.5
Braceville loam, 0 to 2 percent slopes	60	95	24	40	70	86	2.5	3.5
Braceville loam, 2 to 6 percent slopes	60	95	24	40	70	86	2.5	3.5
Braceville loam, 6 to 12 percent slopes, moderately eroded	55	90	20	34	60	74	2.0	3.3
Cambridge silt loam, 2 to 6 percent slopes	60	95	24	36	64	80	2.5	3.5
Cambridge silt loam, 2 to 6 percent slopes, moderately eroded	55	90	22	34	60	75	2.4	3.5
Cambridge silt loam, 6 to 12 percent slopes	55	75	22	34	60	75	2.4	3.4
Cambridge silt loam, 6 to 12 percent slopes, moderately eroded	50	70	20	32	54	70	2.0	3.0
Cambridge silt loam, 12 to 18 percent slopes, moderately eroded	------	------	18	30	44	64	1.5	2.5
Cambridge silt loam, sandstone substratum, 2 to 6 percent slopes	60	90	24	36	64	75	2.0	3.5
Cambridge silt loam, sandstone substratum, 6 to 12 percent slopes, moderately eroded	50	70	20	32	50	70	2.0	3.0
Canadice silt loam	------	70	18	28	60	70	1.5	3.0
Canadice soils, mucky variants	------	80	------	------	------	------	1.5	3.0
Canadice-Caneadea silt loams, 0 to 2 percent slopes	------	70	18	28	60	80	1.5	3.0
Caneadea silt loam, 0 to 2 percent slopes	55	80	22	32	62	75	2.5	3.4
Caneadea silt loam, 2 to 6 percent slopes	55	80	20	30	60	72	2.5	3.4
Caneadea silt loam, 6 to 12 percent slopes, moderately eroded	------	------	------	------	------	------	2.0	2.8
Caneadea silt loam, 12 to 18 percent slopes, moderately eroded	------	------	------	------	------	------	1.5	2.4
Carlisle muck	80	120	------	------	------	------	------	------
Chagrin silt loam	70	110	26	42	70	90	2.5	4.5
Chenango silt loam, 0 to 2 percent slopes	65	100	26	40	70	86	3.0	5.0
Chenango silt loam, 2 to 6 percent slopes	65	100	26	40	70	86	3.0	5.0
Chenango silt loam, 6 to 12 percent slopes, moderately eroded	55	85	24	36	58	72	2.5	4.0
Chenango silt loam, 12 to 18 percent slopes, moderately eroded	50	75	20	32	50	68	2.0	3.5
Chenango gravelly loam, 0 to 2 percent slopes	65	95	26	40	70	86	3.0	5.0
Chenango gravelly loam, 2 to 6 percent slopes	60	90	26	40	70	86	3.0	4.8
Chenango gravelly loam, 6 to 12 percent slopes, moderately eroded	55	85	22	34	58	72	2.4	4.0
Claverack loamy fine sand, silty subsoil variant, 0 to 2 percent slopes	55	80	24	36	64	84	2.0	3.5
Claverack loamy fine sand, silty subsoil variant, 2 to 6 percent slopes	50	75	24	36	64	84	2.0	3.5
Claverack loamy fine sand, silty subsoil variant, 6 to 12 percent slopes	50	75	22	32	60	80	1.9	3.3
Claverack loamy fine sand, moderately shallow variant, 2 to 6 percent slopes	50	75	24	36	64	84	2.0	3.4
Colonie loamy fine sand, 2 to 6 percent slopes	45	70	20	30	50	60	1.5	3.0
Colonie loamy fine sand, 6 to 18 percent slopes	------	------	------	------	------	------	1.5	2.8
Conneaut silt loam	45	80	18	30	60	84	1.5	3.0
Elnora loamy fine sand, 1 to 5 percent slopes	50	75	24	34	60	80	2.0	3.5
Frenchtown silt loam	45	80	18	30	60	75	1.5	3.0
Frenchtown silt loam, sandstone substratum	45	80	18	30	60	75	1.5	3.0
Holly silt loam	50	80	------	------	------	------	1.5	3.5
Hornell silt loam, 2 to 6 percent slopes	45	80	18	28	54	72	1.5	3.0
Hornell silt loam, 6 to 12 percent slopes, moderately eroded	40	70	16	24	40	64	1.0	2.5
Hornell silt loam, 12 to 18 percent slopes, moderately eroded	------	------	------	------	------	------	------	1.2
Ilion silt loam	60	100	------	------	------	------	2.5	4.5
Kingsville fine sandy loam	40	75	18	30	------	------	1.5	3.0
Kingsville silty clay	45	80	20	34	------	------	2.0	3.5
Lobdell silt loam	70	110	26	40	70	90	2.5	4.5
Mahoning silt loam, shale substratum, 2 to 6 percent slopes	55	85	22	38	60	75	2.5	3.5
Mahoning silt loam, shale substratum, 2 to 6 percent slopes, moderately eroded	50	80	22	38	55	70	2.5	3.5
Orrville fine sandy loam	55	100	------	------	------	------	2.0	3.5
Orrville silt loam	55	100	------	------	------	------	2.0	3.5
Otisville sandy loam, 1 to 6 percent slopes	------	------	------	------	------	------	1.5	2.2
Otisville gravelly sandy loam, 1 to 6 percent slopes	------	------	------	------	------	------	1.5	2.2
Otisville gravelly sandy loam, 6 to 12 percent slopes	------	------	------	------	------	------	1.2	2.0
Otisville and Chenango soils, 12 to 25 percent slopes	------	------	------	------	------	------	------	1.0
Pierpont silt loam, 2 to 6 percent slopes	60	85	24	36	64	80	2.5	3.5
Pierpont silt loam, 2 to 6 percent slopes, moderately eroded	55	80	22	34	60	75	2.4	3.5
Pierpont silt loam, 6 to 12 percent slopes, moderately eroded	55	75	22	34	54	70	2.0	3.0
Pierpont and Platea soils, 12 to 18 percent slopes, moderately eroded	------	------	18	30	44	64	1.5	2.5
Platea silt loam, 0 to 2 percent slopes	55	80	22	36	64	80	2.5	3.5
Platea silt loam, 2 to 6 percent slopes	55	80	22	36	60	80	2.5	3.5
Platea silt loam, 2 to 6 percent slopes, moderately eroded	50	80	22	34	60	75	2.5	3.4
Platea silt loam, 6 to 12 percent slopes	50	80	22	34	60	75	2.4	3.4

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

Soil	Corn		Wheat		Oats		Legume-grass hay	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Platea silt loam, 6 to 12 percent slopes, moderately eroded	------	75	20	32	52	70	2.0	3.0
Platea silt loam, 6 to 12 percent slopes, severely eroded	------	65	17	------	40	------	2.0	3.0
Red Hook silt loam, 0 to 4 percent slopes	55	95	24	40	70	86	2.5	3.5
Sheffield silt loam	------	75	18	30	60	75	1.5	3.0
Sheffield silt loam, stratified substratum	------	75	18	30	60	75	1.5	3.0
Swanton fine sandy loam, silty subsoil variant	50	85	24	36	------	------	2.0	3.5
Venango silt loam, 0 to 2 percent slopes	55	80	22	34	62	80	2.5	3.4
Venango silt loam, 2 to 6 percent slopes	55	80	22	32	60	80	2.5	3.4
Venango silt loam, 2 to 6 percent slopes, moderately eroded	50	80	20	32	58	75	2.5	3.4
Venango silt loam, 6 to 12 percent slopes	50	75	22	32	60	75	2.4	3.4
Venango silt loam, 6 to 12 percent slopes, moderately eroded	------	70	20	30	50	70	2.0	3.0
Venango silt loam, sandstone substratum, 0 to 2 percent slopes	55	80	22	34	62	82	2.5	3.4
Venango silt loam, sandstone substratum, 2 to 6 percent slopes	55	80	22	32	60	80	2.5	3.4
Wallington silt loam, 0 to 2 percent slopes	55	85	22	38	64	80	2.5	3.5
Wallington silt loam, 2 to 6 percent slopes	55	85	22	38	60	80	2.5	3.5
Willette muck	75	115	------	------	------	------	------	------
Williamson silt loam, 0 to 2 percent slopes	60	95	24	40	60	82	2.5	3.5
Williamson silt loam, 2 to 6 percent slopes	60	95	24	40	60	80	2.5	3.5
Williamson silt loam, 6 to 12 percent slopes, moderately eroded	50	70	22	34	58	70	2.5	3.5
Williamson silt loam, 12 to 18 percent slopes, moderately eroded	------	------	18	30	54	68	1.5	2.5

3. Appropriate tillage practices are used, including the time of tillage, plowing, seedbed preparation, and weed and insect control. These practices should be adapted to the soil and the specific crop.
4. The fertility and pH of the soil are maintained at optimum levels. Trace elements are supplied by fertilizer as required.
5. All practices are applied at a time when they will contribute most toward efficient production.
6. Adapted high-yielding crop varieties are used.

These estimated yields are not static values but are designed to indicate the productivity of the soils. The yield figure is influenced by soil characteristics. It indicates how desirable these characteristics are for crop production. Consequently, the relative productivity of a soil is evident when its yield figures are compared with those of the other soils in the county. Estimated yields are likely to change as research opens new areas in production technology, but the relative productivity of a soil is not likely to change.

The estimates in table 1 were based primarily on observations and field trials of the county agricultural extension agent and on interviews with farmers and the district conservationist of the Soil Conservation Service. Also used were data from direct observations by members of the soil survey party.

The yield figures do not apply directly to any specific field for any particular year, because the soils vary from place to place and management practices vary from farm to farm. Also, the weather varies from year to year. The estimates are intended only as a general guide to the relative productivity of the soils and as an indicator of how crops on these soils respond to optimum management, as compared to the response under improved management.

Specialty crops [3]

A total area of about 4,100 acres is used for the commercial production of grapes, tree fruits, vegetables, and nursery crops in Ashtabula County. These crops are concentrated in an area 5 to 6 miles wide that borders the southern shore of Lake Erie. The largest acreage is in Geneva and Harpersfield Townships. An exception is about 400 acres, mainly of Chenango silt loam, that are used for potatoes in the east-central part of the county.

Lake Erie is important to fruit growers in Ashtabula County because the lake lessens the danger that spring frost damages fruit buds. The orchards and vineyards within sight of Lake Erie are much less susceptible to damaging frosts than are orchards and vineyards farther away.

Peaches, cherries, and vegetable crops are successfully grown mostly on the two east-west beach ridges in the northern part of the county. These crops are grown on moderately well drained to well drained soils, including the Elnora, Claverack, Colonie, Chenango, and Otisville.

Grapes, apples, and peas grow well on many kinds of soils, including the soils mentioned and some areas of Platea, Red Hook, Kingsville, and Swanton soils.

Drainage, erosion control, and maintenance of organic-matter content and fertility are management needs in areas used for specialty crops. Tile drains are used extensively on the Platea, Red Hook, Kingsville, and Swanton soils. Planting sod crops and winter cover crops and mulching are erosion control practices used to reduce soil loss. Crop residues, cover crops, and mulching material add the needed organic matter. Soil tests, foliar analysis, and symptoms of deficient plant nutrients are used as guides

[3] By JOHN WILSON, district conservationist, Soil Conservation Service, Ashtabula County, Ohio.

for fertility programs. Irritation is needed for satisfactory growth of crops on the Otisville and Colonie soils. Pits excavated in the Kingsville soils are commonly used to supply water for irrigation.

Woodland Management

Woodland, as defined by the 1967 Conservation Needs Inventory, occupies more than 135,000 acres, or about 30 percent of the total land area, in Ashtabula County. Because of the proximity of Metropolitan Cleveland, the development of wooded areas in the county is important. Woodland can be used for recreation, wildlife, and other purposes besides producing wood crops. Much of the wooded acreage in this county consists of former cropland or pasture that is reverting to trees.

Ashtabula County lies in the north-central forest region. Trees typical of the northern forest grow throughout the county. Among these trees are beech, sugar maple, hemlock, yellow birch, and many associated species.

Beech and maple, the dominant trees in many stands, occur on the better drained soils. Associated species are tulip-poplar, white ash, red oak, white oak, red maple, basswood, black cherry, cucumbertree, white elm, butternut, and shagbark hickory.

The oak-hickory and chestnut-oak forests occur locally in all parts of the county. These forests are on the well-drained soils of the lake plain, along the river gorges and on gravel deposits. The virtual elimination of American chestnut by the blight has left the oaks as the dominant trees in areas where chestnut was among the dominant species. Other plentiful trees are white oak, red oak, hickory, and sugar maple.

The almost level wet areas of the lake plain and the glacial till plain are occupied by several swamp forest species, mainly white elm, white ash, and red maple. The Dutch elm disease is slowly killing the elm. Other species include pin oak, beech, and red oak. Beech and red oak grow in these wet areas on windthrow mounds that are better drained than surrounding areas.

Several kinds of forest that included northeastern conifers occurred in the county, but these have largely been destroyed. Hemlock is widely distributed along banks of major streams and on the lake plain. It occurs with maple, hickory, beech, and oaks.

Woodland suitability groups

The soils in Ashtabula County have been placed in the woodland suitability groups shown in table 2. Each group consists of soils that are suited to about the same kinds of trees, that have about the same limitations and require about the same management, and that have about the same potential productivity.

In placing soils in woodland groups several factors were considered. Of first importance is the ability of a soil to supply moisture. The moisture-holding capacity largely depends on slope, effective depth, texture, permeability, and internal drainage. The position on the slope and direction of exposure, or aspect, also affect the supply of moisture.

The length of time that a soil remains saturated is important. Many soils in the county remain saturated throughout spring and, in places, are ponded. Soil saturation affects tree growth and trafficability as well. Because it is not feasible to drain most wet areas in woodland, the choice of tree species adapted to wet soils is necessary. The hazard of wetness should also be considered in timing woodland operations and in selecting equipment.

Other factors influencing tree growth that should be considered when placing soils in woodland groups are aeration, erosion, effective root zone, acidity, and natural fertility. Most of the soils in Ashtabula County are acid and have a low to medium capacity for storing plant nutrients. The effective root zone is limited in some soils by a dense layer (fragipan) within 30 inches of the surface. Severe erosion has decreased the effective depth of some soils. By removing the protective surface layer and exposing the less porous subsoil, erosion contributes to increased runoff and decreased water intake. Loss of the surface layer enriched by organic matter results in considerable loss of plant nutrients and available moisture capacity.

The woodland suitability groups are shown in table 2 by a combination of numbers and letters, for example, 1o1 and 2r1. The first number (class) indicates the site index. A very high site index is shown by 1, high by 2, and moderate by 4. The letter in the group symbol (subclass) indicates the major soil characteristics or limitations that affect woodland use. The letter o indicates no significant limitations; w, a wetness limitation; s, dry sandy soils; and r, moderately steep to steep soils. Woodland suitability groups within subclasses are numbered consecutively from 1 to as many numbers as are needed, for example 1o1, 1o2, and so on. Some of the columns in table 2 require explanation.

Average site index.—Site index is the average height, in feet, that a given tree species attains at 50 years of age. It usually is correlated with yield tables that predict productivity in terms of board feet and cubic feet at stated ages and under stated degrees of stocking and conditions of management. In table 2 the site indexes are for species of oak.

Annual growth.—This column indicates potential yields of species of oak in board feet per acre.

Erosion hazard.—This heading refers to the susceptibility of a soil to water erosion after protective cover has been removed. The ratings are based on soil characteristics that affect surface runoff and erosion, such as the length and steepness of slope and soil texture. If the rating is *slight*, no problem exists. If *moderate*, some attention must be given to control of erosion. Woodland operations are subject to moderate restrictions of method and timing. If the rating is *severe*, considerable attention must be given to control of erosion. Needed are intensive management, specialized equipment, careful operating methods, and proper timing of operations.

Equipment limitations.—This column refers to the relative difficulty of using machines that normally are used in woodland operations. The ratings are based on soil characteristics that limit equipment operations, including soil texture, steepness, wetness, rockiness, and stoniness. The rating is *slight* if the kind of equipment and the time of year it is used are not restricted. It is *moderate* if use of equipment is moderately restricted by one or more of the soil factors mentioned. The rating is *severe* if special equipment is needed to overcome hazards caused by soil characteristics.

TABLE 2.—*Potential productivity, management hazards, and*

[Not rated for commercial tree growth are Beaches (Be), Carlisle muck (Cg), Gravel and sand

Woodland suitability group, soil series, and map symbols	Potential productivity based on measured woodland trees		Management hazards				
	Average site index [1] (oaks)	Annual growth [2]	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition (hardwoods)	Windthrow hazard
		Board feet per acre					
Group 1o1: Cambridge: CaB, CaB2, CaC, CaC2, CbB, CbC2. Chagrin: Ch. Lobdell: Lb. Williamson: WlA, WlB, WlC2.	85+	423	Slight	Slight	Slight	Moderate	Slight
Group 1r1: Cambridge: CaD2. Williamson: WlD2.	85–95	423	Moderate	Moderate	Slight	Moderate	Slight
Group 2w1: Allis: As. Atherton: At. Canadice: Cc, Cd. Canadice-Caneadea: CeA. Conneaut: Ct. Frenchtown: Fr, Fs. Holly: Hm. Ilion: Io. Kingsville: Kf, Kg. Orrville: Or, Os. Sheffield: Sf, Sh. Swanton: Sw.	75–85	341	Slight	Severe	Severe	Severe	Severe
Group 2w2: Caneadea: CfA, CfB, CfC2, CfD2. Hornell: HoB, HoC2, HoD2. Mahoning: MsB, MsB2. Platea: PsA, PsB, PsB2, PsC, PsC2, PsC3. Red Hook: RhB. Venango: VeA, VeB, VeB2, VeC, VeC2, VgA, VgB. Wallington: WaA, WaB.	75–85	341	Slight to moderate.	Moderate	Moderate	Severe	Moderate
Group 2o1: Braceville: BrA, BrB, BrC2. Chenango: CkA, CkB, CkC2, CkD2, ClA, ClB, ClC2. Claverack variants: CmA, CmB, CmC, CnB. Pierpont: PeB, PeB2, PeC2, PoD2.[3]	75–85	341	Mostly slight.	Mostly slight.	Slight	Moderate	Slight
Group 2r1: Steep land, loamy: Sm. Steep land, silty and clayey: Sn.	75–85	341	Moderate to severe.	Moderate to severe.	Moderate	Moderate	Moderate
Group 4s1: Colonie: CoB, CoD. Elnora: ElB. Otisville: OtB, OuB, OuC, OvE.	55–65	196	Mostly slight.	Mostly slight.	Moderate	Slight	Slight

[1] From Schnur, G. Luther, 1937, "Yield, Stand, and Volume Tables for Even-Aged Upland Oak Forests," Tech. Bul. 560 USDA (*10*).
[2] From publication cited in footnote 1, above, table 28, page 32, for tree crop rotation of 80 years.

suitable trees by woodland suitability groups of soils

pits (Gp), Made land (Ma), Quarries (Qu), Riverwash (Rw), and Willette muck (We)]

Species to favor—			Remarks
In existing stands	For planting	For Christmas trees	
Black walnut, tulip-poplar, red oak, sugar maple.	White pine, tulip-poplar, Norway spruce, cottonwood.	Scotch pine, balsam fir, Norway spruce, white pine.	Chagrin and Lobdell soils are subject to flooding.
Tulip-poplar, red oak, black oak, sugar maple, black cherry.	White pine, tulip-poplar, white ash.	Scotch pine, white pine, Norway spruce.	
Pin oak, red oak, red maple, white ash.	White ash, red maple	Black spruce	Poorly drained soils; high water table in winter and early in spring; most tree growth is on hummocks caused by old windthrows.
Tulip-poplar, red oak, sugar maple, white ash, red maple.	White pine, tulip-poplar, white ash.	Scotch pine, black spruce, Norway spruce.	Somewhat poorly drained soils; seasonal high water table; best tree growth is on hummocks caused by old windthrows; for erosion hazard, soils having slopes of 0 to 12 percent rated slight and soils having slopes of 12 to 18 percent rated moderate.
Tulip-poplar, red oak, black oak, white oak.	Tulip-poplar, red oak, white pine.	Scotch pine, Austrian pine, white pine.	PoD2 and CkD2 rated moderate for equipment limitation and erosion hazard.
Tulip-poplar, red oak, black oak, white oak.	Tulip-poplar, red oak, white pine.	[4]	Steep soils are subject to slippage.
White oak, black oak, sugar maple, red oak.	White pine	Scotch pine, Austrian pine, white pine.	The sandy soils are subject to wind erosion if bare; OvE rated severe for erosion hazard and equipment limitations.

[3] Entries apply only to Pierpont soil; see group 2w2 for information on Platea soil.
[4] Not rated for commercial Christmas trees.

Seedling mortality.—Seedling mortality refers to the percentage of seedlings, naturally occurring or planted, that die because of adverse soil characteristics or topography, assuming that plant competition is not a limiting factor. Soil characteristics that contribute to this hazard are internal drainage, effective root depth, surface texture, and aspect. The rating is *slight* if expected mortality is 0 to 25 percent of the seedlings. It is *moderate* if expected mortality is 25 to 50 percent. Some replanting is necessary to maintain a fully stocked stand. The rating is *severe* if mortality is more than 50 percent of the seedlings. Plantings are needed for 2 or 3 years, or special measures have to be taken to insure adequate survival of seedlings.

Plant competition.—This heading refers to the rate of invasion by unwanted trees, shrubs, and vines when openings are made in the canpoy. In table 2, ratings are given for hardwoods. Competition is *slight* if it does not prevent adequate natural regeneration and early growth, or does not interfere with the normal development of planted seedlings. It is *moderate* if it delays natural or artificial regeneration and slows the growth of seedlings, but does not prevent the eventual development of a fully stocked, normal stand. Competition is *severe* if natural or artificial restocking is prevented unless the site is intensively prepared and maintenance practices such as weeding are intensive.

Windthrow hazard.—This column refers to the loss of trees that is expected because they blow down when winds are high. The ratings are based on the effective root depth and wetness. If the rating is *slight*, trees are not expected to blow down in commonly occuring winds. If *moderate*, some trees may blow down during extended periods of rain and high winds. If the rating is *severe*, an excessive number of trees are blown down during extended rainy and windy periods and when winds are high.

Species to favor.—Under this heading the trees are not listed in order of their value. Also, no noncommercial species appear in the listing.

Soils and Wildlife Habitats

Successful management of wildlife on any tract of land requires the achievement of a biological balance. Food, cover, and water are needed in a desirable combination to provide a suitable habitat for wildlife. To a considerable degree vegetation depends on soil properties, and consequently, a knowledge of soils provides guidance in establishing, maintaining, and improving a wildlife habitat.

Suitability of soils for wildlife

In table 3 the soils in the county are rated according to their suitability for elements of wildlife habitat and for kinds of wildlife. Not rated in the table are the land types, Gravel and sand pits, Made land, and Quarries.

The natural drainage of the soils was one criterion used for obtaining the ratings in table 3. Soils that are artificially drained have different ratings than those given in this table. The information in table 3 is useful in planning the development of wildlife habitat on private or public lands. Additional information about mangaging wildlife areas can be obtained by requesting it from the local office of the Soil Conservation Service or the Division of Wildlife, Ohio Department of Natural Resources.

The soil areas shown on the soil survey map are rated without regard to the relation of their position to adjoining mapped areas. The size, shape, or location of the mapped areas does not affect the rating. These ratings are based on limitations caused by the characteristics or behavior of the soil (*1*).

The numerical ratings of 1 to 4 in table 3 indicate the relative suitability of a particular soil for the use rated. A rating of 1 stands for *well suited.* This means that there are few or no soil limitations for the particular element of habitat or kind of wildlife. A rating of 2 denotes *suited* and indicates that the habitat element can be created, maintained, or improved, but that there are moderate soil limitations that affect habitat management. A rating of 3 indicates *poorly suited* and means that the habitat element can be created, maintained, or improved, but that there are severe limitations to use of the soils for the habitat. *Unsuited* is denoted by 4. This rating indicates that the habitat cannot be created, maintained, or improved, or that it is impractical to attempt to do so under the prevailing soil conditions.

The elements of wildlife habitat rated in table 3 are as follows:

Grain and seed crops are grain species valuable for wildlife and include corn, soybeans, oats, barley, rye, and wheat.

Grass and legumes include alfalfa, Ladino clover, red clover, birdsfoot trefoil, fescue, bromegrass, bluegrass, and timothy.

Wild herbaceous upland plants include foxtail, ragweed, smartweed, panicgrass, wild oats, native lespedezas, and herbs.

Hardwood woody plants are trees and shrubs. They include sumac, wild grape, dogwood, viburnum, hawthorn, wild cherry, and such trees as various oaks and hickories, American beech, and walnut. The soils are rated on the basis of good growth of these plants and the size of their fruit or seed.

Coniferous woody plants include eastern redcedar, Virginia pine, Scotch pine, and Austrian pine. The soils are rated on the basis of delayed growth and canopy closure. Delayed growth and canopy closure provide a longer period for wildlife food and cover than rapid growth and closure.

Wetland food and cover plants include cattails, bullrushes, sedges, barnyard grass, duckweed, and various willows.

Shallow water developments are areas of water that have been made by building low dikes and levees, digging shallow excavations, establishing level ditches, and building devices to control the water level of marshy streams. Generally the water is not more than 5 feet deep.

Excavated ponds are dug-out areas or a combination of dug-out areas and low dikes that hold water of suitable quality, of suitable depth, and in ample supply for the production of fish or wildlife. Such a pond should be at least one-tenth acre in surface area, have a depth of 6 feet in at least a half of the area, and have a depth of 8 feet in at least a quarter of the area.

Based on the suitability of the soils for each of the eight habitat elements, the soils were rated in table 3 according to their suitability for producing three major kinds of wildlife.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*

[A rating of 1 denotes well suited; 2, suited; 3, poorly suited; and 4, not suited. Suitability was not determined for Gravel and sand pits (Gp), Made land (Ma), and Quarries (Qu)]

Soil series and map symbols	Wildlife habitat elements								Kinds of wildlife		
	Grain and seed crops	Grass and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Allis: As	3	2	2	1	2	1	1	4	2	2	1
Atherton: At	4	3	3	1	1	1	1	3	2	1	1
Beaches: Be	4	3	3	4	4	4	4	4	4	4	4
Braceville:											
BrA	1	1	1	1	3	3	3	3	1	1	3
BrB	1	1	1	1	3	4	4	3	1	1	4
BrC2	2	1	1	1	3	4	4	4	1	1	4
Cambridge:											
CaB, CaB2	1	1	1	1	3	4	4	3	1	1	4
CaC, CaC2	2	1	1	1	3	4	4	4	1	1	4
CaD2	3	2	1	1	3	4	4	4	2	2	4
Cambridge, sandstone substratum:											
CbB	1	1	1	1	3	4	4	3	1	1	4
CbC2	2	1	1	1	3	4	4	4	1	1	4
Canadice: Cc, Cd	3	2	2	1	2	1	1	1	2	1	1
Canadice-Caneadea: CeA	3	2	2	1	2	2	2	2	2	1	2
Caneadea:											
CfA	2	1	1	1	3	3	3	3	1	1	3
CfB, CfC2	2	1	1	1	3	4	4	4	1	1	4
CfD2	3	2	1	1	3	4	4	4	2	2	4
Carlisle: Cg	4	3	4	4	4	1	1	1	4	4	1
Chagrin: Ch	1	1	1	1	3	4	4	4	1	1	4
Chenango:											
CkA, ClA	1	1	1	1	3	4	4	4	1	1	4
CkB, ClB	2	1	1	1	3	4	4	4	1	1	4
CkC2, ClC2	2	1	1	1	3	4	4	4	1	1	4
CkD2	3	2	1	1	3	4	4	4	2	2	4
Claverack, silty subsoil variant:											
CmA	2	2	1	1	3	3	3	3	1	2	3
CmB	2	2	1	1	3	4	4	3	1	2	4
CmC	2	2	1	1	3	4	4	4	1	2	4
Claverack, moderately shallow variant: CnB	2	2	1	1	3	4	4	4	1	2	4
Colonie:											
CoB	3	2	2	3	1	4	4	4	2	3	4
CoD	4	2	2	3	1	4	4	4	3	3	4
Conneaut: Ct	3	2	2	1	1	1	1	1	2	1	1
Elnora: ElB	3	2	2	3	1	4	4	4	2	3	4
Frenchtown: Fr	3	2	2	1	2	1	1	1	2	1	1

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Wildlife habitat elements								Kinds of wildlife		
	Grain and seed crops	Grass and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Frenchtown, sandstone substratum: Fs	3	2	2	1	2	1	1	3	2	1	1
Holly: Hm	3	2	2	1	2	1	1	1	2	1	1
Hornell:											
HoB	2	2	1	1	3	4	4	4	2	2	4
HoC2	2	2	1	1	3	4	4	4	2	2	4
HoD2	3	2	1	1	3	4	4	4	2	2	4
Ilion: Io	4	3	3	1	1	1	1	1	3	1	1
Kingsville: Kf, Kg	2	2	2	1	2	1	1	1	2	1	1
Lobdell: Lb	1	1	1	1	3	3	3	3	1	1	3
Mahoning, shale substratum: MsB, MsB2	2	2	1	1	3	2	3	3	1	2	3
Orrville: Or, Os	2	2	1	1	3	2	2	2	1	2	2
Otisville: OtB, OuB, OuC	3	3	3	3	1	4	4	4	3	3	4
Otisville and Chenango: OvE	4	3	3	3	1	4	4	4	4	3	4
Pierpont:											
PeB, PeB2	1	1	1	1	3	4	4	3	1	1	4
PeC2	2	1	1	1	3	4	4	4	1	1	4
Pierpont and Platea: PoD2	3	2	1	1	3	4	4	4	2	2	4
Platea:											
PsA	2	2	1	1	3	2	2	2	1	2	2
PsB, PsB2	2	2	1	1	3	3	3	3	1	2	3
PsC, PsC2, PsC3	2	2	1	1	3	4	4	4	1	2	4
Red Hook: RhB	3	2	2	1	2	1	1	1	2	1	1
Riverwash: Rw	4	3	3	4	4	2	4	4	4	4	3–4
Sheffield: Sf, Sh	3	2	2	1	2	1	1	1	2	1	1
Steep land, loamy: Sm	4	3	1	1	3	4	4	4	3	2	4
Steep land, silty and clayey: Sn	4	3	2	1	3	4	4	4	3	2	4
Swanton, silty subsoil variant: Sw	4	3	3	1	1	1	1	1	3	1	1
Venango:											
VeA	2	2	1	1	3	2	2	2	1	2	2
VeB, VeB2	2	2	1	1	3	3	3	3	1	2	3
VeC, VeC2	2	2	1	1	3	4	4	4	1	2	4
Venango, sandstone substratum:											
VgA	2	2	1	1	3	2	2	3	1	2	2
VgB	2	2	1	1	3	3	3	3	1	2	3
Wallington:											
WaA	2	2	1	1	3	2	3	2	1	2	2
WaB	2	2	1	1	3	3	4	3	1	2	4

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Wildlife habitat elements								Kinds of wildlife		
	Grain and seed crops	Grass and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Willette: We	4	3	4	4	4	1	1	1	4	4	1
Williamson:											
WIA	1	1	1	1	3	3	3	3	1	1	3
WIB	1	1	1	1	3	4	4	4	1	1	4
WIC2	2	1	1	1	3	4	4	4	1	1	4
WID2	3	2	1	1	3	4	4	4	2	2	4

Openland wildlife consists of birds and mammals that are commonly found in crop fields, in meadows and pastures, and on nonforested overgrown soils. Examples are quail, pheasants, songbirds, cottontail rabbits, red foxes and woodchucks.

Woodland wildlife consists of birds and mammals that are commonly found in wooded areas. Examples are ruffed grouse, gray and fox squirrels, raccoon, woodcock, and songbirds.

Wetland wildlife consists of birds and mammals that are commonly found in marshes and swamps. Examples are ducks, geese, rails, heron, muskrat, and beaver.

Engineering Uses of the Soils[4]

This section has been prepared specifically for the purpose of interpreting the characteristics of the soils of the county for engineering uses.

Most of the information is in tables 4, 5, and 6. The accompanying text is largely explanation of what is shown in the tables.

Soil properties are of interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important to the engineer are permeability to water, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and pH. Depth to water table, depth to bedrock, and topography are also important.

Information in this survey can be used as a guide to help—

1. Make soil and land use studies that will aid in selecting and developing light industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, diversions, and terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines and cables, and in planning detailed investigations at selected locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and aerial photographs to make maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify and locate the soils, the engineering interpretations in this section can be useful for many purposes. It should be emphasized that the interpretations do not eliminate the need for sampling and testing at the site of specific engineering works where loads are heavy and the excavations are deeper than the depths of layers reported. Nevertheless, the soil map is useful for planning more detailed investigations and for suggesting the kinds of problems that may be expected.

It should be noted that mapping units may contain inclusions of similar or of contrasting soils. Inclusions are noted in the mapping unit descriptions if they were observed during the course of the survey.

Some of the terms used by the soil scientists may be unfamiliar to the engineer, and some words may have special meanings in soil science. These and other terms are defined in the Glossary at the end of the survey.

[4] This section of the survey has been reviewed by LLOYD E. GILLOGLY, construction engineer, Soil Conservation Service, State office, Columbus, Ohio.

TABLE 4.—*Engineering*

[Tests performed by the Ohio Department of Highways in accordance with standard

Soil name and location	Ohio report No.	Depth	Moisture-density [1]		Ohio classification [2]
			Maximum dry density	Optimum moisture	
	SO-	*Inches*	*Pounds per cubic foot*	*Percent*	
Allis silt loam:					
3.5 miles southwest of Conneaut and 400 yards from Keefus Road and Under Ridge Road. (Silty subsoil variant)	41037	0–7	----------	----------	A–4a
	41038	10–20	----------	----------	A–7–6
	41039	27–33	----------	----------	(5)
Claverack loamy fine sand:					
1.5 miles east of Conneaut, 3/8 mile from U.S. Highway No. 20 and 1,000 feet from Penn Central R.R. on Thompson Road.	39613	0–3	87	23	A–4a
	39614	6–16	104	13	A–3a
	39615	37–55	116	13	A–4
	39616	55–65	115	15	A–4a
Colonie loamy fine sand:					
1.25 miles northwest of Kingsville and 3/8 mile west of Interstate Highway No. 90 and 200 yards south of U.S. Highway No. 20. (Modal profile)	693	0–11	103	14	A–3a
	694	11–25	102	16	A–3
	695	48–80	----------	----------	A–3a
	696	108–132	----------	----------	A–3
4 miles west-southwest of Conneaut and 1,430 yards from junction of Maple Street and Gore Road. (Slightly finer textured solum than in modal)	39620	0–2	----------	----------	A–4a
	39621	5–15	----------	----------	A–3a
	39622	50–70	----------	----------	A–3a
Conneaut silt loam:					
3 miles northeast from Conneaut, 50 yards west of Pa. State Line Road, and 100 yards south of Lake Road.	689	0–9			A–7–5
	690	17–27	----------	----------	A–6a
	691	33–44	----------	----------	A–6a
	692	70–112	----------	----------	A–6a
Elnora loamy fine sand:					
4 miles west-southwest of Conneaut, 1 1/8 miles from Salsbury Road, and 7/8 mile from State Route 531. (Modal profile)	39617	0–11	----------	----------	A–3a
	39618	11–20	----------	----------	A–3a
	39619	33–52	----------	----------	A–3a
One-half mile south of State Route 531 and 100 feet west of Grant Road. (Solum slightly finer textured than in modal)	39610	0–11	106	15	A–3a
	39611	15–26	111	12	A–3a
	39612	39–60	109	16	A–3a
Otisville gravelly sandy loam:					
4.5 miles west-southwest of Conneaut, 5/8 mile from U.S. Highway No. 20, and 500 yards from Poor Road on Gore Road.	41034	0–6	----------	----------	A–2–4
	41035	6–15	----------	----------	A–1–b
	41036	37–57	----------	----------	A–1–b

[1] Based on AASHO Designation: T 99–57, Method A (*2*).
[2] Based on "Classification of Soils", Ohio State Testing Laboratory, Ohio Department of Highways, February 1, 1955.
[3] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in

test data

procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [3]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than 0.005 mm.			AASHO	Unified [4]
3-in.	¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					
----------	----------	100	98	93	78	39	36	7	A-4(8)	ML
----------	----------	----------	100	96	94	52	45	19	A-7-6(13)	ML-CL
100	45	21	11	10	9	4	([5])	([5])	([5])	([5])
----------	----------	----------	100	99	40	18	[6] NP	[6] NP	A-4(1)	SM
----------	----------	----------	100	99	34	20	NP	NP	A-2-4(0)	SM
----------	100	99	95	91	84	41	29	7	A-4(8)	ML-CL
----------	100	92	89	85	78	38	30	7	A-4(8)	ML-CL
----------	----------	----------	100	99	15	9	NP	NP	A-2-4(0)	SM
----------	----------	----------	----------	100	7	4	NP	NP	A-3(0)	SP-SM
----------	----------	----------	----------	100	22	11	NP	NP	A-2-4(0)	SM
----------	----------	----------	----------	100	4	2	NP	NP	A-3(0)	SP
----------	----------	----------	100	93	38	10	NP	NP	A-4(1)	SM
----------	----------	----------	100	93	17	10	NP	NP	A-2-4(0)	SM
----------	100	99	98	97	28	7	NP	NP	A-2-4(0)	SM
----------	----------	----------	100	96	88	44	46	11	A-7-5(10)	ML
----------	100	97	90	87	79	39	34	11	A-6(8)	ML-CL
----------	100	97	88	84	77	41	35	11	A-6(8)	ML-CL
----------	100	97	91	83	72	34	31	12	A-6(8)	CL
----------	100	98	96	93	31	16	NP	NP	A-2-4(0)	SM
----------	----------	----------	100	99	28	13	NP	NP	A-2-4(0)	SM
----------	----------	----------	----------	100	17	13	NP	NP	A-2-4(0)	SM
----------	----------	----------	100	95	33	17	NP	NP	A-2-4(0)	SM
----------	----------	----------	100	99	33	16	NP	NP	A-2-4(0)	SM
----------	----------	----------	100	99	21	10	NP	NP	A-2-4(0)	SM
98	91	77	61	40	32	8	NP	NP	A-2-4(0)	SM
----------	100	89	74	28	21	12	NP	NP	A-1-b(0)	SM
----------	100	86	66	31	7	5	NP	NP	A-1-b(0)	SW-SM

this table are not suitable for naming textural classes for soil.

[4] Based on the Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations (*18*). SCS and BPR (Bureau of Public Roads) have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification, for example ML-CL.

[5] Insufficient material.

[6] NP=Nonplastic.

TABLE 5.—*Estimated engi-*

[Properties were not determined for Gravel and sand pits (Gp), Made land (Ma), Quarries

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—			
	Seasonally high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*				
Allis: As	0–½	[1] 2–3½	0–14	----------	100	95–100	90–100	75–95
			14–27	----------	100	100	95–100	90–100
			27–33	(3)	60–85	50–75	50–60	50–60
			33–36	(1)				
Atherton: At	0–½	>5	0–19	----------	95–100	90–100	85–95	70–90
			19–32	----------	70–80	60–75	55–70	50–65
			32–50	1–5	90–95	5–60	5–35	5–20
Beaches: Be	[4] 1½–3	>6	0–60	----------	100	100	50–70	5–15
Braceville: BrA, BrB, BrC2	1½–3	>6	0–10	----------	100	100	75–90	60–75
			10–29	----------	100	100	80–100	70–90
			29–34	----------	100	75–90	40–60	15–30
			34–60	----------	50–70	40–50	30–40	15–30
Cambridge: CaB, CaB2, CaC, CaC2, CaD2, CbB, CbC2.	1½–3	>6	0–24	----------	100	100	90–100	70–90
		4–5	24–50	----------	100	100	90–100	70–90
			50–70	2–5	100	90–100	80–90	70–90
Canadice: Cc, Cd, CeA (See Caneadea series for Caneadea part of CeA).	0–½	>6	0–7	----------	100	100	90–100	70–90
			7–36	----------	100	100	90–100	85–95
			36–66	----------	100	100	90–100	85–95
Caneadea: CfA, CfB, CfC2, CfD2	½–1½	>6	0–8	----------	100	100	90–100	70–90
			8–40	----------	100	100	90–100	85–95
			40–58	----------	100	100	90–100	85–95
Carlisle: Cg	0	>6	0–45	----------	----------	----------	----------	----------
			45–60	----------	100	100	95–100	85–100
Chagrin: Ch	[4] >3	>6	0–11	----------	100	100	80–90	70–90
			11–60	----------	100	100	80–90	65–90
Chenango: CkA, CkB, CkC2, CkD2	3	>6	0–15	----------	100	90–100	80–90	70–90
			15–30	1–5	70–95	55–65	40–60	15–45
			30–50	1–5	40–70	30–50	10–40	1–15
ClA, ClB, ClC2	>3	>6	0–38	5–10	55–95	50–75	25–70	15–40
			38–50	10–30	40–70	30–55	10–40	1–15
Claverack, silty subsoil variant: CmA, CmB, CmC.	1½–3	>6	0–33	----------	100	100	70–90	20–40
			33–70	----------	100	100	90–100	70–85

See footnotes at end of table.

neering properties of soils

(Qu), Riverwash (Rw), Steep land, loamy (Sm), and Steep land, silty and clayey (Sn)]

USDA texture	Engineering classification: Unified	Engineering classification: AASHO	Range in permeability	Range in available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential: Steel	Corrosion potential: Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam to light silty clay loam.	ML, CL	A-4, A-6	0. 2–0. 63	0. 17–0. 20	4. 6–5. 5	Low	(2)	High.
Silty clay	ML–CL, CH	A-6, A-7	0. 06–0. 2	0. 13–0. 15	4. 6–5. 5	Moderate	High	High.
Silty clay shale and interbedded siltstone and sandstone.	ML, CL	A-6, A-7	0. 06–0. 2	0. 06–0. 08	4. 1–5. 5	Moderate	High	High.
Silt loam	ML, ML–CL	A-4	0. 63–2. 0	0. 17–0. 20	4. 6–5. 5	Low	High	High.
Gravelly silt loam or silty clay loam.	ML, CL	A-4, A-6	0. 06–0. 2	0. 16–0. 18	5. 6–6. 0	Low	High	Moderate.
Loamy gravel	GM, GW–GM	A-1, A-2	>6. 3	0. 03–0. 05	6. 1–6. 5	Low	High	Low to moderate.
Sand	SW–SM, SM	A-2, A-3	6. 3–12. 0+	0. 03–0. 05	4. 6–5. 5	Low	Low	High.
Loam	ML	A-4	0. 63–2. 0	0. 15–0. 20	4. 6–6. 0	Low	(2)	Moderate to high.
Silt loam	ML, ML–CL	A-4, A-6	0. 63–2. 0	0. 17–0. 19	5. 1–5. 5	Low	Moderate	Moderate to high.
Loamy sand	SM	A-2	0. 2–0. 63	0. 05–0. 09	4. 6–5. 0	Low	Low	High.
Sand and gravel	GM, SM	A-1, A-2	6. 3–12. 0+	0. 03–0. 06	4. 6–5. 0	Low	Low	High.
Silt loam	ML	A-4	0. 63–2. 0	0. 16–0. 20	4. 6–5. 5	Low	Moderate	High.
Silt loam	ML, CL	A-4, A-6	<0. 06	0. 06–0. 09	5. 1–6. 0	Low	Moderate	Moderate.
Silt loam	ML, CL	A-4, A-6	<0. 06	0. 06–0. 09	[6] 6. 6–7. 8	Low	Moderate	Low.
Silt loam	CL, ML–CL	A-6	0. 2–0. 63	0. 17–0. 24	4. 6–5. 6	Low	(2)	High.
Heavy silty clay loam or silty clay.	ML–CL, CH	A-6, A-7	<0. 06	0. 13–0. 17	5. 1–6. 0	Moderate to high.	High	High to moderate.
Silty clay	CH, ML–CL	A-7	<0. 06	0. 13–0. 15	[6,7] 6.6–7. 8	Moderate to high.	High	Low.
Silt loam	CL, ML–CL	A-6	0. 2–0. 63	0. 17–0. 20	4. 6–5. 0	Low	(2)	High.
Silty clay loam to silty clay.	ML–CL, CH	A-6, A-7	<0. 06	0. 16–0. 19	[7] 4. 6–7. 3	Moderate to high.	High	High to moderate.
Silty clay	CH, ML–CL	A-7	<0. 06	0. 13–0. 15	[6] 7. 4–7. 8	Moderate to high.	High	Moderate to low.
Muck	Pt		2. 0–6. 3	0. 20–0. 25	5. 1–7. 3	Low	High	Moderate.
Silty clay	ML–CL, CH	A-6, A-7	<0. 2	0. 06–0. 09	[6] 7. 4–8. 4	Moderate	High	Low.
Silt loam	ML, CL	A-4, A-6	0. 63–2. 0	0. 17–0. 22	5. 6–6. 0	Low		Moderate.
Silt loam	ML, CL	A-4, A-6	0. 63–2. 0	0. 16–0. 19	5. 6–7. 3	Low	Low	Moderate.
Silt loam	ML	A-4	2. 0–6. 3	0. 17–0. 20	4. 6–5. 5	Low		High.
Gravelly loam	SM	A-2, A-4	6. 3–12. 0	0. 12–0. 15	4. 6–5. 5	Low	Low	High.
Sand and gravel	GM, SM, GW, GP, SP	A-1, A-2	6. 3–12. 0+	0. 04–0. 07	4. 6–5. 5	Low	Low	High.
Gravelly loam	GM, SM	A-2, A-4	6. 3–12. 0	0. 12–0. 15	4. 6–5. 5	Low	Low	High.
Sand and gravel	GW, GP, GM, SP, SM	A-1, A-2	6. 3–12. 0+	0. 04–0. 07	4. 6–5. 5	Low	Low	High.
Loamy fine sand	SM	A-2, A-4	6. 3–12. 0	0. 06–0. 10	4. 6–5. 5	Low	Low	High.
Silt loam	ML–CL, CL	A-4, A-6	<0. 06	0. 08–0. 15	[6,7] 6. 1–7. 8	Low	Moderate	Low.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—			
	Seasonally high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*				
Claverack, moderately shallow variant: CnB.	1½–3	1½–3½	0–23	----------	100	85–100	70–90	20–40
			23–30	----------	100	100	90–100	85–95
			30–36	([8])	45–70	40–50	35–45	25–40
			36–50	([9])	----------	----------	----------	----------
Colonie: CoB, CoD	4	>6	0–14	----------	100	100	80–100	15–40
			14–96	----------	100	95–100	60–100	5–35
Conneaut: Ct	0–½	>6	0–27	----------	95–100	90–100	85–100	80–90
			27–70	----------	90–100	90–100	80–90	75–90
Elnora: ElB	1½–3	>6	0–33	----------	95–100	95–100	90–100	20–40
			33–64	----------	100	100	80–100	15–40
Frenchtown: Fr	0–½	>4	0–7	----------	95–100	90–100	80–90	70–90
			7–22	----------	100	100	90–100	85–95
			22–40	----------	100	75–95	60–90	55–80
			40–60	1–3	95–100	80–90	75–85	60–80
Frenchtown, sandstone substratum: Fs	0–½	3½–4	0–7	----------	95–100	90–100	80–90	70–90
			7–22	----------	100	85–100	80–90	85–95
			22–38	----------	90–100	85–100	75–90	65–80
			38–45	5–20	90–100	35–50	30–40	25–40
			45–50	([5])				
Holly: Hm	[4] 0–½	>6	0–10	----------	100	100	90–100	70–90
			10–27	----------	100	100	85–100	60–95
			27–50	----------	100	100	80–95	50–75
Hornell: HoB, HoC2, HoD2	½–3	1½–3½	0–7	----------	100	90–100	80–90	70–90
			7–20	----------	90–100	80–90	80–90	80–90
			20–26	5–10	70–90	60–75	50–75	45–70
			26–36	([1])				
Ilion: Io	0–½	>6	0–8	----------	100	100	90–100	70–90
			8–22	----------	90–100	90–100	90–100	85–95
			22–60	----------	90–100	90–100	90–100	70–90
Kingsville:								
Kf	0–½	>6	0–10	----------	100	100	70–85	40–50
			10–50	----------	100	100	75–90	20–35
Kg	0–½	>6	0–12	----------	100	100	95–100	90–95
			12–50	----------	100	100	75–90	20–35
Lobdell: Lb	[4] 1½–3	>6	0–14	----------	90–100	90–100	80–90	70–90
			14–50	----------	90–100	90–100	80–90	70–90
Mahoning, shale substratum: MsB, MsB2.	½–1½	5–8	0–12	----------	100	100	90–100	70–90
			12–48	----------	95–100	90–100	85–95	80–90
			48–90	----------	90–100	80–90	75–90	70–85
			90–100	([1])				
Orrville:								
Os	[4] ½–1½	>6	0–8	----------	95–100	90–100	75–95	65–90
			8–25	----------	95–100	90–100	75–95	65–90
			25–50	----------	90–100	90–100	80–90	60–75
Or	----------	----------	0–10	----------	100	100	75–85	20–40
			10–50	----------	100	100	85–95	60–75

properties of soils—Continued

USDA texture	Engineering classification		Range in permea-bility	Range in available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Loamy fine sand	SM	A-2, A-4	6.3-12.0	0.06-0.10	4.6-5.5	Low	Low	High.
Silty clay loam	ML, CL	A-6	0.2-0.63	0.15-0.18	4.6-5.5	Moderate	Moderate	High.
Silty clay loam	GM, GC	A-2, A-6	0.06-0.2	0.07-0.12	4.6-5.5	Low	Moderate	High.
					4.6-5.5	Low	Moderate	High.
Loamy fine sand	SM	A-2, A-4	6.3-12.0+	0.06-0.10	4.1-5.5	Low	Low	High.
Fine sands and bands of loamy fine sand.	SM, SP-SM	A-2, A-3	[10]6.3-12.0+	0.04-0.08	5.1-6.5	Low	Low	High to moderate.
Silt loam	ML, ML-CL	A-4, A-6	0.2-0.63	0.17-0.20	4.6-5.5	Low	High	High.
Silt loam	CL, ML-CL	A-6	0.06-0.2	0.07-0.12	[6,7]6.1-7.8	Low	High	Low.
Loamy fine sand	SM	A-2, A-4	6.3-12.0+	0.06-0.10	4.1-5.0	Low	Low	High.
Fine sand and loamy fine sand.	SM	A-2, A-4	6.3-12.0+	0.04-0.08	4.6-5.5	Low	Low	High.
Silt loam	ML	A-4	0.63-2.0	0.17-0.20	4.6-5.5	Low		High.
Silty clay loam	CL, CL-ML	A-4, A-6	0.63-2.0	0.14-0.17	4.6-5.5	Low	High	High.
Silt loam	ML, ML-CL	A-4	<0.2	0.06-0.10	5.1-7.3	Low	High	Low.
Silt loam	ML, ML-CL	A-4	0.2-0.63	0.06-0.10	[6]6.6-7.8	Low	High	Low.
Silt loam	ML	A-4	0.63-2.0	0.17-0.20	4.6-5.5	Low	(2)	High.
Silty clay loam	CL, CL-ML	A-4, A-6	0.63-2.0	0.14-0.17	4.6-5.0	Low	High	High.
Clay loam	ML, CL	A-4, A-6	<0.2	0.06-0.10	4.6-5.5	Low	High	High.
Very gravelly loam	SM	A-2, A-4	(11)	0.06-0.10	4.1-5.5	Low	High	High.
Silt loam	ML, CL	A-4, A-6	0.63-2.0	0.16-0.22	4.6-6.0	Low	(2)	High.
Silty clay loam	ML-CL, CL	A-6	0.2-0.63	0.14-0.19	5.6-6.0	Low to moderate.	High	Moderate.
Loam	ML	A-4	0.2-0.63	0.12-0.16	5.6-6.5	Low	High	Moderate.
Silt loam	ML	A-4	0.2-0.63	0.17-0.20	4.1-5.5	Low	(2)	High.
Silty clay	ML-CL, CH	A-7	<0.06	0.12-0.15	4.1-5.5	Moderate to high.	High	High.
Shaly silty clay loam.	SM, CL	A-4, A-6	<0.06	0.10-0.15	4.1-5.5	Moderate	High	High.
Silt loam	ML, ML-CL	A-4, A-6	0.2-2.0	0.17-0.22	6.1-6.6	Low	(2)	Low.
Silty clay loam	CL, ML-CL	A-6, A-7	0.2-0.63	0.15-0.18	6.6-7.3	Moderate	High	Low.
Silt loam	ML-CL, CL	A-6	<0.2	0.06-0.10	[6]6.6-7.8	Low	High	Low.
Fine sandy loam	SM	A-4	6.3-12.0	0.10-0.14	4.6-5.5	Low	(2)	High.
Fine sand	SM	A-2	6.3-12.0	0.04-0.06	5.1-6.0	Low	High	High.
Silty clay	ML-CL, CH	A-7	0.2-0.63	0.12-0.15	4.6-5.5	High	(2)	High.
Fine sand	SM	A-2	6.3-12.0+	0.04-0.06	5.1-6.0	Low	High	High.
Silt loam	ML, CL	A-4, A-6	0.63-2.0	0.17-0.22	5.1-6.0	Low	(2)	Moderate.
Silt loam	ML, CL	A-4, A-6	0.63-2.0	0.16-0.19	5.1-6.0	Low	Moderate	Moderate.
Silt loam	ML, ML-CL	A-4, A-6	0.63-2.0	0.16-0.19	4.6-5.5	Low	(2)	High.
Silty clay loam	CL, ML-CL	A-6, A-7	<0.06	0.16-0.18	5.1-6.0	Moderate	High	Moderate.
Shaly silty clay loam.	CL, ML-CL	A-6	<0.06	0.10-0.12	5.1-6.0	Moderate	High	Moderate.
Silt loam	ML, CL	A-4, A-6	0.63-2.0	0.17-0.20	5.1-5.5	Low	(2)	Moderate.
Silt loam	ML, CL	A-4, A-6	0.63-2.0	0.16-0.19	5.1-5.5	Low	High	Moderate.
Loam	ML	A-4	0.63-2.0	0.15-0.18	5.6-6.5	Low	High	Moderate.
Fine sandy loam	SM	A-2, A-4	0.63-2.0	0.10-0.15	5.1-5.5	Low	(2)	High.
Loam	ML	A-4	0.63-2.0	0.15-0.18	5.6-6.5	Low	High	Moderate.

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TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to— Seasonally high water table	Depth to— Bedrock	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.
	Feet	*Feet*	*Inches*	*Percent*				
Otisville: OtB, OuB, OuC, OvE (See Chenango series for Chenango part of OvE.)	>4	>6	0–12		75–100	60–85	25–50	20–35
			12–18		80–100	20–50	10–40	5–20
			18–60		50–100	10–100	10–50	5–20
Pierpont: PeB, PeB2, PeC2, PoD2 (See Platea series for Platea part of PoD2.)	1½–3	>6	0–13		100	95–100	90–100	85–100
			13–21		95–100	90–100	90–100	85–95
			21–60		95–100	90–100	80–90	70–90
Platea: PsA, PsB, PsB2, PsC, PsC2, PsC3.	½–1½	>6	0–13		90–100	95–100	90–100	85–100
			13–18		100	100	90–100	85–95
			18–60		90–100	80–90	70–90	70–90
Red Hook: RhB	½–1½	>6	0–15		95–100	85–95	75–95	65–90
			15–36		90–100	80–90	70–90	55–75
			36–54		80–90	65–75	55–70	20–30
Sheffield: Sf, Sh	0–½	>6	0–8		100	100	90–100	85–95
			8–22		100	100	90–100	85–95
			22–41		100	100	80–90	70–90
			41–60		95–100	90–100	80–90	70–90
Swanton: Sw	0–½	>6	0–11		100	100	75–85	20–40
			11–27		100	100	75–85	20–40
			27–70		100	90–100	80–90	70–90
Venango: VeA, VeB, VeB2, VeC, VeC2, VgA, VgB. (VgA and VgB have a sandstone substratum within 4 to 6 feet.)	½–1½	>6	0–9		100	90–100	75–95	60–85
			9–21		100	90–100	80–90	70–90
			21–46		100	85–100	80–90	55–80
			46–75	2–5	100	85–100	80–90	55–80
Wallington: WaA, WaB	½–1½	>6	0–7		100	100	90–100	70–90
			7–17		100	100	90–100	70–90
			17–50		100	100	90–100	70–90
			50–70		100	100	70–100	40–70
Willette: We	0–½	>6	0–24					
			24–50		100	100	100	90–100
Williamson: WlA, WlB, WlC2, WlD2	1½–3	>6	0–5		100	100	90–100	70–90
			5–22		100	100	90–100	70–90
			22–52		100	100	60–90	40–75
			52–70		100	100	70–100	50–70

[1] Shale.
[2] Corrosion not rated. Pipelines and utility lines not generally placed at these depths.
[3] Some strata of siltstone and sandstone.
[4] Subject to flooding.
[5] Sandstone.
[6] Calcareous (generally at pH 7.4–8.4).

properties of soils—Continued

USDA texture	Engineering classification		Range in permeability	Range in available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Gravelly sandy loam.	SM	A–2, A–1	6. 3–12. 0	0. 08–0. 12	4. 1–5. 0	Low	(2)	High.
Very gravelly coarse sand.	SM, SP–SM	A–2, A–1	6. 3–12. 0	0. 03–0. 06	4. 6–5. 5	Low	Low	High.
Sand and gravel	GW, GM, SW, SM	A–1, A–2	6. 3–12. 0+	0. 02–0. 06	4. 6–6. 0	Low	Low	High.
Silt loam	ML, ML–CL	A–4	0. 2–0. 63	0. 17–0. 20	4. 6–5. 5	Low	(2)	High.
Silty clay loam	ML–CL, CL	A–6	0. 2–0. 63	0. 16–0. 19	5. 1–6. 5	Moderate	Moderate	Moderate.
Silt loam	ML, CL	A–6	0. 06–0. 2	0. 06–0. 10	[6, 7] 6. 6–7. 8	Low	Moderate	Low.
Silt loam	ML	A–4	0. 2–2. 0	0. 17–0. 20	4. 1–5. 5	Low	(2)	High.
Silty clay loam	ML, CL	A–4, A–6	0. 2–0. 63	0. 16–0. 19	4. 1–5. 5	Moderate	High	High.
Silt loam	CL, ML–CL	A–6	<0. 06	0. 06–0. 10	[6, 7] 6. 6–7. 8	Low	High	Low.
Silt loam	ML, ML–CL	A–4	0. 63–2. 0	0. 17–0. 19	4. 6–5. 5	Low	(2)	High.
Loam	ML	A–4	0. 06–0. 2	0. 15–0. 18	4. 6–5. 5	Low	High	High.
Gravelly sandy loam.	SM	A–1, A–2	2. 0–6. 3+	0. 04–0. 08	4. 6–5. 5	Low	High	High.
Silt loam	ML, ML–CL	A–4	0. 2–0. 63	0. 17–0. 20	4. 6–5. 5	Low	(2)	High.
Silt loam	ML, CL	A–4, A–6	0. 2–0. 63	0. 17–0. 19	4. 6–5. 5	Low to moderate.	High	High.
Silt loam	ML, CL	A–4, A–6	<0. 06	0. 06–0. 10	5. 6–7. 3	Low	High	Moderate.
Silt loam	ML–CL, CL	A–6	<0. 06	0. 06–0. 10	[6] 7. 4–8. 4	Low	High	Low.
Fine sandy loam	SM	A–4, A–2	0. 63–2. 0	0. 10–0. 15	4. 6–5. 5	Low	(2)	High.
Fine sandy loam	SM	A–4, A–2	0. 63–2. 0	0. 10–0. 15	5. 1–6. 5	Low	High	Moderate.
Silt loam	CL, ML–CL	A–6	<0. 06	0. 06–0. 10	[6, 7] 6. 1–7. 8	Low	High	Low.
Silt loam	ML	A–4	0. 63–2. 0	0. 17–0. 20	4. 1–5. 5	Low		High.
Silt loam	CL, ML–CL	A–4, A–6	0. 2–0. 63	0. 14–0. 17	4. 1–5. 5	Low	High	High.
Silt loam	ML, ML–CL	A–4	<0. 06	0. 06–0. 10	[7] 5. 6–7. 3	Low	High	Moderate to low.
Silt loam	ML–CL, CL	A–4, A–6	<0. 06	0. 06–0. 10	[6] 7. 4–8. 4	Low	High	Low.
Silt loam	ML	A–4	0. 63–2. 0	0. 17–0. 22	4. 1–5. 5	Low	(2)	High.
Silt loam	ML	A–4	0. 2–0. 63	0. 16–0. 19	4. 1–5. 5	Low	High	High.
Silt loam	ML, CL	A–4, A–6	<0. 2	0. 06–0. 10	5. 1–6. 0	Low	High	Moderate.
Stratified silt loam, sandy loam, and loamy sand.	SM, ML	A–4, A–6	<0. 2	0. 06–0. 10	5. 1–6. 5	Low	High	Moderate to low.
Muck	Pt		(11)	0. 20–0. 25	5. 1–5. 5	Low	High	High.
Silty clay or clay	CH, ML–CL	A–7	<0. 2	0. 05–0. 10	[6] 6. 1–7. 8	Moderate	High	Low.
Silt loam	ML	A–4	0. 2–2. 0	0. 17–0. 22	4. 1–5. 5	Low	(2)	High.
Silt loam	ML	A–4	0. 2–0. 63	0. 16–0. 19	4. 1–5. 5	Low	Moderate	High.
Loam or fine sandy loam.	ML, SM	A–4, A–6	<0. 2	0. 06–0. 10	4. 6–6. 0	Low	Moderate	High to moderate.
Silt loam, silty clay loam or sandy loam.	ML, CL	A–4, A–6	<0. 2	0. 06–0. 10	[7] 5. 1–7. 3	Low	Moderate	Moderate to low.

[7] pH increases with depth.
[8] Thin strata of siltstone and sandstone make up 45 to 70 percent of material.
[9] Interbedded shale, siltstone, and sandstone.
[10] Permeability 2.0–6.3 in the bands.
[11] Variable.

TABLE 6.—*Engineering*

[Beaches (Be), Gravel and sand pits (Gp), Made land (Ma),

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location
					Solum	Substratum	
Allis: As	Poor: 24 to 40 inches to shale; seasonal high water table.	High	Fair: low productivity; limited suitable material.	Not suitable	Poor: clayey layer in subsoil.	Poor: clay shale, siltstone, and sandstone.	24 to 40 inches to shale; poorly drained; seasonal high water table; clayey material; medium to high compressibility.
Atherton: At	Poor: seasonal high water table.	High	Good to depth of 18 inches.	Fair below 3 feet; dirty sand and gravel.	Fair: chiefly medium texture.	Good: sand and gravel.	Seasonal high water table.
Braceville: BrA, BrB, BrC2.	Fair when not saturated.	Moderate	Fair to good to depth of 20 inches; some pebbles.	Fair below depth of 3½ feet; moderate content of fine sand.	Fair: chiefly medium texture.	Good: sand and gravel.	Seasonal high water table; moderately well drained.
Cambridge: CaB, CaB2, CaC, CaC2, CaD2.	Poor: seasonal high water table.	Moderate to high.	Good to depth of 24 inches.	Not suitable	Fair: medium texture.	Fair: medium texture.	Seasonal high water table; very slow permeability; seepage on fragipan.
CbB, CbC2	Poor: seasonal high water table.	Moderate	Good to depth of 24 inches.	Not suitable	Fair: medium texture.	Poor: sandstone at depth of 4 to 5 feet.	Seasonal high water table; sandstone in cuts; seepage on fragipan.
Canadice: Cc, CeA (See Caneadea series for Caneadea part of CeA.)	Poor: seasonal high water table; moderately fine to fine textured material.	High	Fair: limited suitable material over clayey material.	Not suitable	Poor: moderately fine to fine texture.	Poor: clayey.	Seasonal high water table; unstable material; very slow permeability; medium to high compressibility.

See footnotes at end of table.

interpretations of the soils

Quarries (Qu), and Riverwash (Rw) are not rated in this table]

Soil features affecting—Continued						
Pipeline [1] construction and maintenance	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [2]				
24 to 40 inches to acid shale; poorly drained; clayey subsoil.	24 to 40 inches to shale.	24 to 40 inches to shale; fair to poor stability and compaction; medium to high compressibility; good resistance to piping.	Poorly drained; seasonal high water table; 24 to 40 inches to shale; slowly permeable.	Poorly drained; 24 to 40 inches to shale; limited intake rate; seasonal high water table.	Nearly level; poorly drained.	24 to 40 inches to shale; nearly level; poorly drained.
Sand and gravel below depth of of 3 feet; poorly drained; seasonal high water table.	Seasonal high water table; pervious substratum.	Fair to good compaction and stability; high to moderate permeability; susceptible to piping; pervious substratum.	Poorly drained; seasonal high water table; ditchbanks subject to slumping; outlets may be a problem.	Moderate infiltration and slow permeability; seasonal high water table; low to medium available moisture capacity.	Nearly level; poorly drained.	Nearly level; poorly drained.
Moderately well drained; sand and gravel below depth of 3 feet; seasonal high water table.	Seasonal high water table; high seepage potential in pervious substratum.	Fair compaction and stability; moderate to high seepage potential; subject to piping.	Moderately well drained; moderately slow permeability.	Moderately slow infiltration and permeability.	Nearly level to sloping; slopes are commonly short; subject to seepage.	Nearly level to sloping; subject to seepage and erosion.
Dense fragipan in subsoil; moderately well drained; seepage on fragipan.	Low seepage potential.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair resistance to piping.	Moderately well drained; very slow permeability; fragipan in subsoil.	Moderately deep root zone; very slow permeability.	Gently sloping to moderately steep; channels subject to erosion and seepage.	Gently sloping to moderately steep; erosion on slopes; subject to seepage.
Sandstone at depth of 4 to 5 feet; fragipan in subsoil; moderately well drained.	Sandstone at depth of 4 to 5 feet.	Fair stability; fair compaction; moderate to low seepage; low to medium compressibility; fair resistance to piping.	Very slow permeability; fragipan in subsoil; sandstone at depth of 4 to 6 feet.	Moderately deep root zone; very slow permeability.	Channels are erodible; subject to seepage.	Channels are erodible; subject to seepage.
Poorly drained; moderately fine textured to fine textured; seasonal high water table.	Low seepage potential; seasonal high water table.	Fair to poor stability and compaction; low seepage potential; subject to slips and cracking; medium to high compressibility; good resistance to piping.	Poorly drained; seasonal high water table; very slowly permable.	Slow infiltration and very slow permeability; seasonal high water table.	Nearly level slopes; prolonged wetness in channels; poorly drained.	Nearly level slopes; prolonged wetness in channels; poorly drained; moderately fine to fine material.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location
					Solum	Substratum	
Canadice, mucky variants: Cd.	Poor: seasonal high water table; moderately fine to fine textured material.	High	Fair: limited suitable material over clayey material.	Not suitable	Poor: moderately fine to fine texture.	Poor: clayey.	Seasonal high water table; unstable material; very slow permeability; medium to high compressibility.
Caneadea: CfA, CfB, CfC2, CfD2.	Poor: seasonal high water table.	High	Fair: limited suitable material.	Not suitable	Poor: moderately fine to fine texture.	Poor: clayey.	Seasonal high water table; unstable material; medium to high compressibility; very slow permeability.
Carlisle: Cg	Poor: organic soil material; commonly saturated.	High	Poor if used alone; good if blended with mineral material.	Not suitable	Not suitable; organic soil material.	Fair to poor: medium to moderately fine texture.	Organic soil material; high water table; unstable material; subject to subsidence.
Chagrin: Ch	Fair: subject to flooding.	Moderate	Good	Not suitable	Fair: medium texture.	Fair: medium texture.	Subject to flooding.
Chenango: CkA, CkB, CkC2, CkD2, ClA, ClB, ClC2.	Good: well drained; gravelly and sandy material.	Low	Poor for gravelly soils; fair for nongravelly soils.	Good below depth of 4 feet; generally clean sand and gravel.	Fair to good: loamy or gravelly material.	Good: mixed sand and gravel.	Droughty sand and gravel in cuts; stable material; well drained.
Claverack, silty subsoil variant: CmA, CmB, CmC.	Fair in upper 1½ to 3 feet when not saturated; poor below depth of 1½ to 3 feet; silty; moderately well drained.	Moderate	Poor: sandy.	Not suitable	Fair to good: sandy material.	Fair to poor: medium textured to moderately fine textured material.	Seasonal high water table; very slow permeability.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline [1] construction and maintenance	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [2]				
Poorly drained; moderately fine to fine texture; seasonal high water table.	Low seepage potential; seasonal high water table.	Fair to poor stability and compaction; low seepage potential; subject to slips and cracking; medium to high compressibility; good resistance to piping.	Poorly drained; seasonal high water table; very slowly permeable.	Slow infiltration and very slow permeability; seasonal high water table.	Nearly level; prolonged wetness in channels; poorly drained.	Nearly level; prolonged wetness in channels; poorly drained; moderately fine to fine texture.
Somewhat poorly drained; seasonal high water table; moderately fine to fine texture.	Low seepage potential; seasonal high water table.	Fair to poor compaction and stability; low seepage potential; medium to high compressibility; subject to cracking.	Somewhat poorly drained; seasonal high water table; very slowly permeable.	Slow infiltration and very slow permeability; seasonal high water table.	Nearly level to moderately steep; erodible channels; prolonged seepage.	Nearly level to moderately steep; erodible channels; prolonged seepage.
40 inches or more organic material over clayey material; high water table; muck is unstable.	Organic soil material; high water table; subject to seepage.	Organic soil material; not suitable for embankment.	Organic soil material; unstable and subject to subsidence if drained.	Organic soil material; nearly level; high available moisture capacity; rapid infiltration.	Organic soil material; nearly level.	Organic soil material; nearly level.
Subject to flooding; subject to caving.	Subject to flooding; subject to excessive seepage in areas where substratum has sandy layers.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair resistance to piping; possible pervious layers in substratum.	Well drained; subject to flooding; moderately permeable.	Moderate infiltration and permeability; high available moisture capacity; nearly level.	Nearly level; commonly receives surface runoff from adjacent higher land.	Nearly level; well drained; subject to flooding.
Sandy and gravelly; subject to caving; well drained.	Permeable: high seepage potential.	Permeable soil material; high seepage potential; fair to good stability and compaction; slight compressibility; sandy material subject to piping.	Well drained; ditch walls tend to be unstable.	Moderate to rapid infiltration and permeability; low available moisture capacity.	Irregularly shaped slopes; channels are apt to be gravelly and droughty.	Low available moisture capacity for plant cover; erodible on slopes.
Moderately well drained; upper sandy material is subject to caving.	Upper 1½ to 3 feet sandy and rapidly permeable; underlying material slowly permeable.	Fair compaction and stability; potential seepage in upper 1½ to 3 feet; subject to piping; substratum has medium compressibility.	Moderately well drained; ditch walls tend to be unstable; slow permeability in substratum.	Good intake rate; low available moisture capacity.	Nearly level to sloping; slopes generally short; sandy; erodible material.	Nearly level to sloping; channels are erodible and droughty.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Suitability as source of— Sand and gravel	Road fill: Solum	Road fill: Substratum	Soil features affecting— Highway location
Claverack, moderately shallow variant: CnB.	Fair in upper part; shale and sandstone within depth of 1½ to 3½ feet.	Moderate	Poor: sandy.	Not suitable	Fair: sandy and moderately fine texture.	Poor: shale and sandstone bedrock.	1½ to 3½ feet to shale and sandstone bedrock; moderately well drained.
Colonie: CoB, CoD	Good: well drained; sandy.	Low	Poor; sandy material; low in organic content.	Good source of sand; not suitable for gravel.	Good: sandy.	Good: sandy.	Cut areas are sandy and droughty; well drained; slopes are erodible and unstable.
Conneaut: Ct	Poor: seasonal high water table.	High	Good to depth of 24 inches: low organic-matter content.	Not suitable	Fair to poor: medium to moderately fine textured.	Fair to poor: medium to moderately fine textured.	Seasonal high water table; silty and poor stability to depth of 1 to 3 feet; poorly drained.
Elnora: ElB	Good: sandy.	Low	Poor: sandy; low organic-matter content.	Good source of sand; not suitable for gravel.	Good: sandy.	Good: sandy.	Seasonal high water table; loose, sandy substratum that is stable if confined.
Frenchtown:							
Fr	Poor: seasonal high water table.	High	Fair: limited suitable material; low organic-matter content.	Not suitable	Fair to poor: medium to moderately fine textured.	Fair: medium textured.	Seasonal high water table; fragipan in subsoil; slowly to very slowly permeable; seepage on fragipan.
Fs	Poor: seasonal high water table.	High	Fair: low organic-matter content.	Not suitable	Poor: silty	3½ to 4 feet to bedrock.	3½ to 4 feet to bedrock; seasonal high water table; slowly to very slowly permeable.
Holly: Hm	Poor: subject to flooding; seasonal high water table.	High	Good to depth of 12 inches.	Not suitable	Fair to poor: moderately fine texture.	Fair: loamy material.	Subject to flooding; seasonal high water table; soft and compressible when wet.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline [1] construction and maintenance	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [2]				
1½ to 3½ feet to acid shale and sandstone; sandy upper part is subject to caving.	1½ to 3½ feet to shale and sandstone bedrock.	1½ to 3½ feet to shale and sandstone bedrock; moderate seepage potential in upper part.	1½ to 3½ feet to shale and sandstone bedrock.	Low available moisture capacity; rapid intake rate.	1½ to 3½ feet to shale and sandstone bedrock; slopes generally short.	1½ to 3½ feet to shale and sandstone bedrock; erodible on slopes.
Well drained; acid, sandy soil; subject to caving.	Sandy material that has high seepage potential.	Fair compaction and stability; high seepage slight compressibility; poor resistance to piping.	Well drained; moderately rapid to rapid permeability.	Rapid intake rate; very low available moisture capacity.	Gently sloping to moderately steep; channels and berms are droughty; erodible on slopes.	Gently sloping to moderately steep; droughty, sandy material; erodible on slopes.
Poorly drained; unstable silty material in upper 1 to 3 feet.	Low seepage potential.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair to poor resistance to piping.	Poorly drained; seasonal high water table; slowly permeable; ditch walls tend to collapse; outlets may be a problem.	Slow infiltration and permeability; seasonal high water table.	Nearly level; channels are erodible; poorly drained.	Nearly level; subject to severe silting.
Moderately well drained; subject to caving; seasonal high water table; acid sand.	Sandy material that has high seepage potential.	Fair compaction and stability; high seepage potential; slight compressibility; poor resistance to piping.	Moderately well drained; rapidly permeable.	Rapid intake rate and permeability; low available moisture capacity.	Gently sloping; loose sandy substratum; channels and berms are droughty.	Nearly level to gently sloping; loose sandy substratum.
Seasonal high water table; dense fragipan in subsoil; seepage on pan.	Low seepage potential.	Fair to poor stability and compaction; moderate to low seepage potential; medium compressibility; fair resistance to piping.	Poorly drained; seasonal high water table; slowly to very slowly permeable in fragipan.	Slow to very slow infiltration and permeability; seasonal high water table.	Nearly level; likely to be wet in channels; difficult to vegetate.	Nearly level; likely to be wet in channels; difficult to vegetate.
3½ to 4 feet to bedrock; seasonal high water table.	3½ to 4 feet to bedrock.	3½ to 4 feet to bedrock; soil material has fair compaction and stability; medium compressibility and fair resistance to piping.	Sandstone at depth of 3½ to 4 feet; slowly to very slowly permeable.	Very slow to slow infiltration and permeability; seasonal high water table.	Nearly level; 3½ to 4 feet to bedrock; wet in channels; difficult to vegetate.	Nearly level; 3½ to 4 feet to bedrock; wet in channels; difficult to vegetate.
Subject to flooding.	Subject to flooding.	Fair compaction and stability; low seepage potential; medium compressibility; fair resistance to piping.	Poorly drained; seasonal high water table; subject to flooding; outlets may be a problem.	Subject to flooding; moderate infiltration and moderately slow permeability.	Nearly level; subject to flooding.	Nearly level; subject to flooding.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location
					Solum	Substratum	
Hornell: HoB, HoC2, HoD2.	Poor: 1½ to 3½ feet to shale; seasonal high water table.	Moderate to high.	Fair to poor: limited suitable material.	Not suitable	Poor: 1½ to 3½ feet to clay shale bedrock.	Poor: clay shale bedrock.	1½ to 3½ feet to shale; seasonal high water table; moderately fine and fine texture; very slow permeability.
Ilion: Io	Poor: seasonal high water table.	High	Good to a depth of 10 inches, fair to 20 inches.	Not suitable	Fair to poor: moderately fine texture.	Fair to poor: moderately fine texture.	Seasonal high water table; soft, unstable material; poorly drained; slow to very slow permeability.
Kingsville: Kf, Kg	Poor: seasonal high water table.	Moderate for Kf; high for Kg.	Fair for Kf: low productivity; poor for Kg: clayey surface.	Fair for sand; sand dirty; not suitable for gravel.	Poor: sandy material that flows.	Poor: sandy material that flows.	Seasonal high water table; loose, sandy substratum flows when wet; nearly level.
Lobdell: Lb	Poor: subject to flooding; seasonal high water table.	Moderate	Good to a depth of 36 inches.	Not suitable	Fair: medium texture.	Fair: medium texture.	Subject to flooding.
Mahoning: MsB, MsB2	Poor: seasonal high water table.	High	Fair: thin suitable material.	Not suitable	Poor: moderately fine texture.	Poor: moderately fine texture; shale at depth of 5 to 8 feet.	Seasonal high water table; 5 to 8 feet to shale bedrock; very slowly permeable.
Orrville: Or, Os (Locally, Orrville soils have shale bedrock within a 50-inch depth.)	Poor: subject to flooding; seasonal high water table.	High	Good to depth of 24 inches.	Not suitable	Fair: medium texture.	Fair: medium texture.	Subject to flooding; seasonal high water table.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline [1] construction and maintenance	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [2]				
1½ to 3½ feet to acid shale; moderately fine to fine texture; somewhat poorly drained.	1½ to 3½ feet to shale bedrock.	1½ to 3½ feet to shale bedrock; limited material for embankments; subject to cracking.	1½ to 3½ feet to shale bedrock; seasonal high water table; very slow permeability.	1½ to 3½ feet to shale bedrock; very slowly permeable.	1½ to 3½ feet to shale bedrock; subject to seepage.	1½ to 3½ feet to shale bedrock; subject to seepage.
Poorly drained; seasonal high water table.	Low seepage potential; seasonal high water table.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair resistance to piping; subject to cracking.	Poorly drained; seasonal high water table; slow to very slow permeability; outlets may be a problem.	Slow to very slow infiltration and permeability; seasonal high water table; medium available moisture capacity.	Nearly level; wet in channels.	Nearly level; wet in channels.
Poorly drained fine sand flows when wet; unstable ditch walls.	Sandy substratum has high seepage potential; seasonal high water table.	Poor to fair compaction and stability; high seepage potential; subject to piping.	Poorly drained; seasonal high water table; loose, sandy substratum flows when wet.	Seasonal high water table; poorly drained.	Nearly level; loose, sandy substratum; wet in channels.	Nearly level; loose, sandy substratum; wet in channels.
Subject to flooding.	Subject to flooding; subject to seepage where substratum contains sandy layers.	Fair to poor compaction and stability; moderate seepage potential; fair resistance to piping.	Moderately well drained; subject to flooding.	Subject to flooding; seasonal high water table; high available moisture capacity; moderate permeability.	Nearly level; commonly subject to surface runoff from adjacent higher land; subject to flooding.	Nearly level; subject to flooding.
Seasonal high water table; shale at depth of 5 to 8 feet; moderately fine texture.	Shale bedrock at depth of 5 to 8 feet; low seepage.	Fair compaction and stability; very slow permeability; medium compressibility; good resistance to piping; 5 to 8 feet to shale.	Very slow permeability; seasonal high water table.	Seasonal high water table; slow to medium intake rate; very slowly permeable.	Slopes commonly short; channels are difficult to vegetate; somewhat poorly drained.	Channels are difficult to vegetate; somewhat poorly drained.
Subject to flooding; seasonal high water table; subject to caving.	Subject to flooding; subject to excessive seepage where substratum contains sandy layers.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair to poor resistance to piping.	Somewhat poorly drained; subject to flooding; outlets may be a problem.	Moderately slow permeability; subject to flooding; high available moisture capacity.	Nearly level; somewhat poorly drained; subject to flooding.	Nearly level; somewhat poorly drained; subject to flooding.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location
					Solum	Substratum	
Otisville: OtB, OuB, OuC, OvE. (See Chenango series for Chenango part of OvE.)	Good: well drained; gravelly and sandy material.	Low	Poor: sandy and gravelly.	Good for for sand and gravel.	Good: sandy and gravelly.	Good: sandy and gravelly.	Cut areas are coarse textured and droughty; well drained.
Pierpont: PeB, PeB2, PeC2, PoD2. (See Platea series for Platea part of PoD2.)	Poor: seasonal high water table; silty.	Moderate	Good to depth of 12 inches.	Not suitable	Fair to poor: moderately fine texture.	Fair: medium texture.	Seasonal high water table; fragipan in subsoil; erodible on cut slopes; seepage on fragipan.
Platea: PsA, PsB, PsB2, PsC, PsC2, PsC3.	Poor: seasonal high water table.	High	Good to depth of 12 inches.	Not suitable	Fair to poor: moderately fine texture.	Fair: medium texture.	Seasonal high water table; dense fragipan in subsoil; very slow permeability; seepage on fragipan.
Red Hook: RhB	Poor: seasonal high water table.	High	Good to depth of 15 inches.	Fair to poor for sand; generally high in fine material; poor to not suitable for gravel.	Fair: medium texture.	Good: sandy and gravelly.	Seasonal high water table; gently sloping.
Sheffield: Sf, Sh	Poor: seasonal high water table.	High	Good to depth of 22 inches.	Not suitable	Fair to poor: medium to moderately fine texture.	Fair: medium texture.	Seasonal high water table; fragipan in subsoil; poorly drained; seepage on fragipan.
Steep land, loamy: Sm	Fair when not saturated; steep slopes.	Variable	Poor: steep slopes.	Not suitable	Fair: loamy; steep slopes.	Fair: loamy; steep slopes.	Steep slopes

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline [1] construction and maintenance	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [2]				
Well drained; sandy and gravelly.	Permeable material; high seepage losses; fair to good compaction and stability.	Mostly permeable material; high seepage potential.	Well drained	Rapid infiltration and permeability; very low available moisture capacity.	Commonly has irregularly shaped slopes; channels and berms are droughty.	Very low available moisture capacity; droughty material; erodible on slopes.
Moderately well drained; dense fragipan in subsoil; seepage on fragipan.	Low seepage potential.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair resistance to piping.	Moderately well drained; slow permeability; fragipan in subsoil.	Slow permeability; medium available moisture capacity; moderate intake rate.	Gently sloping to moderately steep; channels are erodible.	Gently sloping to moderately steep; channels are erodible.
Somewhat poorly drained; seasonal high water table; dense fragipan in subsoil; seepage on fragipan.	Low seepage potential; seasonal high water table.	Fair compaction and stability; low seepage potential; medium compressibility; fair resistance to piping.	Somewhat poorly drained; seasonal high water table; very slow permeability; fragipan in subsoil.	Very slow infiltration and permeability; seasonal high water table; medium available moisture capacity.	Nearly level to sloping; erodible on slopes; prolonged seepage on fragipan.	Nearly level to sloping; erodible on slopes; prolonged seepage on fragipan.
Sandy and gravelly substratum; subject to caving; seasonal high water table.	Moderate to high seepage potential; substratum is permeable.	Mostly permeable material; moderate to high seepage potential; fair to poor stability and compaction; medium compressibility; poor resistance to piping.	Somewhat poorly drained; seasonal high water table; slow permeability; ditch walls are unstable.	Moderate infiltration and slow permeability; seasonal high water table; medium available moisture capacity.	Gently sloping; prolonged wetness.	Gently sloping; prolonged wetness.
Poorly drained; fragipan in subsoil; seepage on fragipan.	Low seepage potential.	Fair compaction and stability; low seepage potential; medium compressibility; fair to poor resistance to piping.	Poorly drained; seasonal high water table; very slow permeability.	Very slow infiltration and permeability; seasonal high water table.	Nearly level; poorly drained; prolonged wetness.	Nearly level; poorly drained; prolonged wetness.
Steep slopes; subject to slips.	(3)	(3)	(3)	(3)	(3)	(3).

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill: Solum	Road fill: Substratum	Soil features affecting— Highway location
Steep land, silty and clayey: Sn.	Poor: wet for long periods; dries slowly.	High	Poor: high clay content.	Not suitable	Poor: silty and clayey material.	Poor: silty and clayey material.	Steep slopes; soft and unstable material; subject to slippage.
Swanton, silty subsoil variant: Sw. (Locally, there are areas underlain by shale within 40 inches of the surface.)	Poor: seasonal high water table.	High	Good to depth of 20 inches.	Not suitable	Fair: loamy.	Fair to poor: medium to moderately fine texture; shale within 40 inches of the surface in some areas.	Seasonal high water table; subsoil soft and unstable when wet; poorly drained; shale within 40 inches of the surface in some places.
Venango: VeA, VeB, VeB2, VeC, VeC2, VgA, VgB. (VgA and VgB have a sandstone substratum within 4 to 6 feet of the surface.)	Poor: seasonal high water table.	High	Good to depth of 20 inches.	Not suitable	Fair: medium texture.	Fair: medium texture.	Seasonal high water table; fragipan in subsoil; very slowly permeable; seepage on fragipan.
Wallington: WaA, WaB	Poor: seasonal high water table.	High	Good to depth of 20 inches.	Not suitable	Fair to poor: medium to moderately fine texture.	Fair: loamy.	Seasonal high water table; soft, compressible material; very slowly permeable; somewhat poorly drained.
Willette: We	Poor: organic soil material; commonly saturated.	High	Poor is used alone; good if blended with mineral soil.	Not suitable	Not suitable: organic soil material.	Poor: moderately fine to fine texture.	Unstable; organic soil material; subject to subsidence.
Williamson: WlA, WlB, WlC2, WlD2.	Poor: seasonal high water table.	High	Good to depth of 20 inches.	Not suitable	Fair: medium texture.	Fair to poor: medium to moderately fine texture.	Seasonal high water table; soft and compressible when wet; slow or very slow permeability.

[1] Corrosion potential rated on table 5.
[2] Features listed also apply to low dikes and levees.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline [1] construction and maintenance	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [2]				
Steep slopes; subject to slips.	(3)	(3)	(3)	(3)	(3)	(3).
Poorly drained; seasonal high water table; sandy material over silt loam subsoil and substratum; shale within 40 inches of the surface in some places.	Silty material in substratum; shale within 40 inches of the surface locally; seasonal high water table.	Fair compaction and stability; moderate seepage potential; subject to piping; medium compressibility.	Poorly drained; seasonal high water table; very slow permeability below 2 feet.	Moderately rapid infiltration and permeability in upper 2 feet; seasonal high water table; medium available moisture capacity.	Nearly level; subject to prolonged wetness.	Nearly level; subject to prolonged wetness.
Seasonal high water table; dense fragipan in subsoil; seepage on fragipan.	Low seepage potential; seasonal high water table; sandstone within 4 to 6 feet of the surface in VgA, VgB.	Fair compaction and stability; moderate to low seepage potential; medium compressibility; fair to poor resistance to piping.	Poorly drained; seasonal high water table; very slowly permeable; fragipan in subsoil.	Very slow infiltration and permeability; seasonal high water table.	Nearly level to sloping areas; subject to seepage and prolonged wetness; erodible on slopes.	Nearly level to sloping areas; subject to seepage and prolonged wetness; erodible on slopes.
Dense fragipan in subsoil; somewhat poorly drained; seepage on fragipan; seasonal high water table.	Low seepage potential; seasonal high water table.	Fair compaction and stability; low seepage potential; medium compressibility; fair to poor resistance to piping.	Somewhat poorly drained; seasonal high water table; slowly to very slowly permeable.	Slow to very slow infiltration and permeability; seasonal high water table; medium available moisture capacity.	Nearly level to gently sloping; subject to prolonged wetness.	Nearly level to gently sloping; subject to prolonged wetness.
Thin organic material over clayey material; very poorly drained.	Organic soil material; high water table; subject to seepage.	Organic soil material; high seepage losses in muck; substratum has fair to poor stability and compaction; subject to cracking.	Organic soil material; water table control is needed to control subsidence; slowly or very slowly permeable.	Moderate infiltration and slow or very slow permeability; high available moisture capacity.	Organic soil material; nearly level.	Organic soil material; nearly level.
Dense fragipan in subsoil; seasonal high water level; seepage on fragipan.	Low seepage potential.	Fair to poor compaction and stability; low seepage potential; subject to piping; medium compressibility.	Moderately well drained; slow or very slow permeability; fragipan.	Moderately slow infiltration and slow or very slow permeability; medium available moisture capacity.	Nearly level to moderately steep; severely erodible channels.	Nearly level to moderately steep; severely erodible channels.

[3] Not generally used for this purpose.

Engineering classification systems

Two engineering classification systems are used in this survey. One is the system adopted by the American Association of State Highway Officials (AASHO) (*2*). In this system soil materials are classified in seven groups based on load capacity and service. The best soil materials for road subgrade are classified as A–1, and the poorest are classified as A–7. Within each group the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification for tested soils, with index numbers in parentheses, is shown in table 4. Also shown in table 4 is the modified AASHO classification used by the Ohio Department of Highways Testing Laboratory. The estimated classification for all soils mapped in the county is given in table 5.

Some engineers prefer to use the Unified Soil Classification System (*18*). In this system soil materials are classified on the basis of particle-size distribution, plasticity, liquid limit, and organic matter. Soil materials are classified in one of 15 classes. Eight classes represent coarse-grained material, six classes represent fine-grained material, and one class represents highly organic soils. By this system an approximate classification of soils can be made in the field.

Engineering test data

Samples from eight soil profiles in Ashtabula County were tested according to standard procedures to help evaluate the soils for engineering purposes. The results of these tests are shown in table 4. Explanation of some of the columns in table 4 is required.

Moisture-density.—If a soil material is compacted successively at higher moisture content, assuming that the compaction effort remains constant, the density of the 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 called *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.

Mechanical analysis.—This analysis was made by combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method are not used in naming textural classes for soil classification.

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

Estimated engineering properties

Table 5 provides estimates of soil properties important to engineering. The estimates are based on field classification and descriptions, on physical and chemical tests of representative samples, on test data from comparable soils in adjacent counties, and on detailed experience in working with the soils in the survey area. Additional information about the soils is given in the section headed "Descriptions of the Soils". Some reference to geology is in the sections "Formation and Classification of the Soils" and "General Facts about the County".

The estimated properties shown in table 5 are based on the soil test data in table 4 and on test data from the same kinds of soil in other counties. The following paragraphs briefly describe the columns shown on table 5.

Depth to seasonally high water table.—Listed is the shallowest depth to which free water rises at least once a year, generally during winter and early in spring. Soil conditions immediately after heavy precipitation are not considered. In all soils, particularly sloping ones on uplands, the depth to the water table is generally greater late in spring and in summer and fall than is indicated in this column.

Depth to bedrock.—The estimated depth to bedrock is based on observations made during the survey. From place to place, the depth to bedrock may vary considerably. The normal depth of observation of the soils is 5 feet. Occurrence of bedrock within 5 feet is noted in table 5.

Depth from surface.—The depths given in this column correspond to significant differences in texture in the profile described as representative of the soil series. Soil phases that have a profile different from the representative profile may have properties that vary from those shown.

Percentage passing sieve.—These columns show estimated particle-size distribution according to sieves of standard size.

USDA texture.—The textures indicated correspond to the textures given in the technical description of each representative soil profile.

Engineering classification.—The estimated classification of each soil layer shown is based on actual test data from this county and other survey areas. The section "Engineering Classification Systems" describes the Unified and AASHO systems.

Range in permeability.—The permeability values are estimates of the range in rates of the downward movement of water in the major soil horizons when they are saturated above the true water table and allowed to drain freely. The estimates are based on soil texture, soil structure, porosity, permeability and infiltration tests, and field experience with drainage. In any soil, percolation through the surface layer varies according to land use, soil management, and content of moisture at the time more moisture or water is added.

Range in available water capacity.—Available water capacity is a measure of the capacity of soils to hold water available for use by plants. In compact glacial till and fragipans this capacity is lower than normal for a given texture because the increased bulk density of such layers reduces penetration of plant roots. As a result, some of the water stored is not available to plant roots.

Reaction.—The pH ranges given in this column represent a summary of the many field determinations made during the survey. Soil reaction is defined in the Glossary.

Shrink-swell potential.—The estimated shrink-swell potential indicates the volume change to be expected when the moisture content of the soil changes. Soil materials rated high have serious limitations if used for building foundation backfill, highway location, and other engineering purposes.

Corrosion potential.—The corrosion potential indicated for uncoated steel is based on soil texture, soil drainage, and acidity. Electrical resistivity is not considered in this rating. The corrosion potential for concrete is based on soil texture and pH values. The ratings given are for average concrete and do not apply to concrete that is mixed specifically for corrosion resistance.

Engineering interpretations of the soils

Table 6 contains information that will help engineers and others whose work involve soil mechanics or soil engineering data. Interpretations for other selected uses that require engineering are shown in table 7. The interpretations in table 6 are based on the test data in table 4, the estimated data in table 5, and field experience. Explanations of the column headings in table 6 follow.

Suitability for winter grading.—Because of wetness, plasticity, or susceptibility to frost action, many of the soils are not adapted to grading during parts of winter. Such soils are rated as poor.

Susceptibility to frost action.—The soils most susceptible to frost action are those that have a high content of fines (silt and clay) and are wet most of the winter. Such soils are rated high.

Suitability as source of topsoil.—The thickness, texture, and natural fertility of the surface layer determine the suitability of a soil for use as topdressing for road banks and embankments so that the growth of vegetation is promoted. Except as noted otherwise, only the surface layer of the soil is considered in this rating.

Sand and gravel.—This column gives information about the soils as a possible source of sand and gravel for construction purposes. It should not be assumed that, for a soil rated good, all areas of the soil can be used to obtain commercial sand or gravel. A soil rated good has better possibilities for obtaining sand or gravel than soils rated poor or fair.

Road fill.—This column rates the soil material of the solum (surface layer and subsoil) and of the substratum. Road fill is subgrade material that is used to support the subbase and base, or surface course. Soil properties considered in making the ratings are soil texture and its affect on compressibility, shrink-swell potential, and susceptibility to frost action. Also considered is the presence of bedrock.

Soil features affecting.—The following paragraphs explain the columns under this heading.

Highway location.—Soil features that affect highway location include texture, shallow depth to rock, a high water table, steep slopes, susceptibility to slippage, and the hazard of flooding.

Pipeline construction and maintenance.—Soil features that affect pipelines are depth to hard bedrock, soil stability, and natural drainage. Corrosion potential for steel and concrete is rated on table 5.

Farm ponds.—For entries under the subheading "Reservoir area," consideration is given primarily to the sealing potential of the soil, but shallowness to bedrock and the susceptibility to overflow in flood plains are also considered. Under the subheading "Embankment," the entries relate to the stability and permeability of the materials that are used in the construction of pond embankments. The permeability noted in this column is for the soil material that is compacted when moisture content is optimum. The information in this column also applies to dikes and levees.

Agricultural drainage.—Among the soil features listed are natural drainage, permeability of the soil in place, stability of ditchbanks, and the presence of a seasonal high water table.

Irrigation.—If they are limiting features, the rates that water normally infiltrates into, percolates through, and drains for each of the soils is noted. Also noted is available moisture capacity of the soils and other features if they limit use for irrigation.

Terraces and diversions.—The slope of the land and the relative erodibility of the soil material are the main considerations. Where terraces and diversions are planned, other soil features considered are depth to rock and the presence of a seasonal high water table. Nearly level soils do not need terracing, and steep soils are not well adapted to it. Highly erodible soils require special care in the construction of diversions.

Waterways.—The degree of slope and the erodibility of the soil materials are the main considerations. Depth to rock and a high water table are noted if applicable.

Engineering, general

Approximately 85 percent of the land area in the county has a seasonal high water table of some duration. This is a major soil characteristic to consider in engineering design for all except the well-drained soils in the county. On the lake plain, the water table is at a depth of 6 to 8 feet in many places.

Many of the soils in the county have a fragipan, or dense, compact layer in the subsoil. The movement of water downslope across the top of the fragipan is a major cause of wet basements and foundations. Adequate drainage for a foundation is needed on soils that have a fragipan. A fragipan also severely restricts the suitability of a soil for disposal of septic tank effluent.

Soils that contain much unstable silt and clay do not compress well and in foundations they are unstable when saturated. Soils of the following series are of this kind: Canadice, Caneadea, Carlisle, Sheffield, and Willette. Steep land, silty and clayey, is also unstable when it is saturated. Because fine sand in the Kingsville soils tends to flow when saturated, excavation for tile lines is difficult.

Most of the soils in the county are moderately to highly susceptible to frost action. This hazard should be considered in places where the soils are to be used for such purposes as streets and parking lots.

Town and Country Planning [5]

The present land use of Ashtabula County is well diversified. Historically, most of the land has been used for farming, but now a significant amount is used for residences, commercial and industrial buildings, transportation facilities, and recreation. The shift to these uses has

[5] By RALPH L. MEEKER, soil scientist (soil specialist), Soil Conservation Service.

been going on at an increasing rate. Continuation of this trend can be expected because Ashtabula County is located within a large area that has a dense population and much diversified industry. A large acreage in the county is presently idle or has been abandoned for farming. This is partly a result of the increased pressure for land for uses other than farming.

The expansion of nonfarm uses of land in the county may, in a short period of time, remove many acres from farm use. Highways commonly displace as much as 50 acres per mile. A shopping center commonly occupies 50 to 100 acres. These uses permanently reduce the acreage formerly farmed.

This section provides information on properties of soils in the county and their effect on selected uses of soils in town and country planning. This information is valuable in planning for land use.

In table 7 the estimated degree of limitations to specified uses are rated for each soil in the county and the main kinds of limitations are listed. The land uses considered are those commonly present in areas undergoing a transition from farm to nonfarm uses.

It is recognized that factors other than soil properties may play a major part in determining the use to which each area of land will be put. This survey is not intended to suggest what the use in a given area should be, but table 7 does point out the kind and degree of soil limitations that can be expected if a soil is used for a selected purpose.

The estimated degree of limitations for each land use is based on soil properties. To provide a comparison between land uses, limitations of the soils for each land use are rated slight, moderate, or severe in table 7. Limitations are rated *slight* if the soil has no important restriction for the specified use. Limitations are rated *moderate* if the soil has some restrictions for the specified use. These limitations need to be recognized, but they can be overcome or corrected. Limitations are rated *severe* if the soil properties cause serious restrictions for the specified use. Severe limitations are difficult and costly to overcome, but a rating of severe does not mean that the soil cannot be used for the specified purpose. It does mean that more problems can be expected than on soils rated slight or moderate for the same use. For limitations rated moderate or severe, the main soil properties causing the limitations are given. The following paragraphs discuss the columns in table 7.

Farming.—This column rates only the limitations of soils used for cultivated crops. The ratings were made to help indicate the soils that have a good potential for farming.

Sewage effluent disposal.—Soil properties important to the installation and operation of septic tanks include depth to rock, permeability, slope, natural drainage, depth to the water table, and the hazard of flooding.

The water table is high for extended periods in soils that have very poor, poor, and somewhat poor natural drainage. Septic tank effluent seeps away slowly in slowly permeable soils. Some soils have a sandy or gravelly substratum that permits effluent to seep away without proper filtration. This effluent may cause pollution of nearby streams and water supplies. Septic tank filter fields on steep slopes may cause seepage problems on the lower slopes.

Sewage lagoons.—These are shallow ponds built to dispose of sewage through oxidation. They may be needed in an area if septic tanks or a central sewage system is not feasible. Among the features that determine the degree of limitation are the hazard of flooding, degree of slope, depth to bedrock, and permeability.

Homesites.—This column rates limitations of soils used as sites for homes and for small commercial and industrial buildings that have basements and are not more than three stories high.

A large part of the land converted from farming is used as homesites. Soil and site characteristics that affect the rating of soils for homesites include depth to bedrock, slope, natural drainage, flood hazard, and surface stoniness. Alternative methods of sewage disposal are not considered in rating the soils for homesites.

Soils subject to flooding have severe limitations to use for buildings and homes. Flooding may be infrequent, but it is costly and damaging when it does occur. Homes on naturally wet soils are likely to have wet basements if foundation drainage is not provided. The soils in much of Ashtabula County have poor or somewhat poor natural drainage. Existing systems of tile and open-ditch drains are now in large areas of naturally wet soils, and these drains permit the areas to be farmed. In many places development for homesites disrupts these drainage systems and return the soils to their natural wet condition. Some soils that have poor natural drainage and a silty texture are not favorable for foundations, because they are soft and compressible.

Lawns, landscaping, and golf fairways.—In most areas, the present surface soil is better suited for lawns and ornamental plants than the soil material excavated for basements or fill brought in from another area. The surface soil can be scalped prior to construction and piled away from the area of construction and grading. After grading is complete, this material can be returned. Also, the surface soil taken from areas being graded for streets can be used for lawns. Some soils in Ashtabula County are shallow to very acid shale. If this shale is mixed with the surface soil, lawns are hard to establish. Grading on steep slopes in most kinds of soil material causes an erosion hazard.

The soil properties used to make the ratings of limitations to use of soils for lawns and landscaping include natural drainage, slope, depth to bedrock, texture of the surface layer, stoniness, flooding hazard, soil fertility, and available moisture.

The ratings in this column also apply to golf fairways. The requirements of golf greens are too detailed to be considered here.

Streets and parking lots.—Table 7 provides information useful in both the selection of routes and the design of streets and roads in residential areas. The ratings of limitation to use of soils for streets are based on the depth to the water table, slope, depth to bedrock, flood hazard, and stoniness. The ratings are for residential streets, which do not carry much heavy traffic. These ratings also apply to parking lots.

Recreation.—Recreation is increasing on both public and private land in the county. A knowledge of the soil properties is an area proposed for recreation aids in the selection of the recreational use and in the arrangement of facilities within the area.

Many recreational uses are related directly to scenery and landscape. The soil map indicates where certain kinds of landscapes occur. The locations of streams and slopes is shown. A knowledge of soil properties is important in the selection of sites for artificial lakes and ponds (fig. 9). Soils are rated for this purpose in table 6 of the engineering section.

Many soils that have severe limitations for most other uses have few limitations for some forms of recreational use. Soils subject to flooding, for example, can be used for ball diamonds, picnic areas, and other facilities that are not subject to costly damage by flooding and that are not used during the flooding season. Areas of soils on bottom lands are often scenic, and because of their linear shape, they can be planned to be accessible to a large number of people. Recreation facilities on flood plains should be based on a knowledge of local flooding frequency and duration.

Athletic fields and intensive play areas.—The soil properties that influence the degree of limitations for these uses include natural drainage, slope, depth to bedrock, stoniness, permeability, texture of the surface layer, and flooding hazard. The ratings are made on the assumption that no fill is used.

Parks and play areas.—Soil features considered in rating limitations to use for parks and play areas are degree of slope, texture of the surface layer, natural drainage, and the hazard of flooding.

Campsites.—Areas used for campsites need to be suitable for outdoor living during the camping season. Without surfacing, the soils should be suitable for parking of cars and camping trailers for trailer campsites. Wetness and slope are major features in determining the degree of soil limitations for campsites. Texture of the surface layer and permeability are also important features.

Sanitary land fill.—The need for a means of refuse disposal is important in Ashtabula County and will become more so as the population continues to grow. Soils most suitable for sanitary land fill are nearly level, slowly permeable, and well drained. The well-drained soils in this county are not slowly permeable, and the soils that are slowly permeable have a seasonal high water table. Soil properties that influence the degree of limitations for sanitary land fill include depth to rock, wetness, permeability, texture, slope, and flood hazard. Soil wetness is very critical for this land use. Slopes are important because of the heavy equipment used and because of the erosion hazard on bare slopes. Pollution of underground water is possible where sandy or other permeable soils are used for sanitary land fill.

Cemeteries.—Natural drainage and depth to rock are important soil properties that influence the suitability of soils for cemeteries. Soil texture and slope also affect suitability for cemeteries. In the wetter soils, graves dug below the seasonal high water table may fill with water. Medium-textured soils have fewer limitations than very sandy or very clayey soils. Slope is important primarily because of trafficability and the difficulty of setting a good foundation for monuments on steep slopes. Soils that are flooded have severe limitations.

***Figure 9.*—Private recreation lake constructed on Platea silt loam.**

Descriptions of the Soils

This section describes the soil series and mapping units in Ashtabula County. The approximate acreage and proportionate extent of each mapping unit are given in table 8.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are in a soil series. For example, Beaches, Made land, and Riverwash are miscellaneous land types and do not belong to a soil series. Nevertheless, they, and the other land types in the county, are listed in alphabetic order along with the soil series.

An essential part of each soil series is the description of the soil profile, the sequence of layers beginning at the surface and continuing downward to depths beyond which roots of most plants do not penetrate. Each soil series contains both a brief nontechnical and a detailed technical description of the soil profile. The nontechnical description is useful for most readers. The detailed technical description is included for soil scientists, engineers, and others who need to make thorough and precise studies of soils.

Many of the terms used in describing soils are defined in the Glossary at the back of this survey. Those who want information about the procedures of soil surveying should refer to the *Soil Survey Manual* (*16*). The terms "light colored" and "dark colored," as used in this publication, refer to color of the surface layer. Surface layers having a color value of less than 4, measured according to the Munsell system of color notation (*16*), are dark colored; those with a value of 4 or more are light colored.

Allis Series

The Allis series consists of nearly level, poorly drained soils that formed in contrasting materials. Their upper part is material that was deposited in an old glacial lakebed, or it is glacial till material. The lower part formed in residuum weathered from the underlying shale.

TABLE 7.—*Estimated degree and kinds of limitations*

[Gravel and sand pits (Gp), Made land (Ma), Quarries

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Allis: As	Severe: wetness.	Severe: slowly permeable; seasonal high water table; shale bedrock at depth of 2 to 3½ feet.	Slight: shale bedrock at depth of 2 to 3½ feet.	Severe: seasonal high water table; poorly drained; shale bedrock at depth of 2 to 3½ feet.	Severe: poorly drained; seasonal high water table.	Severe: Poorly drained; seasonal high water table.
Atherton: At	Moderate: wetness.	Severe: [2] seasonal high water table; poorly drained.	Severe: [2] rapidly permeable substratum.	Severe: seasonal high water table; poorly drained.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.
Beaches: Be	(3)	(3)	(3)	(3)	(3)	(3)
Braceville:						
BrA	Slight	Severe: [2] moderately slow permeability.	Severe: [2] rapidly permeable substratum.	Moderate: moderately well drained.	Slight	Moderate: moderately well drained.
BrB	Slight	Severe: [2] moderately slow permeability.	Severe: [2] rapidly permeable substratum.	Moderate: moderately well drained.	Slight	Moderate: slope; moderately well drained.
BrC2	Moderate: erosion hazard.	Severe: [2] moderately slow permeability.	Severe: [2] rapidly permeable substratum; slope.	Moderate: moderately well drained; slope.	Moderate: slope.	Severe: slope.
Cambridge:						
CaB, CaB2, CbB (CbB has sandstone at depth of 4 to 5 feet.)	Slight	Severe: very slow permeability.	Moderate: slope.	Moderate: moderately well drained.	Slight	Moderate: slope; moderately well drained.
CaC, CaC2, CbC2 (CbC2 has sandstone at depth of 4 to 5 feet.)	Moderate: erosion hazard.	Severe: very slow permeability.	Severe: slope	Moderate: moderately well drained; slope.	Moderate: slope.	Severe: slope.
CaD2	Severe: slope; erosion hazard.	Severe: very slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Canadice: Cc, CeA (See CfA under Caneadea series for the Caneadea part of CeA.)	Severe: wetness.	Severe: very slowly permeable; seasonal high water table.	Slight	Severe: seasonal high water table; poorly drained.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained.
Canadice, mucky variants: Cd.	Severe: wetness.	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table; poorly drained.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained.

See footnotes at end of table.

of soils for specified land uses

(Qu), and Riverwash (Rw) not rated in this table]

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites			
		Tents	Trailers		
Severe: poorly drained; seasonal high water table.	Severe: poorly drained.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained: clayey subsoil; shale bedrock at depth of 2 to 3½ feet.	Severe: poorly drained; shale bedrock at depth of 2 to 3½ feet.
Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.
Severe: loose sand	Slight	Severe: loose sand	Severe: loose sand	(3)	(3).
Moderate: moderately well drained; moderately slow permeability.	Slight	Moderate: moderately well drained; moderately slow. permeability.	Moderate: moderately well drained: moderately slow permeability.	Severe: [2] rapidly permeable substratum.	Moderate: moderately well drained; moderately slow permeability.
Moderate: slope; moderately well drained; moderately slow permeability.	Slight	Moderate: moderately well drained; moderately slow permeability.	Moderate: moderately well drained; moderately slow permeability.	Severe: [2] rapidly permeable substratum.	Moderate: moderately well drained; moderately slow permeability.
Severe: slope	Moderate: slope	Moderate: moderately well drained: slope; moderately slow permeability.	Severe: slope	Severe: [2] rapidly permeable substratum.	Moderate: moderately well drained: slope; moderately slow permeability.
Severe: very slow permeability.	Slight	Severe: very slow permeability.	Severe: very slow permeability.	Moderate: moderately well drained; sandstone at depth of 4 to 5 feet in CbB.	Severe: very slow permeability; sandstone at depth of 4 to 5 feet in CbB.
Severe: slope; very slow permeability.	Slight	Severe: very slow permeability.	Severe: slope; very slow permeability.	Moderate: moderately well drained; slope; sandstone at depth of 4 to 5 feet in CbC2.	Severe: very slow permeability; sandstone at depth of 4 to 5 feet in CbC2.
Severe: slope; very slow permeability.	Moderate: slope	Severe: very slow permeability; slope.	Severe: slope; very slow permeability.	Severe: slope	Severe: slope; very slow permeability.
Severe: poorly drained; very slowly permeable.	Severe: poorly drained.	Severe: poorly drained; very slowly permeable.	Severe: poorly drained; very slowly permeable.	Severe: poorly drained; clayey; subject to ponding.	Severe: poorly drained; very slowly permeable.
Severe: poorly drained; very slowly permeable.	Severe: poorly drained.	Severe: poorly drained; very slowly permeable.	Severe: poorly drained; very slowly permeable.	Severe: poorly drained; clayey; subject to ponding.	Severe: poorly drained; very slowly permeable.

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Caneadea:						
CfA	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
CfB	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slope.
CfC2	Severe: erosion hazard.	Severe: very slow permeability; seasonal high water table.	Severe: slope	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained; slope.	Severe: slope
CfD2	Severe: erosion hazard.	Severe: very slow permeability; seasonal high water table; slope.	Severe: slope	Severe: seasonal high water table; slope.	Severe: slope.	Severe: slope
Carlisle: Cg	Moderate: wetness.	Severe:[2] high water table; organic soil material; very poorly drained.	Severe:[2] permeable muck; organic soil material.	Severe: high water table; soft organic soil material; subject to subsidence if drained.	Severe: very poorly drained; saturated, soft organic soil material; subject to subsidence if drained.	Severe: very poorly drained; saturated, soft, organic soil material; subject to subsidence if drained.
Chagrin: Ch	Slight	Severe:[2] subject to flooding.	Severe:[2] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Chenango:						
CkA, ClA	Slight	Slight [2]	Severe:[2] moderately rapid to rapid permeability.	Slight	Moderate: droughty.	Slight
CkB, ClB	Slight	Slight [2]	Severe:[2] moderately rapid to rapid permeability.	Slight	Moderate: droughty.	Moderate: slope.
CkC2, ClC2	Moderate: erosion hazard.	Moderate:[2] slope.	Severe: moderately rapid to rapid permeability; slope.	Moderate: slope.	Moderate: droughty.	Severe: slope.
CkD2	Severe: erosion hazard.	Severe:[2] slope.	Severe:[2] moderately rapid to rapid permeability; slope.	Severe: slope.	Severe: droughty; slope.	Severe: slope.

See footnotes at end of table.

of soils for specified land uses—Continued

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites			
		Tents	Trailers		
Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; very slow permeability.	Severe: clayey; subject to ponding.	Severe: somewhat poorly drained; very slow permeability.
Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; very slow permeability.	Severe: clayey	Severe: somewhat poorly drained; very slow permeability.
Severe: slope	Moderate: somewhat poorly drained; slope.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; slope; very slow permeability.	Severe: clayey	Severe: somewhat poorly drained; very slow permeability.
Severe: slope	Severe: slope	Severe: slope; somewhat poorly drained; very slow permeability.	Severe: slope; somewhat poorly drained; very slow permeability.	Severe: clayey; slope.	Severe: slope; very slow permeability.
Severe: very poorly drained; saturated, soft, organic soil material; subject to subsidence if drained.	Severe: very poorly drained; saturated, soft, organic soil material.	Severe: very poorly drained; saturated, soft, organic soil material.	Severe: very poorly drained; saturated, soft, organic soil material.	Severe:[2] very poorly drained; saturated, soft, organic soil material.	Severe: very poorly drained; saturated, soft, organic soil material.
Moderate [4]	Moderate [4]	Severe: subject to flooding.	Severe: subject to flooding.	Severe:[2] subject to flooding.	Severe: subject to flooding.
Slight [5]	Slight	Slight [5]	Slight [5]	Severe:[2] moderately rapid to rapid permeability.	Moderate: gravelly material.
Moderate:[5] slope	Slight	Slight [5]	Moderate:[5] slope	Severe:[2] moderately rapid to rapid permeability.	Moderate: gravelly material.
Severe: slope	Moderate: slope	Moderate: slope	Severe: slope	Severe:[2] moderately rapid to rapid permeability.	Moderate: gravelly.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe:[2] slope	Severe: gravelly; slope.

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Claverack, silty subsoil variant:						
CmA	Slight	Severe: very slowly permeable substratum.	Severe: rapidly permeable in upper 20 to 36 inches.	Moderate: moderately well drained.	Slight	Moderate: moderately well drained.
CmB	Slight	Severe: very slowly permeable substratum.	Severe: rapidly permeable in upper 20 to 36 inches.	Moderate: moderately well drained.	Slight	Moderate: slope; moderately well drained.
CmC	Moderate: erosion hazard.	Severe: very slowly permeable substratum.	Severe: rapidly permeable in upper 20 to 36 inches; slope.	Moderate: moderately well drained; slope.	Moderate: droughty; slope.	Severe: slope
Claverack, moderately shallow variant: CnB.	Moderate	Severe: 20 to 40 inches to shale; slowly permeable.	Severe: 20 to 40 inches to shale; rapidly permeable in upper part.	Severe: 20 to 40 inches to shale.	Moderate: droughty.	Moderate: slope; 20 to 40 inches to shale; moderately well drained.
Colonie:						
CoB	Moderate: droughty.	Slight [2]	Severe: [2] rapidly permeable.	Slight	Moderate: droughty.	Moderate: slope.
CoD	Moderate: droughty.	Severe: [2] slope.	Severe: [2] rapidly permeable; slope.	Moderate: slope.	Moderate: droughty.	Severe: slope
Conneaut: Ct	Moderate: wetness.	Severe: slowly permeable; seasonal high water table.	Slight	Severe: seasonal high water table; poorly drained.	Severe: poorly drained.	Severe: poorly drained.
Elnora: ElB	Moderate: droughty.	Moderate: [2] temporary seasonal high water table.	Severe: [2] rapidly permeable.	Moderate: moderately well drained.	Moderate: droughty.	Moderate: slope; moderately well drained.
Frenchtown: Fr, Fs (Fs has sandstone at depth of 3½ to 4 feet.)	Moderate: wetness.	Severe: slow to very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table; poorly drained.	Severe: poorly drained.	Severe: poorly drained.
Holly: Hm	Moderate: wetness.	Severe: [3] subject to flooding; poorly drained.	Severe: [3] subject to flooding.	Severe: subject to flooding.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.

See footnotes at end of table.

of soils for specified land uses—Continued

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites			
		Tents	Trailers		
Severe: very slowly permeable.	Slight	Severe: very slowly permeable.	Severe: very slowly permeable.	Moderate: moderately well drained.	Severe: very slowly permeable.
Severe: very slowly permeable.	Slight	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Moderate: moderately well drained.	Severe: very slowly permeable.
Severe: slope; very slowly permeable.	Moderate: slope	Moderate: moderately well drained; slope.	Severe: slope	Moderate: moderately well drained; slope.	Severe: very slowly permeable.
Severe: 20 to 40 inches to shale; slowly permeable.	Moderate: 20 to 40 inches to shale.	Moderate: moderately well drained.	Moderate: moderately well drained; slope.	Severe: 20 to 40 inches to shale.	Severe: 20 to 40 inches to shale.
Moderate: slope; sandy surface layer.	Slight	Moderate: sandy texture of the surface layer.	Moderate: slope; sandy surface layer.	Severe:[2] rapid permeability.	Severe: sandy surface layer.
Severe: slope	Slight	Severe: slope	Severe: slope	Severe:[2] rapid permeability; slope.	Severe: slope; sandy surface layer.
Severe: poorly drained; slowly permeable.	Severe: poorly drained.	Severe: poorly drained; slowly permeable.	Severe: poorly drained; slowly permeable.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; slowly permeable.
Moderate: slope; moderately well drained; sandy texture of surface layer.	Slight	Moderate: moderately well drained; sandy texture of surface layer.	Moderate: moderately well drained; slope; sandy texture of surface layer.	Severe:[2] rapidly permeable.	Severe: sandy surface layer.
Severe: poorly drained; slow to very slow permeability.	Severe: poorly drained.	Severe: poorly drained; slow to very slow permeability.	Severe: poorly drained; slow to very slow permeability.	Severe: poorly drained; Fs has sandstone at depth of 3½ to 4 feet.	Severe: poorly drained; slow to very slow permeability; Fs has sandstone at depth of 3½ to 4 feet.
Severe: poorly drained.	Severe: poorly drained.	Severe: subject to flooding.	Severe: subject to flooding.	Severe:[3] subject to flooding.	Severe: subject to flooding.

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Hornell:						
HoB	Moderate: wetness.	Severe: very slowly permeable; 20 to 40 inches to shale and siltstone; seasonal high water table.	Severe: 20 to 40 inches to shale and siltstone.	Severe: 20 to 40 inches to shale and siltstone; somewhat poorly drained.	Moderate: somewhat poorly drained; 20 to 40 inches to shale and siltstone.	Moderate: somewhat poorly drained; 20 to 40 inches to shale and siltstone.
HoC2	Severe: erosion hazard.	Severe: very slowly permeable; 20 to 40 inches to shale and siltstone; seasonal high water table.	Severe: 20 to 40 inches to shale and siltstone; slope.	Severe: 20 to 40 inches to shale and siltstone.	Moderate: somewhat poorly drained; 20 to 40 inches to shale and siltstone.	Severe: slope.
HoD2	Severe: erosion hazard.	Severe: slowly permeable; 20 to 40 inches to shale and siltstone; slope; seasonal high water table.	Severe: 20 to 40 inches to shale and siltstone; slope.	Severe: 20 to 40 inches to shale and siltstone; slope.	Severe: somewhat poorly drained; 20 to 40 inches to shale and siltstone; slope.	Severe: slope.
Ilion: Io	Moderate: wetness.	Severe: slow to very slow permeability; seasonal high water table; poorly drained.	Slight	Severe: seasonal high water table; poorly drained.	Severe: poorly drained.	Severe: poorly drained.
Kingsville: Kf, Kg	Moderate: wetness.	Severe: [2] seasonal high water table; poorly drained.	Severe: [2] rapidly permeable; sandy material.	Severe: seasonal high water table; poorly drained.	Severe: poorly drained.	Severe: poorly drained.
Lobdell: Lb	Slight	Severe: [2] subject to flooding.	Severe: [2] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Mahoning: MsB, MsB2	Moderate: wetness.	Severe: seasonal high water table; very slow permeability; somewhat poorly drained.	Moderate: slope.	Severe: seaseasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Orrville: Or, Os	Slight	Severe: [2] subject to flooding.	Severe: [2] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

See footnotes at end of table.

of soils for specified land uses—Continued

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites			
		Tents	Trailers		
Severe: somewhat poorly drained; very slowly permeable.	Moderate: somewhat poorly drained; 20 to 40 inches to shale and siltstone.	Severe: somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained; very slowly permeable.	Severe: 20 to 40 inches to shale and siltstone.	Severe: somewhat poorly drained; 20 to 40 inches to shale and siltstone; very slowly permeable.
Severe: slope; very slowly permeable.	Moderate: somewhat poorly drained; 20 to 40 inches to shale and siltstone; slope.	Severe: somewhat poorly drained; very slow permeability.	Severe: slope; somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; 20 to 40 inches to shale and siltstone.	Severe: somewhat poorly drained; 20 to 40 inches to shale and siltstone; very slowly permeable.
Severe: slope; very slowly permeable.	Severe: slope____	Severe: slope; somewhat poorly drained; very slow permeability.	Severe: slope; somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained; 20 to 40 inches to shale and siltstone; slope.	Severe: somewhat poorly drained; 20 to 40 inches to shale and siltstone; slope.
Severe: poorly drained; slow to very slow permeability.	Severe: poorly drained.	Severe: poorly drained; slow to very slow permeability.	Severe: poorly drained; slow to very slow permeability.	Severe: poorly drained.	Severe: poorly drained; slow to very slow permeability.
Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; seasonal high water table.	Severe:[2] poorly drained; rapidly permeable; fine sand.	Severe: poorly drained.
Moderate:[4] subject to flooding.	Moderate:[4] subject to flooding.	Severe: subject to flooding.	Severe: subject to to flooding.	Severe:[2] subject to flooding.	Severe: subject to flooding.
Severe: somewhat poorly drained; very slowly permeable.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; 5 to 8 feet to shale.	Severe: somewhat poorly drained; very slowly permeable.
Severe: somewhat poorly drained; subject to flooding.	Moderate:[4] somewhat poorly drained; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe:[2] subject to flooding.	Severe: subject to flooding.

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Otisville:						
OtB, OuB	Severe: droughty.	Slight [2]	Severe: [2] rapidly permeable.	Slight	Severe: droughty.	Moderate: slope.
OuC	Severe: droughty.	Moderate: [2] slope.	Severe: [2] rapidly permeable; slope.	Moderate: slope.	Severe: droughty.	Severe: slope
OvE (See Chenango series for Chenango part of OvE.)	Severe: droughty.	Severe: [2] slope.	Severe: [2] rapidly permeable; slope.	Severe: slope	Severe: droughty.	Severe: slope
Pierpont:						
PeB, PeB2	Slight	Severe: slow permeability.	Moderate: slope.	Moderate: moderately well drained.	Slight	Moderate: slope; moderately well drained.
PeC2	Moderate: erosion hazard.	Severe: slow permeability.	Severe: slope	Moderate: moderately well drained.	Slight	Severe: slope
PoD2 (Both soils in PoD2 rate the same.)	Severe: erosion hazard.	Severe: slow to very slow permeability; slope.	Severe: slope	Severe: seasonal high water table; slope.	Moderate: moderately well drained and somewhat poorly drained.	Severe: slope
Platea:						
PsA	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
PsB, PsB2	Moderate: wetness.	Severe: very slow permeability; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slope.
PsC, PsC2	Moderate: erosion hazard.	Severe: very slow permeability; seasonal high water table.	Severe: slope	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained; slope.	Severe: slope
PsC3	Severe: erosion hazard.	Severe: very slow permeability; seasonal high water table.	Severe: slope	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained; slope.	Severe: slope

See footnotes at end of table.

of soils for specified land uses—Continued

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites: Tents	Campsites: Trailers		
Moderate:[5] slope	Slight	Slight[5]	Moderate:[5] slope	Severe:[2] rapid permeability.	Slight.[5]
Severe: slope	Slight	Moderate:[5] slope	Severe: slope	Severe:[2] rapid permeability.	Moderate:[5] slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe:[2] slope	Severe: slope.
Severe: slow permeability.	Slight	Severe: slow permeability.	Severe: slow permeability.	Moderate: moderately well drained.	Severe: slow permeability.
Severe: slope	Slight	Moderate: slope; moderately well drained.	Severe: slope	Moderate: moderately well drained.	Moderate: moderately well drained.
Severe: slope; slow to very slow permeability.	Moderate: slope; somewhat poorly drained and moderately well drained.	Severe: slope; slow to very slow permeability.	Severe: slope; slow to very slow permeability.	Severe: slope	Severe: slope.
Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; subject to ponding.	Severe: somewhat poorly drained; very slow permeability.
Severe: somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained; very slow permeability.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.
Severe: slope; somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; slope.	Severe: somewhat poorly drained; very slow permeability.	Severe: slope	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.
Severe: slope; somewhat poorly drained; very slow permeability.	Moderate: somewhat poorly drained; slope.	Severe: somewhat poorly drained; very slow permeability.	Severe: slope	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability.

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Red Hook: RhB	Slight	Severe: [2] seasonal high water table.	Severe: [2] permeable substratum.	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Sheffield: Sf, Sh	Moderate: wetness.	Severe: very slow permeability; seasonal high water table; poorly drained.	Slight	Severe: seasonal high water table; poorly drained; Sh is less stable for buildings than Sf.	Severe: poorly drained.	Severe: poorly drained.
Steep land, loamy: Sm	Severe: erosion hazard.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Steep land, silty and clayey: Sn.	Severe: erosion hazard.	Severe: slope	Severe: slope	Severe: slope; subject to slips.	Severe: slope	Severe: slope
Swanton, silty subsoil variant: Sw.	Moderate: wetness.	Severe: very slow permeability; seasonal high water table; poorly drained.	Moderate: moderately rapid permeability in upper 20 to 36 inches.	Severe: seasonal high water table; poorly drained.	Severe: poorly drained.	Severe: poorly drained.
Venango:						
VeA, VgA (VgA has sandstone within depth of 4 to 6 feet.)	Moderate: wetness.	Severe: very slowly permeable; seasonal high water table	Slight: seasonal high water table.	Severe: somewhat poorly drained; VgA has sandstone within 4 to 6 feet.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
VeB, VeB2, VgB (VgB has sandstone within depth of 4 to 6 feet.)	Moderate: wetness.	Severe: very slowly permeable; seasonal high water table.	Moderate: slope.	Severe: seasonal high water table; VgB has sandstone within 4 to 6 feet.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slope.
VeC, VeC2	Moderate: erosion hazard.	Severe: very slowly permeable; seasonal high water table.	Severe: slope	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: slope

See footnotes at end of table.

of soils for specified land uses—Continued

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites: Tents	Campsites: Trailers		
Severe: somewhat poorly drained; slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; slow permeability.	Severe: somewhat poorly drained; slow permeability.	Severe:[2] somewhat poorly drained; permeable substratum.	Severe: somewhat poorly drained; slow permeability.
Severe: poorly drained; very slow permeability.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.	Severe: poorly drained; very slow permeability.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; very slow permeability.
Severe: slope------	Severe: slope----	Severe: slope------	Severe: slope------	Severe: slope------	Severe: slope.
Severe: slope------	Severe: slope----	Severe: slope------	Severe: slope------	Severe: slope------	Severe: slope.
Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.
Severe: somewhat poorly drained; very slowly permeable.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable.
Severe: somewhat poorly drained; very slowly permeable.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable.
Severe: slope; very slowly permeable.	Moderate: somewhat poorly drained: slope.	Severe: somewhat poorly drained; very slowly permeable.	Severe: slope; somewhat poorly drained; very slowly permeable.	Severe: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable.

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location [1] (3 stories or less)	Lawns, landscaping, golf fairways	Streets and parking lots
Wallington:						
WaA	Moderate: wetness.	Severe: slowly or very slowly permeable; somewhat poorly drained.	Moderate: pervious strata below a depth of 50 inches in some places.	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
WaB	Moderate: wetness.	Severe: slowly or very slowly permeable; somewhat poorly drained.	Moderate: slope.	Severe: seasonal high water table; somewhat poorly drained.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slope.
Willette: We	Moderate: wetness.	Severe: [2] high water table; organic soil material.	Severe: [2] permeable organic soil material.	Severe: high water table; soft, organic soil material; very poorly drained.	Severe: high water table; soft, organic soil material.	Severe: very poorly darined; soft, organic soil material.
Williamson:						
WlA	Slight	Severe: slowly or very slowly permeable.	Moderate: pervious strata below depth of 50 inches in some places.	Moderate: moderately well drained.	Slight	Moderate: moderately well drained.
WlB	Slight	Severe: slowly or very slowly permeable.	Moderate: slope.	Moderate: moderately well drained.	Slight	Moderate: slope; moderately well drained.
WlC2	Moderate: erosion hazard.	Severe: slowly or very slowly permeable.	Severe: slope	Moderate: moderately well drained; slope.	Moderate: slope.	Severe: slope
WlD2	Severe: erosion hazard.	Severe: slowly or very slowly permeable; slope.	Severe: slope	Severe: slope; moderately well drained; subject to slips.	Severe: slope	Severe: slope

[1] The entries in this column also apply to light industrial, institutional, and commercial structures that have three stories or less.
[2] Pollution of ground water is a hazard because of the porous substratum and inadequate filtration.
[3] Not rated.

of soils for specified land uses—Continued

Recreation				Sanitary land fill (trench method)	Cemeteries
Athletic fields (intensive use)	Parks and play areas	Campsites			
		Tents	Trailers		
Severe: somewhat poorly drained; slow or very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; slow or very slow permeability.	Severe: somewhat poorly drained; slow or very slow permeability.	Severe: somewhat poorly drained, pervious substrata below depth of 50 inches in some places.	Severe: somewhat poorly drained; slow or very slow permeability.
Severe: somewhat poorly drained; slow or very slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; slow or very slow permeability.	Severe: somewhat poorly drained; slow or very slow permeability.	Severe: somewhat poorly drained, pervious substrata below depth of 50 inches in some places.	Severe: somewhat poorly drained; slow or very slow permeability.
Severe: very poorly drained; soft, organic soil material.	Severe: very poorly drained; soft, organic soil material.	Severe: very poorly drained; soft, organic soil material.	Severe: very poorly drained; soft, organic soil material.	Severe: very poorly drained; soft, organic soil material.	Severe: very poorly drained; soft, organic soil material.
Severe: slowly or very slowly permeable.	Slight	Severe: slowly or very slowly permeable.	Severe: slowly or very slowly permeable.	Moderate: moderately well drained.	Severe: slowly or very slowly permeable.
Severe: slowly or very slowly permeable.	Slight	Severe: slowly or very slowly permeable.	Severe: slowly or very slowly permeable.	Moderate: moderately well drained.	Severe: slowly or very slowly permeable.
Severe: slope	Moderate: slope	Severe: slowly or very slowly permeable.	Severe: slope	Moderate: moderately well drained; slope.	Severe: slowly or very slowly permeable.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

[4] Limitation rating is variable as it depends upon local frequency and duration of flooding.
[5] Gravelly soils rated moderate.

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TABLE 8.—*Acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Allis silt loam	520	0.1	Made land	2,647	0.8
Atherton silt loam	3,125	.7	Mahoning silt loam, shale substratum, 2 to 6 percent slopes	538	.1
Beaches	143	(1)	Mahoning silt loam, shale substratum, 2 to 6 percent slopes, moderately eroded	265	(1)
Braceville loam, 0 to 2 percent slopes	323	.1	Orrville silt loam	8,224	1.8
Braceville loam, 2 to 6 percent slopes	1,295	.3	Orrville fine sandy loam	262	(1)
Braceville loam, 6 to 12 percent slopes, moderately eroded	346	.1	Otisville sandy loam, 1 to 6 percent slopes	1,386	.3
Cambridge silt loam, 2 to 6 percent slopes	4,599	1.0	Otisville gravelly sandy loam, 1 to 6 percent slopes	2,342	.5
Cambridge silt loam, 2 to 6 percent slopes, moderately eroded	418	.1	Otisville gravelly sandy loam, 6 to 12 percent slopes	329	.1
Cambridge silt loam, 6 to 12 percent slopes	274	(1)	Otisville and Chenango soils, 12 to 25 percent slopes	494	.1
Cambridge silt loam, 6 to 12 percent slopes, moderately eroded	1,767	.4	Pierpont silt loam, 2 to 6 percent slopes	1,704	.4
Cambridge silt loam, 12 to 18 percent slopes, moderately eroded	510	.1	Pierpont silt loam, 2 to 6 percent slopes, moderately eroded	91	(1)
Cambridge silt loam, sandstone substratum, 2 to 6 percent slopes	287	(1)	Pierpont silt loam, 6 to 12 percent slopes, moderately eroded	1,049	.2
Cambridge silt loam, sandstone substratum, 6 to 12 percent slopes, moderately eroded	85	(1)	Pierpont and Platea soils, 12 to 18 percent slopes, moderately eroded	4,296	.9
Canadice silt loam	9,031	2.0	Platea silt loam, 0 to 2 percent slopes	18,602	4.1
Canadice soils, mucky variants	641	.1	Platea silt loam, 2 to 6 percent slopes	94,564	20.9
Canadice-Caneadea silt loams, 0 to 2 percent slopes	3,340	.7	Platea silt loam, 2 to 6 percent slopes, moderately eroded	1,754	.4
Caneadea silt loam, 0 to 2 percent slopes	1,813	.4	Platea silt loam, 6 to 12 percent slopes	1,529	.3
Caneadea silt loam, 2 to 6 percent slopes	2,355	.5	Platea silt loam, 6 to 12 percent slopes, moderately eroded	16,850	3.7
Caneadea silt loam, 6 to 12 percent slopes, moderately eroded	134	(1)	Platea silt loam, 6 to 12 percent slopes, severely eroded	254	(1)
Caneadea silt loam, 12 to 18 percent slopes, moderately eroded	157	(1)	Quarries	7	(1)
Carlisle muck	108	(1)	Red Hook silt loam, 0 to 4 percent slopes	3,424	.8
Chagrin silt loam	2,319	.5	Riverwash	303	.1
Chenango silt loam, 0 to 2 percent slopes	291	(1)	Sheffield silt loam	129,124	28.7
Chenango silt loam, 2 to 6 percent slopes	3,999	.9	Sheffield silt loam, stratified substratum	6,353	1.4
Chenango silt loam, 6 to 12 percent slopes, moderately eroded	1,773	.4	Steep land, loamy	6,428	1.4
Chenango silt loam, 12 to 18 percent slopes, moderately eroded	652	.1	Steep land, silty and clayey	2,298	.5
Chenango gravelly loam, 0 to 2 percent slopes	1,057	.2	Swanton fine sandy loam, silty subsoil variant	6,428	1.4
Chenango gravelly loam, 2 to 6 percent slopes	2,244	.5	Venango silt loam, 0 to 2 percent slopes	892	.2
Chenango gravelly loam, 6 to 12 percent slopes, moderately eroded	711	.2	Venango silt loam, 2 to 6 percent slopes	12,929	2.9
Claverack loamy fine sand, silty subsoil variant, 0 to 2 percent slopes	1,214	.3	Venango silt loam, 2 to 6 percent slopes, moderately eroded	199	(1)
Claverack loamy fine sand, silty subsoil variant, 2 to 6 percent slopes	3,492	.8	Venango silt loam, 6 to 12 percent slopes	107	(1)
Claverack loamy fine sand, silty subsoil variant, 6 to 12 percent slopes	127	(1)	Venango silt loam, 6 to 12 percent slopes, moderately eroded	896	.2
Claverack loamy fine sand, moderately shallow variant, 2 to 6 percent slopes	174	(1)	Venango silt loam, sandstone substratum, 0 to 2 percent slopes	367	.1
Colonie loamy fine sand, 2 to 6 percent slopes	2,592	.6	Venango silt loam, sandstone substratum, 2 to 6 percent slopes	639	.1
Colonie loamy fine sand, 6 to 18 percent slopes	501	.1	Wallington silt loam, 0 to 2 percent slopes	1,107	.2
Conneaut silt loam	17,996	4.0	Wallington silt loam, 2 to 6 percent slopes	1,389	.3
Elnora loamy fine sand, 1 to 5 percent slopes	5,422	1.2	Willette muck	592	.1
Frenchtown silt loam	13,013	2.9	Williamson silt loam, 0 to 2 percent slopes	336	.1
Frenchtown silt loam, sandstone substratum	660	.1	Williamson silt loam, 2 to 6 percent slopes	621	.1
Gravel and sand pits	567	.1	Williamson silt loam, 6 to 12 percent slopes, moderately eroded	123	(1)
Holly silt loam	20,468	4.5	Williamson silt loam, 12 to 18 percent slopes, moderately eroded	92	(1)
Hornell silt loam, 2 to 6 percent slopes	446	.1	Interstate highways	1,246	.3
Hornell silt loam, 6 to 12 percent slopes, moderately eroded	150	(1)	Water areas 3 to 40 acres in size, and streams less than 1/8 mile wide	1,027	.2
Hornell silt loam, 12 to 18 percent slopes, moderately eroded	109	(1)	Individual soils less than 0.1 percent of the total acreage	--------	.9
Ilion silt loam	507	.1			
Kingsville fine sandy loam	1,953	.4			
Kingsville silty clay	126	(1)			
Lobdell silt loam	3,399	.8	Total	451,340	100.0

[1] Less than 0.1 percent of the county.

In a representative profile of Allis silt loam, the surface layer is dark grayish-brown silt loam about 7 inches thick. It is underlain by a thin layer of light brownish-gray silt loam that extends to a depth of 10 inches. The uppermost layer of the subsoil is light brownish-gray, sticky silty clay that extends to a depth of 14 inches. It is underlain by a subsoil layer of gray silty clay that is plastic and sticky when wet. This part of the subsoil formed in residuum weathered from shale and extends to a depth of 27 inches. It contains fragments of fine-grained sandstone and siltstone. Next is gray shaly silty clay shale that has bedding planes. The upper 2 or 3 feet of this shale is relatively soft and can be easily excavated.

Allis soils have slow permeability and stay wet for long periods in winter. They dry out slowly in spring unless they are drained. These soils supply medium amounts of water for plant use because they accumulate water from adjacent areas. Available moisture capacity, however, is low, and the soils are commonly droughty in extended dry periods. The root zone is moderately deep except when the water table is high. The underlying shale limits the root zone. These soils are very strongly acid or strongly acid. Allis soils have a moderate capacity for storing and releasing plant nutrients.

Only a few areas of Allis soils are used for farming, because these soils generally are wet. Growing in most areas are small brushy plants and weeds. Wetness and slow permeability are limitations for many uses other than farming.

Representative profile of Allis silt loam (T. 13 N., R. 1 W., 3½ miles southwest from the center of the city of Conneaut, 400 yards northeast of the junction of Keefus Road and Under Ridge Road; *laboratory sample* AB–112 in table 10):

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) silt loam; moderate, fine and medium, granular structure; friable; common roots; few, fine, black concretions; very strongly acid; abrupt, smooth boundary.

A2g—7 to 10 inches, light brownish-gray (2.5Y 6/2) heavy silt loam that has many, medium, distinct, yellowish-brown (10YR 5/6) mottles and common, medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; firm; few roots; many ferromanganese concretions; very strongly acid; clear, wavy boundary.

B21g—10 to 14 inches, light brownish-gray (2.5Y 6/2) silty clay loam that has many, medium, prominent, strong-brown (7.5YR 5/8) and yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; firm; few roots; gray (5Y 6/1) ped faces; very strongly acid; clear, smooth boundary.

IIB22g—14 to 27 inches, gray (N 6/0) silty clay that has many, medium, prominent, yellowish-brown (10YR 5/4) mottles and few, medium, prominent, strong-brown (7.5YR 5/6) and reddish-yellow (7.5YR 6/8) mottles; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very firm; few roots; gray (N 6/0) ped faces; strongly acid; clear, smooth boundary.

IIC1—27 to 33 inches, gray (N 6/0) shaly silty clay and thin layers of yellowish-brown (10YR 5/4), fine-grained sandstone and siltstone; structureless (massive) but shows bedding planes; firm; siltstone and sandstone strata, 15 percent, by volume; strongly acid; gradual, smooth boundary.

IIR—33 to 36 inches, gray (N 6/0) slightly weathered silty clay shale; about 15 percent, by volume, thin, alternating, hard strata of dark yellowish-brown (10YR 4/4) siltstone and sandstone; bedding planes; very firm; strongly acid.

The depth to shale ranges from 24 to 42 inches. The IIB22g horizon (lithologic discontinuity) is at a depth of 10 to 20 inches. The A2 horizon has platy or subangular blocky structure. The matrix colors of the B horizons above the IIB horizon have a hue of 2.5Y or 5Y, a value of 5 or 6, and a chroma of 2 or 3. The mottles in the upper part of the solum have a hue of 10YR or 7.5YR, a value of 5 or 6, and a chroma of 4 or more, generally 6 or 8. The matrix colors in and below the IIB horizon are neutral (N 6/0 and N 5/0) or have a hue of 2.5Y, a value of 5 or 6, and a chroma of 2 or less. The mottles in this lower part have a hue of 10YR or 7.5YR, values of 4 to 6, and chromas of 4 to 8. The ped coatings are neutral (N 6/0) or have a hue of 5Y, a value of 5 or more and a chroma of 1 or less. The primary structure in the B horizons normally is moderate or strong prismatic that parts to subangular blocky. Coarse fragments above the IIB horizon make up less than 10 percent of the volume.

Allis soils are in a drainage sequence with Hornell soils, but Allis soils are more gray and more poorly drained. A profile of Allis soils is simiar to that of the nearby Conneaut soils in appearance but has a more clayey subsoil and has underlying shale instead of glacial till. Allis soils are less sandy throughout than the nearby Swanton soils, which also are poorly drained. Allis soils are not less acid as depth increases, as are most soils in the county.

Allis silt loam (As).—This soil is level or nearly level. Surface runoff is slow to very slow, and ponding is likely in level or depressional areas. Included with this soil in mapping are small areas where the entire soil formed in residuum weathered from shale.

Slow movement of water through the soil, seasonal wetness, and a limited depth to shale are the major limitations for many uses of this soil. (Capability unit IVw–1; woodland suitability group 2w1)

Atherton Series

The Atherton series consists of poorly drained soils that overlie deposits of sandy and gravelly material. These soils are nearly level and occur in the valleys of the Shenango River and Pymatuning Creek and in the northern part of the county.

A representative profile of Atherton silt loam in a cultivated area has a very dark gray silt loam plow layer that contains a few pebbles and rounded fragments of sandstone. A light olive-gray and gray silt loam subsurface layer is directly beneath the plow layer. Together these layers are about 12 inches thick. The subsoil consists of three layers that have a combined thickness of about 20 inches. The upper part of the subsoil is light olive-gray to light-gray silt loam that is friable and contains some pebbles. The middle layer is variegated strong-brown, yellowish-brown, light olive-brown, and gray gravelly silty clay loam. It is slightly sticky when wet. The lowermost layer in the subsoil is variegated olive-yellow, yellowish-brown, and light yellowish-brown gravelly silt loam. Below a depth of 32 inches, and extending to a depth of 50 inches, is the underlying material. It is gray to light olive-gray loamy gravel. Up to 95 percent of this material is fine gravel.

Atherton soils have slow permeability above the underlying material, but water moves rapidly in that coarse-textured material. Because water from adjacent soils tends to accumulate on these soils, the water table is high for long periods during winter and spring. These soils dry out slowly in spring unless they are artificially drained. If the water table is lowered, the root zone is mostly moderately deep. These soils have a low to medium available moisture capacity, but large amounts of seepage water are supplied to plants. The root zone of Atherton soils normally is strongly acid, but the upper part is less acid in limed areas. The capacity for storing and releasing plant nutrients is moderate.

A large acreage of Atherton soils is used as woodland or for nonfarm purposes. Cultivated areas are used for general farm crops, a large acreage of which is in forage crops.

Representative profile of Atherton silt loam (T. 9 N., R. 1 W., 3 miles northeast of Andover, 2¼ miles north of State Route 85, and 440 yards east of Pymatuning Lake Road, Andover Township):

Ap—0 to 6 inches, very dark gray (10YR 3/1) silt loam that has few, fine, faint, pale-yellow (5Y 8/3) mottles; moderate, medium and coarse, granular structure; friable; many roots; about 5 percent gravel and subrounded sandstone fragments up to one-half inch in size; strongly acid; abrupt, smooth boundary.

A2g—6 to 12 inches, intermingled light olive-gray (5Y 6/2) and gray (5Y 5/1) silt loam; very weak, medium and coarse, granular structure; friable; common roots; about 5 percent gravel and subrounded standstone fragments up to one-half inch in size; strongly acid; clear, wavy boundary.

B1g—12 to 19 inches, intermingled light olive-gray (5Y 6/2), olive gray (5Y 5/2), and light-gray (5Y 7/2) silt loam that has many, medium, distinct mottles of yellowish brown (10YR 5/8), olive yellow (2.5Y 6/6), pale yellow (5Y 8/4), and strong brown (7.5YR 5/8); weak, medium and coarse, subangular blocky structure; friable; few roots; about 5 percent gravel and subrounded sandstone fragments up to one-half inch in size; strongly acid; clear, wavy boundary.

B2g—19 to 23 inches, intermingled strong-brown (7.5YR 5/8), yellowish-brown (10YR 5/8), light olive-brown (2.5Y 5/4), and gray (5Y 5/1) gravelly light silty clay loam; weak, medium to coarse, subangular blocky structure; friable when moist, slightly sticky when wet, few roots; some peds coated with patchy, gray (5Y 5/1) clay films; about 20 percent sandstone and quartz pebbles; medium acid; clear, irregular boundary.

B3—23 to 32 inches, intermingled olive-yellow (5Y 6/8), yellowish-brown (10YR 5/6), and light yellowish-brown (2.5Y 6/4) gravelly silt loam; weak, medium and coarse, subangular blocky structure; friable; few roots; some peds coated with patchy, gray (5Y 5/1) clay films; few black stains; about 15 percent shale, sandstone, and quartz pebbles, medium acid; clear, wavy boundary.

IIC—32 to 50 inches, gray (5Y 5/1) to light olive-gray (5Y 6/2) loamy gravel that has common, medium, distinct mottles of brownish yellow (10YR 6/8); structureless (single grain); loose; as much as 95 percent is fine gravel and subrounded pebbles up to one-quarter inch in diameter; slightly acid.

The solum ranges from 30 to 50 inches in thickness. Thickness coincides with the depth to stratified sand and gravel. Wooded areas have a black (5Y 2/1, N 2/0, 10YR 2/1) or a very dark gray (10YR 3/1 or 5Y 3/1) A1 horizon that is 5 to 8 inches thick. The A2 horizon generally has continuous grayish colors, but in places it is highly mottled with yellowish colors. The B horizons are highly mottled with colors having hues of 5Y, 2.5Y, 10YR, and 7.5YR. In 20 to 50 percent of their mass, the B horizons have chromas of 4 or more. The B1 horizon has a loam or silt loam texture. The B2 and B3 horizons are silt loam, loam, silty clay loam, or clay loam. The reaction ranges from strongly acid to slightly acid, and the pH increases with depth.

Atherton soils are the poorly drained members of a drainage sequence that includes the shallow, well drained Otisville soils; the well drained Chenango soils; the moderately well drained Braceville soils; and the somewhat poorly drained Red Hook soils. All of these soils formed in similar materials, but Atherton soils generally occupy the lowest, wettest areas.

Atherton silt loam (At).—This nearly level soil has a surface layer that is susceptible to crusting. In wooded areas, tree windthrow has left numerous small knolls and shallow depressions. Surface runoff from this soil generally is slow, and ponding for short periods is likely in the more nearly level areas.

Poor natural drainage and a seasonally high water table are major limitations to use of this soil for farming and for many nonfarm purposes. (Capability unit IIIw-4; woodland suitability group 2w1)

Beaches

Beaches (Be) consist of sand and other coarse material washed up by waves along the shores of Lake Erie (fig. 10). Beaches are nearly continuous along the shore of Lake Erie, and they are in a narrow band that is more than 50 feet wide in only a few places. A fairly steep escarpment borders these beaches. This land type is coarse textured, and it generally lacks particles of silt and clay. It has very rapid permeability and a very low available moisture capacity. It is very droughty and is used mostly for recreation. (Capability unit and woodland suitability group not assigned)

Braceville Series

The Braceville series consists of deep soils that are moderately well drained. These nearly level to sloping soils are in the valleys of the Shenango River and Pymatuning Creek and in the northern part of the county. They formed in loamy materials and the underlying stratified sand and gravel. The underlying sand and gravel were derived largely from noncalcareous sandstone and shale and some limestone.

The surface layer of a representative profile of a Braceville loam in a cultivated area is dark grayish-brown loam about 10 inches thick. Beneath this layer, to a depth of 15 inches, is the uppermost subsoil layer that consists of friable, yellowish-brown silt loam. To a depth of about 21 inches, the subsoil is yellowish-brown silt loam that is mottled with strong brown and pale brown. A fragipan is between depths of 21 and 34 inches. It is strong brown silt loam in the upper part and dark yellowish-brown loamy sand in the lower part. The fragipan is firm, dense, and brittle. Below the fragipan the content of sand and gravel increases as depth increases. Strata of the sand and gravel are evident below a depth of 36 inches in most places.

Braceville soils have moderately slow permeability because of the fragipan. This layer also restricts root growth to the soil material above it. Within the normal root zone, these soils have a low to medium available moisture capacity, but the pan layer is beneficial in that it slows water movement. For this reason, moisture that otherwise would move readily through the root zone is available to plants. Except in limited areas, Braceville soils generally are strongly acid to very strongly acid throughout. They have a moderate capacity for storing and releasing plant nutrients.

The Braceville soils are used extensively for cultivated field crops and specialty crops. Their moderately slow permeability is a limitation to many nonfarm uses.

Representative profile of a Braceville loam (T. 13 N., R.

***Figure 10.*—Beach along shore of Lake Erie.**

2 W., 1 mile west of Kingsville and 530 yards south of State Route 84, in Kingsville Township) :

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

B1—10 to 15 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium and coarse, subangular blocky structure; friable; abundant roots; strongly acid; clear, wavy boundary.

B21—15 to 21 inches, yellowish-brown (10YR 5/4) silt loam; interiors of peds mottled with strong brown (7.5YR 5/6) and pale brown (10YR 6/3); yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) ped surfaces; weak, medium and coarse, subangular blocky structure; friable; common roots; less than 3 percent of volume is root channels that have thin clay films; 5 percent ferromanganese concretions; strongly acid; clear, wavy boundary.

Bx1—21 to 29 inches, strong-brown (7.5YR 5/6) silt loam that has ped interiors mottled with light gray (N 7/0) and yellowish brown (10YR 5/4); continuous light brownish gray (10YR 6/2) on vertical faces of peds; very weak, coarse (4 inches), prismatic structure parting to weak, medium and thick, platy structure; firm; few roots; 80 percent of the root channels coated with thin clay films; few thin clay films on vertical faces in lower inch of horizon; very strongly acid; abrupt, wavy boundary.

IIBx2—29 to 34 inches, dark yellowish-brown (10YR 4/4) loamy sand; medium, reddish-brown (5YR 4/3) and few, coarse, gray (10YR 6/1) mottles; massive (structureless) but is single grain if shattered; firm; slightly brittle when moist; very strongly acid; abrupt, wavy boundary.

IIC1—34 to 54 inches, intermingled zones of dark yellowish-brown (10YR 3/4) loamy coarse sand and gray (5YR 6/1) coarse sand and fine gravel; structureless (single grain); loose; 50 percent pebbles that are mostly less than one-fourth inch in diameter; very strongly acid; gradual, wavy boundary.
IIC2—54 to 100 inches, gray (5Y 6/1) coarse sand and fine gravel; structureless (single grain); loose; no roots; 50 percent pebbles mostly less than one-fourth inch in diameter; very strongly acid.

The thickness of the solum ranges from about 30 to 40 inches and depends on depth to sand and gravel. Depth to the top of the fragipan ranges from 18 to 30 inches. In some wooded areas, a 1- to 3-inch, very dark brown (10YR 2/2) A1 horizon and a 1- to 3-inch, brown (10YR 4/3) A2 horizon occur. In some areas the surface layer is silt loam. The B1 horizon is yellowish brown (10YR 5/4) or brown (7.5YR 5/4). The matrix color of the B21 horizon is yellowish brown (10YR 5/4) or dark yellowish brown (10YR 4/4). This horizon is silt loam, sandy clay loam, or loam. The ped coatings in the Bx1 horizon commonly are light brownish gray (10YR 6/2), pale brown (10YR 6/3), or light gray (2.5Y 7/2). The C horizons are most commonly gray, strong brown, brownish yellow, and olive brown. The reaction of the solum ranges from slightly acid to very strongly acid but most commonly is strongly acid to very strongly acid.

Coarse fragments in the upper part of the solum range from 0 to 10 percent, by volume. They are mainly subrounded pebbles up to one-half inch across, but flat angular sandstone fragments up to 6 inches across also occur in some places. Coarse fragments most commonly make up 10 to 15 percent of the B21 horizon by volume. They are mostly fine pebbles. In some places the fragipan is missing or is weakly developed.

The Braceville soils generally are adjacent to the coarser textured and better drained Otisville soils, the well-drained Chenango soils, the somewhat poorly drained Red Hook soils, and the poorly drained Atherton soils. Braceville soils are the moderately well drained members of a drainage sequence that includes all of these soils. The fragipan in Braceville soils is less firm and dense than the fragipan in Platea and Frenchtown soils.

Braceville loam, 0 to 2 percent slopes (BrA).—This soil is in small areas. A profile of this soil is described as representative for the series. The tilth of the surface layer generally is good.

Included with this soil in mapping are small areas of somewhat poorly drained Red Hook soils that generally occupy the lowest part of the mapped areas. Also included are a few areas of a soil that has a gravelly surface layer.

The major limitations for farm or some nonfarm uses are moderately slow permeability and seasonal wetness in winter and spring. (Capability unit IIw-2; woodland suitability group 2o1)

Braceville loam, 2 to 6 percent slopes (BrB).—Surface runoff from this soil occurs only during or after intense storms or after the soil is saturated. This soil generally lies adjacent to or between well-drained Chenango soils and somewhat poorly drained Red Hook soils, and small areas of Chenango and Red Hook soils commonly are included in mapped areas. The wetter Red Hook soils occupy low areas, and the more droughty Chenango soils generally are in the more sloping areas. Locally, the surface layer of this soil is gravelly.

Because surface runoff is slow to medium, the erosion hazard is moderate in cultivated or bare areas. Moderately slow permeability and slope are limitations for some nonfarm uses. (Capability unit IIe-1; woodland suitability group 2o1)

Braceville loam, 6 to 12 percent slopes, moderately eroded (BrC2).—This eroded soil is more droughty than the other Braceville soils because it has a surface layer about 5 inches thinner than that described for the representative profile.

Adjacent to this soil and included with it in mapping are areas of the more droughty Otisville and Chenango soils. Also included are small areas where the surface layer is gravelly.

Surface runoff from this soil is mostly medium. Although this soil is eroded, tilth is generally good. Some wet spots occur because water seeps from adjacent higher lying areas.

A combination of slope, past erosion, moderately slow permeability, and a severe erosion hazard limit use of this soil for farm and some nonfarm purposes. (Capability unit IIIe-1; woodland suitability group 2o1)

Cambridge Series

In the Cambridge series are light-colored, moderately well drained soils. These gently sloping to moderately steep soils occur in the glaciated uplands. They formed in silt loam glacial till that has a low content of lime. Most areas are in the southeastern part of the county.

A representative profile of a Cambridge silt loam in a wooded area has its surface covered with a thin layer of dark-brown decayed leaves and leaf litter. Beneath this is a layer of very dark brown silt loam 1 inch thick. Next are three subsoil layers that consist of yellowish-brown silt loam. Together these layers are 20 inches thick. At depths between 21 and 24 inches, the subsoil is strong-brown silt loam. A fragipan occurs at a depth of 24 inches and extends to 50 inches. It consists of two silt loam layers that are very firm and compact. Firm silt loam glacial till is beneath the fragipan. A few coarse fragments are throughout this soil.

The Cambridge soils have very slow permeability and a seasonally high water table because of the dense, compact fragipan. The fragipan also limits root penetration to a moderate depth. Cambridge soils have a medium available moisture capacity in the normal root zone, which is very strongly acid in most places. Cambridge soils have a moderate capacity for storing and releasing plant nutrients. Because these soils have a high silt content, they are highly erodible. Erosion control is particularly important in cultivated areas and in areas of the urban fringe undergoing development. In the Hartsgrove Township, sandstone underlies the Cambridge soils at a depth of 4 to 6 feet.

Cambridge soils are used mostly for general farm crops, of which a high proportion is forage crops. Some areas near the Pymatuning Reservoir are no longer farmed.

Representative profile of a Cambridge silt loam (T. 10 N., R. 1 W., approximately 6 miles northwest of Andover and 500 yards east of Pymatuning Lake Road, Richmond Township; *laboratory sample* AB-35 in table 10):

O1—1½ inches to 1 inch, fairly even mantle of leaf litter, mostly undecomposed; abrupt, smooth boundary.
O2—1 inch to 0, dark-brown (10YR 3/3), matted, somewhat greasy mor; abundant, fine roots; abrupt, smooth boundary.
A1—0 to 1 inch, very dark brown (10YR 2/2) silt loam; strong, very fine and fine, crumb structure; very friable; many roots; few or no coarse fragments; very strongly acid; clear, wavy boundary.
B1—1 to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak to moderate, fine, subangular blocky structure; friable; common roots; about 5 percent, by volume, is coarse fragments that are mostly flat, angular

sandstone less than 5 centimeters across; very strongly acid; gradual, wavy boundary.

B21—8 to 17 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; firm to friable; common roots; about 5 percent, by volume, coarse fragments that are mostly flat, angular sandstone less than 5 centimeters across; very strongly acid; clear, wavy boundary.

B22—17 to 21 inches, yellowish-brown (10YR 5/4) silt loam that has common, fine, distinct, strong-brown (7.5YR 5/6) mottles; ped faces coated with light yellowish-brown (10YR 6/4) silt; weak, fine and medium, subangular blocky structure; firm; few roots; about 5 percent, by volume, is coarse fragments that are mostly flat angular sandstone less than 5 centimeters across; very strongly acid; clear, wavy boundary.

B23—21 to 24 inches, strong-brown (7.5Y 5/8) silt loam that has common, fine, distinct, strong-brown (7.5YR 5/6) mottles; thin, vesicular, discontinuous, light yellowish-brown (10YR 6/4) silty ped coatings; weak, fine and medium, subangular blocky structure; firm; few roots; about 5 percent, by volume, is fragments that are mostly of flat angular sandstone less than 5 centimeters across; strongly acid; abrupt, wavy boundary.

Bx1—24 to 37 inches, dark yellowish-brown (10YR 4/4) light silt loam that has a strong-brown (7.5YR 5/8) thick rind along the outer edge of the peds; ped faces coated with light brownish gray (2.5Y 6/2) and gray (10YR 5/1); weak, very coarse (6 to 12 inches across), prismatic structure that parts to weak, medium, angular blocky; very firm; brittle; common, thin, black (10YR 2/1) stains in prism interiors; no roots in ped interiors but very few fine roots along prism faces; dark grayish-brown (10YR 4/2), thick, patchy clay films on vertical faces of prisms; about 5 to 10 percent, by volume, is coarse fragments, mainly sandstone; slightly acid; diffuse, wavy boundary.

Bx2—37 to 50 inches, olive-brown (2.5Y 4/4) light silt loam; thin vesicular light olive-gray (5Y 6/2) ped coatings; very weak, very coarse (8 to 14 inches across), prismatic structure that parts to weak, medium, angular blocky and platy; very firm; brittle; few, thin, black (10YR 2/1) stains in prism interiors; no roots; about 5 to 10 percent, by volume, is coarse fragments, mainly sandstone; slightly acid; clear, wavy boundary.

C—50 to 70 inches, olive-brown (2.5Y 4/4) coarse silt loam that has a few vertical fractures coated with gray (5Y 6/1); massive; firm; about 5 to 10 percent, by volume, is coarse fragments, mainly sandstone and a few fragments of black shale and igneous pebbles; neutral and weakly calcareous.

The solum ranges from 36 to 60 inches in thickness. The A1 horizon normally dries to one unit lower in chroma and one unit higher in value than is given in the representative profile. In some places there is a discontinuous, dark grayish-brown (10YR 4/2) or gray (10YR 6/2) A2 horizon about 1 inch thick. The Ap horizon is commonly dark grayish brown (10YR 4/2). The B1 horizon is strong brown (7.5YR 5/6), yellowish brown (10YR 5/4–5/6), or dark yellowish brown (10YR 4/4). In places where the A2 horizon is thin, the B1 horizon typically is strong brown (7.5YR 5/6), but it is dark reddish brown (5YR 3/4) in a few places. The B1 horizon has moderate to strong, coarse, granular or crumb structure in some places.

Surface and coating colors on the ped faces of the upper B2 horizons include light gray (5Y 7/2), light grayish brown (10YR 6/2), and grayish brown (10YR 5/2) in addition to the more typical chroma of 3 or 4. The B2 horizons are loam or silt loam. The soil material above the fragipan is very strongly acid and has low base saturation.

The fragipan is at depths between 18 and 26 inches. Its matrix colors are dark yellowish brown (10YR 4/4), olive brown (2.5Y 4/4), and yellowish brown (10YR 5/4–5/6). The faces of prisms are coated with films of light brownish-gray (2.5Y 6/2) and gray (5Y 5/1) silt and clay. Clay films are more than 1 millimeter thick but are patchy. The fragipan is silt loam or loam. The average clay content of the B2 and Bx horizons, by weight, ranges from 18 to 25 percent to a depth of 40 inches. In this zone the content of pebbles and of sand coarser than very fine sand ranges from 20 to 50 percent. The content of coarse fragments ranges from 5 to 25 percent. In some places, the pH and base saturation are greater in the upper part of the fragipan or are as little as in the soil material above its fragipan. The depth of leaching to calcareous material is variable within short distances but is generally more than 48 inches. A neutral C1 horizon, up to 2 feet thick, occurs in some places. The C horizon is silt loam or loam. The calcium carbonate equivalent of the calcareous till ranges from 2.4 to 10.1 percent.

Cambridge soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Venango soils, the poorly drained Frenchtown soils, and the very poorly drained Ilion soils. Cambridge soils are similar to Pierpont soils but contain less clay. Cambridge and Williamson soils are similar, but they are in different positions and occur in different parts of the county.

Cambridge silt loam, 2 to 6 percent slopes (CaB).—This soil occupies broad areas in the upland and narrow areas along drainageways. A profile of this soil is described as representative for the series. Included with this soil in mapping, in lower areas, are Frenchtown soils.

Surface runoff is medium to rapid. Slow permeability and a moderate hazard of erosion are the main limitations to the use of this soil for farming. Very slow permeability is the main limitation to many nonfarm uses. (Capability unit IIe–2; woodland suitability group 1o1)

Cambridge silt loam, 2 to 6 percent slopes, moderately eroded (CaB2).—The profile of this soil has a thinner, browner surface layer than the profile described as representative for the series. Water erosion has decreased the organic-matter content of the plow layer and has reduced the thickness of the root zone and the available moisture capacity of this soil. This soil is susceptible to erosion. Included with this soil in mapping, generally in woodland, are small areas that are only slightly eroded.

Surface runoff is medium to rapid. In cultivated areas the hazard of erosion is moderate. Very slow permeability is a limitation for many nonfarm uses. (Capability unit IIe–2; woodland suitability group 1o1)

Cambridge silt loam, 6 to 12 percent slopes (CaC).—This soil occupies narrow areas along streams and large drainageways. Cultivated areas are very susceptible to surface crusting. Included with this soil in mapping are small areas where slopes are more than 12 percent.

Because surface runoff is rapid, the erosion hazard is severe in cultivated areas. Slope and very slow permeability are limitations for many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 1o1)

Cambridge silt loam, 6 to 12 percent slopes, moderately eroded (CaC2).—This soil has lost 25 to 75 percent of its original surface layer. Most of the present plow layer was formerly the upper part of the subsoil. The plow layer is lower in organic-matter content and more susceptible to surface crusting than is the plow layer of uneroded Cambridge soils. This soil occurs along drainageways in narrow areas where erosion is difficult to control. Included in mapping are small wooded areas that are only slightly eroded.

Because surface runoff is rapid, the erosion hazard is severe unless the soil has a protective plant cover. From open areas of this soil, large amounts of silt are carried to adjacent streams and lower areas. (Capability unit IIIe–2; woodland suitability group 1o1)

Cambridge silt loam, 12 to 18 percent slopes, moderately eroded (CaD2).—This moderately steep soil has lost 25 to 75 percent of its original surface layer as a result of erosion. The present surface layer is mostly material from the upper part of the subsoil. This layer is low in content of organic matter and plant nutrients.

Included with this soil in mapping are soils on short slopes of more than 18 percent. Also included are some small wooded areas that are only slightly eroded.

In cultivated areas the erosion hazard is severe. Slope and very slow permeability are limitations for many nonfarm uses. From open areas of this soil, large amounts of silt are carried to adjacent streams and low areas. (Capability unit IVe–1; woodland suitability group 1r1)

Cambridge silt loam, sandstone substratum, 2 to 6 percent slopes (CbB).—This soil has a profile that is similar to the one described as representative for the series, except that fractured sandstone is at a depth of 4 to 5 feet and many sandstone fragments are throughout the soil. This soil occurs mainly near the town of Hartsgrove.

Because surface runoff is medium to rapid, the erosion hazard is medium. Very slow permeability and the fractured underlying sandstone are also limitations to use of this soil, particularly for engineering work. (Capability unit IIe–2; woodland suitability group 1o1)

Cambridge silt loam, sandstone substratum, 6 to 12 percent slopes, moderately eroded (CbC2).—This soil occurs mostly near Hartsgrove. It has a profile similar to the one described as representative for the series, except that fractured sandstone is at a depth of 4 to 5 feet and that many sandstone fragments are throughout. Erosion has thinned the original surface layer, and the plow layer contains material from the surface layer and from the subsoil. The organic-matter content of this soil is low. Included with this soil in mapping are a few areas where slopes are as much as 18 percent.

Surface runoff is rapid, and the erosion hazard is severe. Seepy areas are common near the lower slopes of this soil. The underlying fractured sandstone is a limitation to use of this soil for many engineering practices. (Capability unit IIIe–2; woodland suitability group 1o1)

Canadice Series

The Canadice series consists of poorly drained, nearly level soils that occupy broad areas in the valley of the Grand River and in the headwater areas of Pymatuning Creek and the Ashtabula River. These soils formed in layers of silty and clayey sediments that were deposited in lakebeds during the glaciation of Wisconsin age. These soils have some clayey layers in the subsoil.

A representative profile of Canadice silt loam in a wooded area has a thin, black organic layer on the surface. This layer is underlain by a thin, black silt loam layer that is very friable and very strongly acid. Next is 5 inches of gray silt loam that is distinctly mottled with yellowish brown. The uppermost layer in the subsoil is light brownish-gray silty clay that is sticky when wet. This layer is between depths of 7 and 21 inches. Below 21 inches the subsoil is firm silty clay or silty clay loam that is gray or olive brown. Beneath a depth of 52 inches, textural stratification is commonly apparent.

The permeability in Canadice soils is very slow. These soils have a seasonally high water table for long periods during winter and spring. As a result, they are slow to warm up and dry out in spring unless they are drained. Their root zone is moderately deep most of the time, but it is deep in summer when the water table is low. The root zone has a medium available moisture capacity, but large amounts of water are available from seepage and accumulation from adjacent areas.

The root zone of these soils generally is strongly acid in the upper 2 feet, though the surface layer is less acid in limed areas. The capacity for storing and releasing plant nutrients is moderate.

Most areas of Canadice soils in this county are not fully used for farming. Although many areas are wooded or are overgrown with brush, they can be farmed if they are cleared and intensively managed.

Representative profile of Canadice silt loam (T. 10 N., R. 4 W.; about 2 miles north-northwest of Rock Creek, 100 feet east of entrance to Beaumont Boy Scout Camp, Morgan Township):

O1—1½ inches to 1 inch, mantle of undecomposed leaf litter; abrupt, smooth boundary.

O2—1 inch to 0, black matted, somewhat greasy mor; many fine roots; abrupt, smooth boundary.

A1—0 to 2 inches, black (10YR 2/1) silt loam; strong, fine, granular structure; very friable; many roots; very strongly acid; abrupt, wavy boundary.

A2g—2 to 7 inches, gray (10YR 6/1) heavy silt loam that has common, medium, distinct mottles of yellowish brown (10YR 5/8); weak, medium, platy structure that parts to weak, medium, granular; firm; few roots; peds coated with light brownish gray (2.5Y 6/2); thin, patchy clay films; strongly acid; clear, wavy boundary.

B21tg—7 to 12 inches, light brownish-gray (2.5Y 6/2) silty clay that has common, medium, distinct mottles of strong brown (7.5YR 5/8); moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; firm; few roots; peds are coated with light brownish-gray (2.5Y 6/2), thin, patchy clay films; strongly acid; clear, wavy boundary.

B22tg—12 to 21 inches, light brownish-gray (2.5Y 6/2) silty clay that has common, medium, distinct mottles of strong brown (7.5YR 5/8); strong, medium, prismatic structure; firm; few roots; peds coated with thin, gray (5Y 6/1) clay films; numerous small pores in ped interiors; strongly acid; clear, wavy boundary.

B23tg—21 to 30 inches, gray (5Y 6/1) heavy silty clay loam that has common, medium, distinct mottles of strong brown (7.5YR 5/8); moderate, medium and coarse, prismatic structure; firm; few roots; peds coated with thin, gray (5Y 6/1) clay films; few small pores; strongly acid; clear, wavy boundary.

B31t—30 to 36 inches, olive-brown (2.5Y 4/4) heavy silty clay loam that has few, medium, distinct mottles of gray (5Y 6/1); weak, coarse and very coarse, prismatic structure; firm; few roots; peds coated with gray (5Y 6/1) clay films; slightly acid; gradual, wavy boundary.

B32t—36 to 52 inches, olive-brown (2.5Y 4/4) silty clay that has few, medium, distinct mottles of gray (5Y 6/1); weak, coarse and very coarse, prismatic structure; firm; peds coated with thin, gray (5Y 6/1) clay films; neutral; clear, irregular boundary.

C—52 to 66 inches, olive-brown (2.5Y 4/4) silty clay and some thin, vertical and horizontal streaks of gray (5Y 6/1); weak, thin and medium, platy structure; firm; few, thin, discontinuous, gray (5Y 6/1) clay films in upper part; mildly alkaline; weakly calcareous.

The Ap horizon normally is dark grayish brown (10YR 4/2) or dark gray (10YR 4/1). It ranges from silt loam to silty clay loam, but it is silt loam in most places. In some places the lower B2 horizons have common yellowish-brown (10YR 5/4) or reddish-yellow (7.5YR 6/6) mottles in the ped interiors. The gray mottles and clay films commonly vary one unit in value, chroma, or hue. In some places the B3 and C horizons are yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), or light olive brown (2.5Y 5/4). The B horizons are heavy silty clay loam or silty clay. The clay content ranges from 35 to 52 percent, and the sand content is less than 10 percent.

The C horizon is silty clay, clay, or heavy silty clay loam. The C horizon is commonly stratified in texture, and thin layers of medium-textured or moderately coarse textured materials occur in some places. Canadice soils are strongly acid or medium acid in the upper part of the solum, but the reaction increases markedly to slightly acid or neutral in the lower part of the B horizon. The depth to carbonates ranges from 36 to 56 inches.

Canadice soils are the poorly drained members of a drainage sequence that includes the somewhat poorly drained Caneadea soils. The Canadice soils are higher in elevation and more clayey beneath the surface layer than the poorly drained Holly soils, which are near the Canadice soils in some places. A fragipan that is characteristic of the poorly drained Sheffield does not occur in the Canadice soils. Canadice soils are more clayey in the B horizon than are the Sheffield soils.

Canadice silt loam (Cc).—This nearly level soil commonly surrounds gently sloping, somewhat poorly drained Caneadea soils. It has slow surface runoff, and it is subject to ponding. Some small areas of this soil along the headwaters of Ashtabula River in Richmond Township are subject to flooding. A profile of this Canadice soil is described as representative for the series. Included with this soil in mapping are small areas of Caneadea soils that were too small to map separately.

This soil is highly susceptible to surface crusting in cultivated areas. Its range of optimum moisture content for tillage is narrow.

Seasonal wetness and very slow permeability are the major limitations to the use of this soil. In engineering work, the clayey subsoil and substratum are subject to compression and possible slippage under heavy loads. (Capability unit IVw–1; woodland suitability group 2w1)

Canadice-Caneadea silt loams, 0 to 2 percent slopes (CeA).—This mapping unit consists of nearly level or depressional areas of Canadice soils that are interspersed with low knolls or ridges of somewhat poorly drained Caneadea soils. The Caneadea soils are described under the heading "Caneadea Series". The Canadice soils and the Caneadea soils each occupy approximately 50 percent of the mapping unit. Included with these soils in mapping are small depressional areas of Canadice soils, mucky variants.

Most areas of this mapping unit are wooded. The depressional Canadice soils are commonly ponded for long periods. Seasonal wetness and very slow permeability are the main limitations to the use of these soils. Both kinds of soils tend to be unstable when used for engineering purposes. (Capability unit IVw–1; woodland suitability group 2w1)

Canadice Series, Mucky Variants

Soils of the Canadice series, mucky variants, differ from representative Canadice soils by having a mucky surface layer. They are nearly level to depressional and occur in the headwater area of Rock Creek on the Trumbull County line. These soils formed in swampy areas that were lakebeds during the Wisconsin glacial age.

A representative profile of Canadice soils, mucky variants, has a black, mucky surface layer about 9 inches thick. A thin, very dark gray silty clay layer extends to a depth of 12 inches. The silty clay subsoil is gray to a depth of 30 inches and brown to a depth of 40 inches. It is mottled with yellowish brown, strong brown, and reddish brown. Between depths of 40 and 45 inches is massive silty clay.

Canadice soils, mucky variants, have very slow permeability. Unless they are drained, they have a high water table for long periods. The root zone is limited by excess water and the clayey subsoil. Large amounts of water are available to plants through seepage, but these soils have only a medium available moisture capacity. In the uppermost 2 feet, these soils range from strongly acid to slightly acid.

These mucky variants are used for crops, for pasture, or as woodland.

Representative profile of Canadice soils, mucky variants (3 miles southeast of Orwell and three-quarters of a mile south of Moore Road, Orwell Township):

O2—0 to 9 inches, black (10YR 2/1) muck, dark reddish brown (5YR 3/2) when crushed; moderate, fine and medium, granular structure; very friable; many roots; strongly acid; abrupt, wavy boundary.

A1—9 to 12 inches, very dark gray (10YR 3/1) silty clay; few, light brownish-gray (10YR 6/2) mottles; structureless (massive); very firm; many roots; yellowish-brown (10YR 5/6) coatings in root channels; upper inch has a few black (10YR 2/1) stains; medium acid; abrupt, smooth boundary.

B2g—12 to 30 inches, gray (5Y 5/1) silty clay in which 10 percent of the upper part is yellowish-brown (10YR 5/8) mottles; strong brown (7.5YR 5/8) in the lower part; weak, coarse, prismatic structure; very firm; common roots; slightly acid; clear, wavy boundary.

B3—30 to 40 inches, brown (10YR 4/3) silty clay; 10 percent of ped interiors mottled with gray (10YR 5/1); weak, coarse, prismatic structure parting to moderate, coarse, angular blocky; structure is weaker as depth increases; very firm; few roots; root channels coated with dark reddish brown (5YR 3/4); vertical prism faces are gray (N 4/0); secondary horizontal faces mottled with dark reddish brown (5YR 3/4), dark gray (10YR 4/1), and very dark gray (10YR 3/1); moderately alkaline; gradual, wavy boundary.

C—40 to 45 inches +, brown (10YR 4/3) silty clay; ped interiors have gray (N 5/0) coatings in cracks and root channels; structureless (massive); vertical drying cracks; very firm; few roots; moderately alkaline; calcareous.

The mucky surface layer ranges from 8 to 12 inches in thickness but is generally less than 10 inches thick. The A1 horizon ranges from 3 to 8 inches in thickness. The A1 horizon is black (10YR 2/1) or very dark gray (5Y 3/1) in some places. The B horizons have a few yellowish-brown (10YR 5/6) mottles in some places.

Canadice soils, mucky variants, are similar to the representative Canadice soils except that the variants have a mucky surface layer and that they formed in generally wetter material. They have a much thinner muck layer than Carlisle or Willette muck.

Canadice soils, mucky variants (Cd).—Crusting on the nearly level soils of this mapping unit is minimal because the surface layer contains a large amount of organic matter. In cultivated areas, however, the muck surface layer commonly is destroyed by oxidation and surface clodding is a problem. Drainage is needed in all places before crops can be grown. Most areas where the muck has been destroyed are used for pasture.

Seasonal wetness, very slow permeability, and surface ponding are the main limitations to the use of this soil. In engineering work, the clayey subsoil and substratum are subject to slippage under heavy loads. (Capability unit IVw–1; woodland suitability group 2w1)

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Caneadea Series

In the Caneadea series are deep, somewhat poorly drained soils that range from nearly level to moderately steep. In this county Caneadea soils are mostly in the valley of the Grand River. They formed in silty and clayey sediments that were deposited in glacial lakebeds during the Wisconsin glaciation. The Caneadea soils are clayey beneath the uppermost layers (fig. 11).

A representative profile of a Caneadea soil has a dark grayish-brown silt loam plow layer that is friable. The uppermost layer in the subsoil is about 7 inches thick and is mottled yellowish-brown, brownish-yellow, and brown silty clay loam. The subsoil from a depth of 15 to 40 inches is olive-brown silty clay that is slightly sticky and slightly plastic when wet. Below a depth of 40 inches, olive-brown silty clay is stratified with thin silty and sandy layers.

Because their permeability is very slow, Caneadea soils have a seasonal high water table during winter and spring. They dry out slowly in spring unless they are drained. Their root zone is mostly moderately deep, but it is deep when the water table is low. It has only a medium available moisture capacity, but these soils are seldom droughty. The root zone is generally very strongly acid or strongly acid. Caneadea soils have a moderate capacity for the storing and releasing of plant nutrients.

Most areas of Caneadea soils are overgrown with brush or are wooded. If these soils are intensively managed, they are suited to field crops or grasses and legumes.

Representative profile of a Caneadea silt loam (T. 10 N., R. 4 W., 2½ miles southwest of Eagleville and one-half mile west of the intersection of Tote and Sweitzer Roads, on north side of Sweitzer Road, Morgan Township):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; very strongly acid; abrupt, wavy boundary.

B1g—8 to 15 inches, mottled yellowish-brown (10YR 5/6), brownish-yellow (10YR 6/6), and grayish-brown (10YR 5/2) silty clay loam; weak, fine and medium, subangular and angular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; common roots; few clay films; very strongly acid; clear, wavy boundary.

B21tg—15 to 24 inches, olive-brown (2.5Y 4/4) silty clay that has few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, coarse, prismatic structure; firm when moist, slightly sticky and slightly plastic when wet; common roots along ped faces; peds coated with thin, continuous, light olive-gray (5Y 6/2) clay films; few, fine, black concretions and films; strongly acid; gradual, smooth boundary.

B22tg—24 to 40 inches, olive-brown (2.5Y 4/4) silty clay; weak, coarse, prismatic structure; very firm when moist, slightly sticky and slightly plastic when wet; few roots along ped faces; peds coated with thin, continuous, gray (5Y 5/1) clay films; few, fine, black concretions and stains; neutral; gradual, wavy boundary.

C—40 to 58 inches, olive-brown (2.5Y 4/4) silty clay that has few, fine, prominent, gray (5Y 5/1) streaks and mottles; weak, thin and medium, platy structure that

Figure 11.—Farm pond constructed in Caneadea silt loam.

seems to represent bedding planes; firm; no roots; mildly alkaline; calcareous.

The A horizon is silt loam or silty clay loam. The Ap horizon is brown (10YR 5/3), grayish brown (10YR 5/2), or dark grayish brown (10YR 4/2). The B2 horizons are heavy silty clay loam in some places. The clay content of the B2 horizons ranges from 35 to 52 percent. Textural stratification is apparent, and thin zones of medium-textured or moderately coarse textured materials occur. The hues of the matrix in the B and C horizons range from 2.5Y to 10YR. Clay films on peds in the upper part of the B horizon have a chroma of 2 or 3, but in the lower part of the B horizon, they have a chroma of 1 or 2. The reaction of the upper part of the solum ranges from very strongly acid to strongly acid, but very strongly acid is most common. The pH in the lower part of the solum increases markedly to slightly acid or neutral. The depth to carbonates ranges from 36 to 56 inches. In many places the calcareous materials occur as hard concretions, as whitish zones between bedding planes, or as both.

Caneadea soils are the somewhat poorly drained members of a drainage sequence that includes the poorly drained Canadice soils. The layer beneath the surface layer of Caneadea soils are more clayey than corresponding layers in the nearby poorly drained Wallington soils. Caneadea soils lack a fragipan in the subsoil but a fragipan is characteristic of Wallington soils.

Caneadea silt loam, 0 to 2 percent slopes (CfA).—This soil occupies slight rises that are generally surrounded by poorly drained Canadice soils. A profile of this soil is described as representative for the series. Included with this soil in mapping are some small areas of the wetter Canadice soils. These included areas generally are in low depressions.

Surface runoff is slow to ponded. Cultivated areas are susceptible to surface crusting. This soil has a narrow range of optimum moisture for tillage.

Very slow permeability and seasonal wetness are the major limitations to most uses of this soil. In addition, this soil is soft and compressible when saturated, and it has poor trafficability. (Capability unit IIIw–6; woodland suitability group 2w2)

Caneadea silt loam, 2 to 6 percent slopes (CfB).—This soil occupies narrow areas along drainageways. Near the base of these areas, small areas of poorly drained Holly or Canadice soils are included.

Because surface runoff is medium, erosion is a hazard in cultivated areas. The major limitations to the use of this soil, however, are seasonal wetness and very slow permeability. The soil is soft and compressible and is subject to slippage under heavy loads. (Capability unit IIIw–6; woodland suitability group 2w2)

Caneadea silt loam, 6 to 12 percent slopes, moderately eroded (CfC2).—The present surface layer of this soil is a mixture of the original surface layer and some of the upper part of the subsoil. As a result of erosion, the surface layer generally is more brown than that in the profile described as representative for the series. In some areas, the surface layer is silty clay loam instead of silt loam. This soil has a narrower range of optimum moisture for tillage than uneroded Caneadea soils, but it dries out more quickly than do the less strongly sloping Caneadea soils. If tilled when too wet or too dry, this soil is cloddy. It occupies narrow side slopes along upland drainageways and streams. These side slopes are short, and erosion control measures on them are difficult.

The major limitation to the use of this soil for crops is a very severe erosion hazard. Very slow permeability and slope are limitations for many nonfarm uses. This soil is subject to slippage, and it is soft and compressible when it is wet. (Capability unit IVe–2; woodland suitability group 2w2)

Caneadea silt loam, 12 to 18 percent slopes, moderately eroded (CfD2).—On most areas of this soil, erosion has removed 25 to 75 percent of the original surface layer. In cultivated areas, the surface layer contains much material from the upper part of the subsoil. The surface layer generally is finer textured and more brown than that of Caneadea silt loam, 0 to 2 percent slopes, which has the profile described as representative for the series.

Cultivated areas and areas bare of vegetation are highly susceptible to erosion. This soil generally is too steep and erodible for cultivated crops. Because it occupies fairly narrow slopes, erosion control is difficult. Slips commonly occur, and this soil is soft and compressible when wet. Very slow permeability and slope are additional limitations for many nonfarm uses. (Capability unit VIe–1; woodland suitability group 2w2)

Carlisle Series

The Carlisle series in this county consists of organic soils that are deep, dark colored, and very poorly drained. In these soils are layers of muck that accumulated from partly decomposed plant materials from trees, fibrous grasses, sedges, and reeds. The depth of the muck layer to the underlying mineral soil material is more than 42 inches. The Carlisle soils are level and occupy low, swampy areas near the headwaters of Rock Creek, in the valley of Pymatuning Creek, and in a few lagoons along Lake Erie.

In a representative profile, a Carlisle soil is black muck to a depth of 45 inches. Beneath the muck layer is gray, clayey material. Both the muck and the clayey underlying material are saturated with water almost continuously, unless the soil is drained.

Carlisle soils must be drained before they can be used for farming. If they are drained, they have a high available moisture capacity and provide a deep root zone for annual crops. This root zone normally is strongly acid to neutral. The muck layer has moderately rapid permeability, and the underlying material has very slow permeability.

Undrained areas of Carlisle muck generally are swampy and brushy. Some cleared and drained areas are used for vegetable crops. If they are intensively managed, Carlisle soils are well suited to these crops.

Representative profile of Carlisle muck (T. 8 N., R. 4 W., 3 miles southeast of Orwell, Orwell Township):

1—0 to 8 inches, black (10YR 2/1) muck; moderate, medium and fine, granular structure; very friable; abundant roots; strongly acid; diffuse boundary.

2—8 to 45 inches, black (10YR 2/1) muck; moderate, medium and coarse, granular structure; very friable; few reddish-brown (5YR 4/4) wood fragments; strongly acid.

IICg—45 to 60 inches, gray (10YR 5/1) silty clay; structureless (massive); moderately alkaline; calcareous.

The 1 and 2 horizons have been ranging from 5YR to 10YR and a chroma and value of 2 or less. The quantity of partly decomposed wood fragments is variable, but in most places the fragments are easily recognized. The Carlisle soils in this county have a thinner layer of muck than Carlisle soils mapped in other survey areas. This difference, however, does not affect the use or behavior of the soils.

Carlisle soils differ from Willette soils in that they have muck layers thicker than 40 inches.

Carlisle muck (Cg).—Some areas of this nearly level soil have a thicker muck layer than that in the profile described as representative for the Carlisle series. Included with this soil in mapping are a few areas of Willette muck that are too small to map separately.

Drained areas of Carlisle muck are subject to subsidence (shrinkage) when the organic materials are oxidized. During dry periods, this soil is subject to soil blowing where the soil is bare and exposed to strong winds. Control of the water table is desirable if vegetable crops of high value are grown.

The wetness hazard on this soil is severe, even where the soil is drained. Roads and buildings are subject to severe soil settlement. (Capability unit IIIw-5; woodland suitability group not assigned)

Chagrin Series

The Chagrin series consists of well-drained soils that are subject to flooding. These soils formed in medium acid to mildly alkaline alluvium washed from uplands. They are nearly level and occur on flood plains along the major streams throughout the county.

A representative profile of a Chagrin silt loam has a dark grayish-brown silt loam surface layer about 11 inches thick. The subsoil is yellowish-brown silt loam that extends to a depth of 44 inches. The underlying material is brown silt loam to a depth of 60 inches. The entire profile is friable.

Chagrin soils have moderate permeability. These soils have a deep root zone and a high available moisture capacity. The capacity for storing and releasing plant nutrients is moderate. The root zone of these soils is mostly medium acid.

Most areas of the Chagrin soils are used for general farm crops.

Representative profile of Chagrin silt loam (T. 13 N., R. 1 W., 4 miles southwest of the center of downtown Conneaut along Conneaut Creek, 100 yards east of the covered bridge, Monroe Township):

Ap1—0 to 3 inches, silt loam that is dark grayish brown (10YR 4/2) when moist and crushed; weak, very fine, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.

Ap2—3 to 11 inches, silt loam that is dark grayish brown (10YR 4/2) when moist and crushed; weak, moderate and coarse, granular structure; friable; common roots; medium acid; abrupt, smooth boundary.

B2—11 to 44 inches, yellowish-brown (10YR 5/4) silt loam; very weak, medium, subangular blocky structure; friable; few roots; dark-brown (10YR 4/3), patchy organic stains in cracks and very dark grayish-brown (10YR 3/2) organic stains in root channels; organic stains are more confined to root channels and are less numerous as depth increases; medium acid; clear, smooth boundary.

C—44 to 60 inches, brown (10YR 4/3) silt loam; massive; friable; medium acid.

The Ap2 horizon is compacted and massive in places. To a depth of 40 inches, reaction is medium acid to slightly acid. The B horizon is dominantly silt loam or loam. The average clay content in the B horizon is slightly more than 18 percent, by weight. The C horizon commonly is stratified and has strata ranging from sandy loam to silty clay loam. In some places, strata having these textures are also in the B horizon.

Chagrin soils are part of a drainage sequence on flood plains that includes the moderately well drained Lobdell soils, the somewhat poorly drained Orrville soils, and the poorly drained Holly soils. Chagrin soils generally occupy parts of the flood plain that are flooded less easily than Lobdell, Orrville, and Holly soils. Chagrin soils are commonly on the natural levees adjacent to the streambanks.

Chagrin silt loam (Ch).—This Chagrin soil is deep and nearly level. Because it is flooded, mostly in winter and early in spring, the choice of crops to be grown is somewhat limited. Flooding also limits use of this soil for most other purposes. This soil has a wide range of optimum moisture for tillage, and it generally is in good tilth. As a result, it is commonly used for corn and other summer crops. It is well suited to these crops. (Capability unit IIw-4; woodland suitability group 1o1)

Chenango Series

The Chenango series consists of deep, well-drained soils that are moderately deep or deep to sand and gravel. These soils formed in gravelly material on beach ridges and glacial outwash terraces. They are mainly in the northern part of the county and in the valley of Pymatuning Creek.

A representative profile of a Chenango soil has a plow layer of gravelly loam that is very dark grayish brown when crushed. This layer is about 25 percent gravel, by volume. The subsoil is 30 inches thick and is yellowish brown in the upper part, dark yellowish brown in the middle 6 inches, and strong brown in the lower part. It is friable and gravelly throughout. At a depth of 38 inches, there is dark yellowish-brown coarse sand and fine gravel.

Because Chenango soils have moderately rapid to rapid permeability, they dry out early in spring. Permeability causes a pollution hazard to underground water supplies if these soils are used for disposal of solid waste or of sewage effluent. These soils hold only small amounts of moisture available for plants, but the soils are well suited to irrigation if they are protected from erosion. The root zone of Chenango soils largely depends on the depth to coarse sand and gravel and is less than 36 inches thick in most places. The root zone is strongly acid or very strongly acid. Chenango soils have a moderate capacity for the storing and releasing of plant nutrients.

Chenango soils are used mostly for general farm crops that include a high proportion of forage crops. In the northern part of the county, these soils are used for specialty crops, such as tree fruits, small fruits, and nursery crops.

Representative profile of a Chenango gravelly loam (T. 13 N., R. 1 W., 1 mile south of State Route 20 and one-half mile west of new State Route 7, Monroe Township):

Ap—0 to 8 inches, gravelly loam that is very dark grayish brown (10YR 3/2, 4/2) when crushed; moderate, medium and fine, granular structure; very friable; many roots; 25 percent gravel; strongly acid; abrupt, smooth boundary.

B21—8 to 20 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, medium and coarse, subangular blocky structure; friable; common roots; 25 percent gravel; strongly acid; gradual, wavy boundary.

B22—20 to 26 inches, dark yellowish-brown (10YR 4/4) gravelly loam that has few, fine, faint, dark-brown (7.5YR 4/4) mottles; weak, medium and coarse, subangular blocky structure; friable; common roots; 35 percent gravel; strongly acid; gradual, irregular boundary.

B23—26 to 38 inches, strong-brown (7.5YR 5/6) gravelly loam that has few, fine, faint, dark-brown (7.5YR 4/4) mottles; weak, coarse, subangular blocky structure; friable; few roots; few, medium, prominent, very dark brown (10YR 2/2) stains; 35 percent gravel; strongly acid; clear, wavy boundary.

C—38 to 50 inches, dark yellowish-brown (10YR 4/4) coarse sand and fine gravel; structureless (single grain); few, medium, prominent, very dark brown (10YR 2/2) stains; loose; no roots; 65 percent gravel; strongly acid.

The solum ranges from 30 to 40 inches in thickness. The surface layer is silt loam or gravelly loam. The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3). When crushed, the Ap horizon has a value of 4. The matrix of the B horizons is yellowish brown (10YR 5/4–5/6), dark yellowish brown (10YR 4/4), dark brown 7.5YR 4/4), or strong brown (7.5YR 5/6). The B horizons are dominantly gravelly loam or gravelly silt loam. Chenango soils are strongly acid or very strongly acid, and pH increases only slightly as depth increases. The Chenango silt loams are less than 15 percent gravel to a depth of 10 to 20 inches.

The Chenango soils typically are adjacent to the moderately well drained Braceville, the somewhat poorly drained Red Hook, and the very poorly drained Atherton soils. Chenango soils are the well-drained members of this drainage sequence. They are also adjacent to well-drained Otisville and Colonie soils. Chenango soils are thicker to sand and gravel than the Otisville soils and are more gravelly and less sandy than the Colonie soils.

Chenango silt loam, 0 to 2 percent slopes (CkA).—This soil occupies broad areas, mainly in the valley of Pymatuning Creek. The profile of this soil contains less gravel in the uppermost 10 to 20 inches than does the profile described as representative for the series. This soil can hold more moisture available for plants than can other Chenango soils. Because of the available moisture capacity, and because there is practically no erosion hazard, this is the best suited Chenango soil for crops in the county. Although this soil is less droughty than other Chenango soils, its major limitation to crop production is droughtiness. Other than droughtiness, limitations are few for many nonfarm uses. (Capability unit IIs–1; woodland suitability group 2o1)

Chenango silt loam, 2 to 6 percent slopes (CkB).—This soil generally has few or no pebbles in the uppermost 10 to 15 inches. It occupies convex knolls and areas along drainageways.

Included with this soil in mapping are moderately eroded areas. These eroded areas generally can be identified by a concentration of gravel on the soil surface. Also, they generally are lighter colored than uneroded areas.

Surface runoff is slow to medium. In cultivated areas the erosion hazard is moderate. This soil has few limitations for many nonfarm uses. (Capability unit IIe–1; woodland suitability group 2o1)

Chenango silt loam, 6 to 12 percent slope, moderately eroded (CkC2).—This soil is mostly on narrow side slopes along drainageways. In most areas 25 to 75 percent of the silt loam surface layer has been removed by water erosion. For this reason, this soil is lower in available moisture capacity than most uneroded Chenango soils, but it generally has a higher available moisture capacity than the gravelly Chenango soils. Included with this soil in mapping are some small droughty areas that are shallow to gravel or sand.

This soil has a low organic-matter content. Surface runoff is medium to rapid and the hazard of erosion is severe in cultivated areas. This soil has few limitations other than slope or droughtiness for many nonfarm uses. (Capability unit IIIe–1; woodland suitability group 2o1)

Chenango silt loam, 12 to 18 percent slopes, moderately eroded (CkD2).—This soil occupies long narrow side slopes. In a few places, it is on irregular, hummocky hills, or kames. Because this soil is eroded, it generally has more coarse fragments and pebbles in the surface layer than other Chenango silt loams. It has a very low organic-matter content, and it is very droughty. Included with this soil in mapping are areas of Otisville soils, which are shallow to gravel.

Surface runoff is rapid, and the erosion hazard is very severe in cultivated areas. Slope and droughtiness are limitations for many nonfarm uses. (Capability unit IVe–3; woodland suitability group 2o1)

Chenango gravelly loam, 0 to 2 percent slopes (ClA).—This soil occupies fairly large areas mostly in the northern part of the county. A profile of this soil is described as representative for the series. Included with this soil in mapping are a few areas of a soil that lack the gravelly surface layer of this soil and generally is higher in sand content. Also included are small areas of Otisville and Braceville soils. The Braceville soils are moderately well drained and generally are in the lowest parts of the mapped areas.

This soil is widely used for specialty crops. Surface runoff is slow, and erosion is not a hazard. Irrigation is necessary for the successful growth of most crops.

A low available moisture capacity is the major limitation to use of this soil for farming. Limitations to many nonfarm uses are few. (Capability unit IIs–1; woodland suitability group 2o1)

Chenango gravelly loam, 2 to 6 percent slopes (ClB).—This gently sloping soil is on knolls and narrow areas on side slopes around drainageways. In some places, this soil is less gravelly and more sandy than typical, and in other places it is less deep to gravel.

This soil is used mainly for specialty crops, but irrigation is needed for the successful growth of plants. The major limitations of this soil for farming are droughtiness and a moderate erosion hazard. Surface runoff is slow. Limitations for many nonfarm uses are few. (Capability unit IIe–1; woodland suitability group 2o1)

Chenango gravelly loam, 6 to 12 percent slopes, moderately eroded (ClC2).—This soil typically occupies narrow slopes adjacent to drainageways. Because of erosion, the surface layer is browner and more gravelly than that of uneroded Chenango soils. This soil is very low in organic-matter content, and it is very droughty.

Cultivated areas of this soil are used for general farm crops, forage crops, and specialty crops. Erosion is a very severe hazard if this soil is cultivated and not protected from erosion. Farm use is also limited by low available moisture capacity, and some nonfarm uses are limited by slope. (Capability unit IIIe–1; woodland suitability group 2o1)

Claverack Series, Silty Subsoil Variant

The Claverack series, silty subsoil variant, consists of moderately well drained soils that formed partly in an upper layer of sandy material and partly in underlying material consisting of silt loam glacial till. The sandy upper part of these soils is about 20 to 36 inches thick. These soils typically occupy areas on the lake plain in the northern part of the county.

In a representative profile of a Claverack loamy fine sand, silty subsoil variant, the loamy fine sand extents to a depth of 33 inches. The thin surface layer is dark grayish brown. As depth increases beneath the surface layer, color ranges from strong brown to pale brown. The lower half of this sandy material has prominent, yellowish-red mottles. The common light brownish-gray mottles, at depths between 24 and 33 inches, indicate that this soil has a seasonal high water table. Below a depth of 33 inches, glacial till occurs and is light olive-brown silt loam. The uppermost 20 inches of this till has weak, blocky structure and firm consistence. The till material contains a few small angular fragments of sandstone and shale, as well as some igneous pebbles.

These soils have very slow permeability because of the firm underlying glacial till, but air and water move rapidly through the sandy upper part. The water table is seasonally high because of the very slowly permeable till. Also for most annual plants, the till limits root growth to the soil above it. The sandy rooting zone generally is very strongly acid unless the soil has been limed. The capacity for storing and releasing plant nutrients is low. These soils have a low available moisture capacity, but they are suited to irrigation.

Many areas of Claverack soils, silty subsoil variant, are not used for general farming. Areas that are cultivated are used mainly for orchards, vegetables, nursery stock, and other specialty crops.

Representative profile of a Claverack loamy fine sand, silty subsoil variant (T. 14 N., R. 1 W., about one-half mile north of U.S. Highway No. 20, in the city of Conneaut; *laboratory sample* AB-108 in table 10):

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loamy fine sand that has common, coarse, prominent, strong-brown (7.5YR 5/6) mottles; moderate, fine and medium, granular structure; friable; many roots; unstained sand grains are common; very strongly acid; abrupt, smooth boundary.

B&A—3 to 6 inches, strong-brown (7.5YR 5/6) loamy fine sand, 30 percent of which is stained with very dark grayish-brown (10YR 3/2) organic matter; very weak, medium, subangular blocky structure; friable; many roots; very strongly acid; abrupt, smooth boundary.

B21—6 to 11 inches, brown (7.5YR 4/4) loamy fine sand that has few, faint, medium, strong-brown (7.5YR 5/8) mottles; few, medium, prominent, very dark grayish-brown (10YR 3/2) organic stains; weak, medium, subangular blocky structure; friable; common roots; very strongly acid; clear, smooth boundary.

B22—11 to 16 inches, strong-brown (7.5YR 5/6) loamy fine sand; weak, fine and medium, subangular blocky structure; friable; common roots; very strongly acid; abrupt, smooth boundary.

B23—16 to 24 inches, brownish-yellow (10YR 6/6) loamy fine sand that has many, prominent, coarse, yellowish-red (5YR 4/6) mottles; weak, medium, subangular blocky structure; weakly cemented, but shatters under pressure; few roots; common, medium, slightly hard, yellowish-red (5YR 4/6) concretions; strongly acid; clear, wavy boundary.

B31—24 to 33 inches, pale-brown (10YR 6/3) loamy fine sand that has common, medium, distinct, dark-brown (7.5YR 4/4), light brownish-gray (10YR 6/2), and yellowish-red (5YR 5/8) mottles; very weak, medium, subangular blocky structure; friable; few roots; strongly acid; abrupt, smooth boundary.

IIB32—33 to 54 inches, light olive-brown (2.5Y 5/4) silt loam that has common, fine, prominent, light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; weak, medium, angular blocky structure; firm; few roots; about 5 percent coarse material consists of small angular fragments of sandstone and shale and some igneous pebbles; mainly slightly acid, but neutral in lower part; clear, wavy boundary.

IIC—54 to 70 inches, light olive-brown (2.5Y 5/4) silt loam that has few, distinct, medium, yellowish-brown (10YR 5/6) mottles and common, prominent, medium, dark-gray (N 4/0) mottles; structureless (massive); firm; no roots; dark gray (N 4/0) mottles are abundant as depth increases; about 5 percent coarse material consists of small, angular fragments of sandstone and shale and a few igneous pebbles; mildly alkaline; calcareous.

The sandy material is stratified in many places. The content of gravel generally is less than 10 percent, but gravelly strata occur near the lithologic discontinuity in some profiles. The Ap horizon is dark brown (10YR 4/3), dark grayish brown (10YR 4/2), or very dark grayish brown (10YR 3/2). Immediately below the A horizon, the color includes dark brown (10YR 4/3), dark yellowish brown (10YR 4/4), strong brown (7.5YR 5/6), or yellowish brown (10YR 5/6–5/8). The matrix color of the B31 horizon is olive brown (2.5Y 4/4), pale brown (10YR 6/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4). Depth to the silt loam till ranges from 20 to 36 inches.

The horizons above the IIB horizon are strongly acid to very strongly acid. The depth to less acid material and mottling varies with the depth to the silty till material. The IIB horizon is slightly acid or neutral. The IIC horizon is calcareous.

The Claverack soils in Ashtabula County have some characteristics outside the defined range for the Claverack series. The Claverack soils in this county and elsewhere in Ohio have silty IIB and IIC horizons instead of the clayey IIC horizons as in other places. Also, the Claverack soils in Ohio have structure in the IIB horizon, whereas Claverack soils in places other than Ohio have a structureless IIB horizon. A new series is not proposed because of the limited extent of these soils in this State. Also, the differences between Claverack soils in Ohio and those elsewhere are such that their use and management are not affected. Consequently, these soils are placed in the Claverack series, silty subsoil variant.

Claverack soils, silty subsoil variant, are moderately well drained members of a drainage sequence of soils that includes the poorly drained Swanton soils. These variants are similar to the Elnora soils in appearance, but Elnora soils formed in a thicker deposit of sand. Claverack soils have a water table within 6 to 8 feet of the surface much of the time.

Claverack loamy fine sand, silty subsoil variant, 0 to 2 percent slopes (CmA).—This soil occupies scattered areas on the lake plains. Most of these areas are 2 to 5 acres in size. These soils commonly are surrounded by or are adjacent to the poorly drained Conneaut soils. Included with this soil in mapping are areas of Elnora soils that have thicker sandy material than this soil.

This Claverack soil dries out in spring more slowly than other Claverack soils mapped in the county because of its topographic position and nearly level slopes. It does, however, dry out more quickly than the adjacent poorly drained soils. Surface runoff is generally slow because infiltration through the sandy surface layer is rapid.

The major limitation to use of this soil for cultivated crops is a low available moisture capacity and seasonal wetness. Very slow permeability in the lower subsoil and underlying till is a limitation to many nonfarm uses. (Capability unit IIw–2; woodland suitability group 2o1)

Claverack loamy fine sand, silty subsoil variant, 2 to 6 percent slopes (CmB).—This soil occupies knolls that are next to areas of poorly drained Swanton and Conneaut soils. A profile of this soil is described as representative for the series. Included with this soil in mapping are areas of Elnora soils and small areas of a soil that has a less sandy surface layer than this soil.

This Claverack soil dries out and warms up early in spring. Surface runoff generally is slow because infiltration through the sandy surface layer is rapid. During intense storms, however, erosion is a hazard. The fine sand particles are easily detached at the surface, and they are then free to move when runoff occurs. Strong winds can also cause movement of the fine sand particles in areas that are bare of vegetation.

The dominant limitations to the use of this soil for farming are seasonal wetness and a low available moisture capacity. The slow permeability of the lower subsoil and the underlying glacial till is a major limitation for some nonfarm uses. (Capability unit IIw-2; woodland suitability group 2o1)

Claverack loamy fine sand, silty subsoil variant, 6 to 12 percent slopes (CmC).—This soil generally occupies short side slopes adjacent to drainageways. It commonly is in long narrow areas. The sandy upper part of this soil typically is thinner than that of less sloping Claverack soils, and it is generally more droughty than those soils because its sandy upper part is thinner than that of the less sloping soils. Areas lacking a thick plant cover are susceptible to soil blowing or water erosion.

A severe erosion hazard is the major limitation to the use of this soil for farming. Very slow permeability in the lower part of the subsoil and in the underlying glacial till is a limitation for many nonfarm uses. The slope of this soil is also a limitation for many uses. (Capability unit IIIe-1; woodland suitability group 2o1)

Claverack Series, Moderately Shallow Variant

The soils of this variant from the Claverack series are similar to Claverack soils, silty subsoil variant, except for the underlying material. Soils of this moderately shallow variant are underlain by shale bedrock generally within a depth of 20 to 40 inches, whereas soils of the silty subsoil variant have silt loam glacial till at a depth of 20 to 36 inches. Soils of this variant formed partly in sandy material and partly in residuum weathered from the shale. They are gently sloping and occupy areas on the lake plain.

A representative profile of Claverack loamy fine sand, moderately shallow variant, has a dark-brown loamy fine sand plow layer. At depths between 8 and 23 inches, the subsoil is loamy fine sand that is yellowish brown, brownish yellow, and dark yellowish brown. Beneath this sandy material, there is an unconforming layer of reddish-yellow silty clay loam mottled with gray. The silty clay loam in the lower part of the subsoil is gray below a depth of 30 inches. Slightly weathered shale bedrock occurs at a depth of 36 inches.

The sandy upper part of these soils has rapid permeability. The silty clay loam in the lower part of the subsoil and the massive underlying shale permit only very slow permeability. As a result, these soils have a seasonal high water table. The normal root zone of these soils corresponds to the depth to bedrock. These soils have a low available moisture capacity and are very strongly acid.

Cultivated areas of these soils are used mainly for specialty crops. Some areas are not now farmed.

Representative profile of Claverack loamy fine sand, moderately shallow variant (T. 13 N., R. 1 W., about one-quarter mile east of the junction of Interstate Highway No. 90 and Dorman Road, in the city of Conneaut):

Ap—0 to 8 inches, dark-brown (10YR 4/3) loamy fine sand that has few, faint, light yellowish-brown (10YR 6/4) mottles and few, fine, distinct, yellowish-red (5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common roots; some dark-brown (10YR 3/3) fillings in root channels; very strongly acid, clear, smooth boundary.

B21—8 to 14 inches, yellowish-brown (10YR 5/6) loamy fine sand that has few, faint, light yellowish-brown (10YR 6/4) and few, fine, distinct, yellowish-red (5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common roots; some dark-brown (10YR 3/3) fillings in root channel; very strongly acid; clear, smooth boundary.

B22—14 to 18 inches, brownish-yellow (10YR 6/6) loamy fine sand that has many, distinct, coarse, brown (7.5YR 4/4) mottles and few, distinct, coarse, pale-brown (10YR 6/3) mottles; structureless (single grain); weakly cemented; few roots; very strongly acid; clear, smooth boundary.

B23—18 to 23 inches, dark yellowish-brown (10YR 4/4) loamy fine sand that has common, medium, distinct, light brownish-gray (2.5Y 6/2) and yellowish-red (5YR 5/6) mottles; common, distinct, medium, pale-brown (10YR 6/3) vertical and horizontal streaks; structureless (massive); very firm; few roots; very strongly acid; abrupt, smooth boundary.

IIB24—23 to 30 inches, reddish-yellow (7.5YR 6/8) silty clay loam that has many, medium, distinct, gray (10YR 6/1) mottles occurring mostly as horizontal streaks; weak, medium, prismatic structure parting readily to moderate, medium, subangular blocky; firm; few roots; primary peds have gray (10YR 6/1) coatings; few, thin, sandstone fragments; strongly acid; clear, smooth boundary.

IIB3—30 to 36 inches, gray (N 6/0) silty clay loam that has many, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure that parts to weak, medium and thin, platy; firm; no roots; peds coated with gray (N 6/0); thin horizontal sandstone and siltstone strata make up 50 percent of the mass; strongly acid; gradual, smooth boundary.

IIIR—36 to 60 inches, slightly weathered bedrock consisting of dark grayish-brown (2.5Y 4/2) shale and thin, yellowish-brown (10YR 5/4) siltstone and sandstone; structureless (massive); firm; fragments make up 20 percent of the mass; apparent bedding planes; very strongly acid.

The Ap horizon is loamy fine sand in most places. In some places stratification is apparent in the upper horizons, and gravelly strata may occur. The gravel and other coarse material in the upper part of the solum generally does not exceed 15 percent, by volume. Under trees an A1 horizon occurs and is 3 inches or less thick. It is very dark grayish brown or very dark brown and has common to abundant bleached sand grains. Underlying the A1 horizon is a strong-brown or dark-brown B1 horizon. In some places, the matrix color in the B21 horizon is strong brown (7.5YR 5/6) instead of yellowish brown (10YR 5/6). The matrix color in the B22 and B23 horizons are yellowish brown (10YR 5/6), brownish yellow (10YR 6/6), dark brown (7.5YR 4/4), dark yellowish brown (10YR 4/4), or light olive brown (2.5Y 5/4). Mottles with a chroma of 3 or less may occur within 10 inches of the surface or as deep as 24 inches. The B22 and B23 horizons commonly are somewhat brittle. The content of siltstone and sandstone in the IIB horizons is variable, but it does not exceed 35 percent, by volume. The depth to the IIB24 horizon (lithologic discontinuity) ranges from 20 to 42 inches.

Soils of the Claverack series, moderately shallow variant, are similar to the other Claverack variants in this county except that they have bedrock within a 40-inch depth and generally thinner corresponding horizons. Also, soils of this Claverack variant are more strongly acid in the lower part of the solum. Their sandy material is much thinner than that of the moderately well drained Elnora soils.

Claverack loamy fine sand, moderately shallow variant, 2 to 6 percent slopes (CnB).—Although the seasonal water table is high, this soil dries out readily in spring. Included in mapping are small areas that are less than 20 inches to shale or are more than 40 inches to shale. Surface runoff generally is slow because infiltration into the surface layer is rapid. During intense storms or during windy periods, however, there is an erosion hazard if the soil is bare of vegetation. Seasonal wetness is the dominant limitation to farming. The limited depth to shale and slow permeability are limitations to many nonfarm uses. (Capability unit IIw–2; woodland suitability group 2o1)

Colonie Series

The Colonie series consists of well-drained soils that formed in fine sands. The Colonie soils in this county are gently sloping to moderately steep and occur on a beach ridge along U.S. Highway No. 20.

A representative profile of a Colonie soil is loamy fine sand to a depth of 14 inches. The plow layer, about 11 inches thick, is very dark grayish brown and brown. Between depths of 11 and 14 inches, there is a strong-brown layer that is the upper part of the subsoil. Beneath this layer, yellowish-brown fine sand extends to a depth of 25 inches. Extending to a depth of 80 inches is grayish-brown fine sand that has thin, continuous, wavy bands of yellowish-brown and dark-brown loamy fine sand. These bands are less permeable than the adjacent fine sand. Consequently, they help to slow the rapid movement of water through this soil. Below a depth of 80 inches, there are layers of yellowish-brown fine sand, brown loamy sand, and dark-brown loamy fine sand that extend to a depth of 132 inches.

Colonie soils generally have rapid permeability, but the thin bands below a depth of 25 inches tend to slow water movement to a moderate rate (fig. 12). Pollution of underground water supplies is a hazard if Colonie soils are used for sanitary load fills or disposal of effluent from septic systems. These soils have a deep root zone, a low available moisture capacity, and a very low capacity for storing and releasing plant nutrients. The root zone in Colonie soils is mostly very strongly acid to strongly acid in the upper 48 inches. Colonie soils are very droughty.

Community development is increasing in the area where Colonie soils occur. Numerous sand pits are in the area, and some fields are used for specialty crops. The Colonie soils are well suited to irrigation. Irrigation is essential for the successful growth of specialty crops on these soils.

Representative profile of a Colonie loamy fine sand (T. 13 N., R. 2 W., about 1¼ miles northwest of Kingsville in the village of North Kingsville, three-eighths of a mile northwest of State Route 170, Kingsville Township):

Ap1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, fine, granular structure; very friable; abundant roots; very strongly acid; abrupt, smooth boundary.

Ap2—3 to 11 inches, brown (10YR 4/3) loamy fine sand; weak, fine, granular structure; very friable; abundant roots; very strongly acid; abrupt, smooth boundary.

B11—11 to 14 inches, strong-brown (7.5YR 5/6) loamy fine sand; very weak, fine and medium, subangular blocky structure; plentiful roots; colors vary horizontally from strong brown (7.5YR 5/6) to yellowish brown (10YR 5/8); very strongly acid; diffuse, wavy boundary.

B12—14 to 25 inches, yellowish-brown (10YR 5/6) fine sand; very weak, fine and medium, subangular blocky structure; very friable; plentiful roots; the color fades with depth from yellowish brown (10YR 5/6) to grayish brown (10YR 5/2); very strongly acid; clear, wavy boundary.

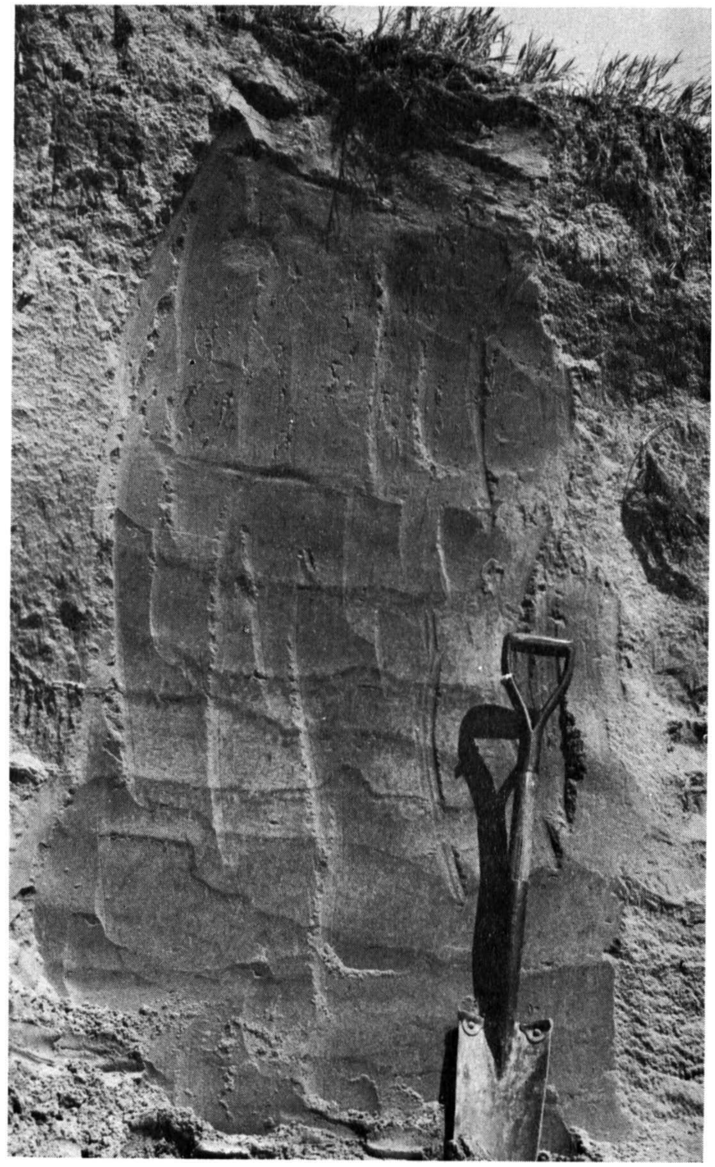

Figure 12.—**Profile of Colonie loamy fine sand.**

A'21&B21t—25 to 48 inches, A'21 is grayish-brown (10YR 5/2) fine sand; structureless (single grain); loose; B21t occurs as bands of yellowish-brown (10YR 5/4) loamy fine sand up to one-half inch thick; structureless (massive); friable; bands are wavy, irregular, and discontinuous, and they have many vertical holes; few roots; strongly acid; diffuse, wavy boundary.

A'21&B22t—48 to 80 inches, A'22 is grayish-brown (10YR 5/2) fine sand; structureless (single grain); loose; B22t occurs as thin, wavy bands of dark-brown (7.5YR 4/4) loamy fine sand; structureless (massive); friable; slightly acid; gradual, wavy boundary.

A'22&B22t—80 to 96 inches, A'22 is yellowish-brown (10YR 5/4) fine sand; structureless (single grain); loose; B22t occurs as thin, wavy bands of dark-brown (7.5YR 4/4) loamy fine sand; structureless (massive); friable; slightly acid; diffuse, wavy boundary.

A'23—96 to 107 inches, brown (10YR 4/3) loamy sand that has few, faint, fine mottles of brownish yellow (10YR 6/6), dark yellowish brown (10YR 4/4), and light yellowish brown (2.5Y 6/4); structureless (single grain); loose; no roots; slightly acid; abrupt, wavy boundary.

B′22t—107 to 108 inches, dark-brown (7.5YR 4/4) loamy fine sand; structureless (massive); firm; no roots; slightly acid; abrupt, wavy boundary.

C—108 to 132 inches, yellowish-brown (10YR 5/4) fine sand; structureless (single grain); loose; no roots; many unstained quartz sand particles and a few black, sand size minerals; faint, very thin, horizontal stains of dark brown (7.5YR 4/4); slightly acid.

The A horizons range from fine sandy loam to loamy fine sand, but loamy fine sand is dominant. In cultivated areas the Ap horizon is dark brown (10YR 4/3) or very dark grayish brown (10YR 3/2). If crushed, the Ap horizons have a value of 4 or more. In some places the Ap1 horizon is very dark brown (10YR 2/2). The B1 horizons are strong brown (7.5YR 5/6), dark brown (10YR 4/3), dark yellowish brown (10YR 4/4), or yellowish brown (10YR 5/4, 5/6). In some areas the sandy material is neutral at a depth of more than 5 feet. The depth to the first band ranges from 24 to 48 inches. The total thickness of the bands is not more than 6 inches within 60 inches of the surface.

Colonie soils are the well drained members of a drainage sequence that includes the moderately well drained Elnora soils and the poorly drained Kingsville soils. Colonie soils lack the high content of pebbles or gravelly material that is characteristic of Chenango and Otisville soils.

Colonie loamy fine sand, 2 to 6 percent slopes (CoB).—This soil occupies long, narrow strips on the beach ridges that parallel Lake Erie. A profile of this soil is described as representative for the series. Areas of this soil are separated or broken by areas of poorly drained Kingsville soils and moderately well drained Elnora soils. Included in mapping are areas of moderately well drained Elnora soils. These included areas tend to be nearly level, particularly in small areas.

This Colonie soil is very susceptible to soil blowing, especially in areas where a thick plant cover is lacking. Tilth of the surface layer is good. Because the soil dries out quickly early in spring, it is suited to specialty crops that are planted early.

Droughtiness is the major limitation to use for farming. For many nonfarm uses, limitations other than the sandy texture and droughtiness are few. (Capability unit IIIs–1; woodland suitability group 4s1)

Colonie loamy fine sand, 6 to 18 percent slopes (CoD).—This soil occupies billowy, or dunelike, areas along the beach ridges. It is similar to the less sloping Colonie soil, but the hazard of water erosion is greater because of the steeper slope. This soil is very susceptible to soil blowing if a thick plant cover is lacking. Included with this soil in mapping are a few areas where slopes are short and steep. Droughtiness is a major limitation to use of this soil for farming. Slope is the major limitation for many nonfarm uses. (Capability unit IIIs–1; woodland suitability group 4s1)

Conneaut Series

The Conneaut series consists of deep, poorly drained, nearly level soils that formed partly in a silt loam mantle and partly in underlying silt loam glacial till. The silt loam in the upper part of these soils is lake-deposited sediment. These soils occupy broad areas on the lake plain.

A representative profile of Conneaut silt loam has a dark grayish-brown plow layer about 9 inches thick. This layer is very strongly acid. The subsoil is light brownish-gray silt loam to a depth of 27 inches. Below this depth, the subsoil is silt loam that is dark grayish brown, dark yellowish brown, and yellowish brown. Very firm, platy silt loam glacial till occurs at a depth of 52 inches.

Conneaut soils have slow permeability. Unless they are drained, they have a seasonal high water table for long periods. The root zone of these soils is very strongly acid, and it is deep if the water table is low. It has a medium available moisture capacity. Conneaut soils have a moderate capacity for storing and releasing plant nutrients.

Most areas of Conneaut soils are idle and brushy. If adequately drained and intensively managed, the soils are suited to general farm crops.

Representative profile of Conneaut silt loam (T. 14 N., R. 1 W., 50 yards west of State Line Road, about 3 miles northeast from the center of the city of Conneaut, and 100 yards south of Lake Road):

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

B1g—9 to 14 inches, silt loam that is 60 percent light brownish gray (2.5YR 6/2) and 40 percent yellowish brown (10YR 5/8); moderate, medium, subangular blocky structure; firm; common roots; the light brownish gray (2.5Y 6/2) occurs as a continuous coating on ped faces; many root channel fillings of very dark gray (10YR 3/1); very strongly acid; clear, smooth boundary.

B21g—14 to 17 inches, silt loam that is 60 percent light brownish gray (2.5Y 6/2) and 40 percent yellowish brown (10YR 5/8); moderate, medium and fine, subangular blocky structure; firm, common roots; the light brownish gray occurs as a continuous coating on ped faces; this horizon tongues downward into the IIB23g horizon to a depth of 33 inches; tongues are 8 to 10 inches apart and are 2 inches wide at top and one-half inch wide near bottom; tongues seem to be fillings in cracks of the glacial till; very strongly acid; gradual, irregular boundary.

B22g—17 to 27 inches, silt loam that is 60 percent light brownish gray (2.5Y 6/2) and 40 percent yellowish brown (10YR 5/8); moderate, medium and coarse, subangular blocky structure; firm; few roots; peds coated with light brownish gray (2.5Y 6/2); strongly acid; gradual, discontinuous boundary.

IIB23g—27 to 33 inches, silt loam that is 80 percent dark grayish brown (10YR 4/2) and 20 percent medium, distinct mottles of strong brown (7.5YR 5/8); weak, medium and coarse, subangular blocky structure; firm; few roots; few gray (5Y 6/1) streaks in ped interiors and on ped surfaces; a few black (10YR 2/1) stains; material more than 2 millimeters in size is about 5 percent, by volume; slightly acid; diffuse, wavy boundary.

IIB24g—33 to 44 inches, silt loam that is 80 percent dark yellowish brown (10YR 4/4) and 20 percent distinct, medium mottles of yellowish brown (10YR 5/8); weak, medium and coarse, subangular blocky structure; very firm; few roots; gray (N 6/0) silty coats on ped faces; material more than 2 millimeters in size is about 5 percent, by volume; slightly acid; gradual, wavy boundary.

IIB3g—44 to 52 inches, mottled yellowish-brown (10YR 5/6) and light-gray (N 7/1) silt loam; weak, medium, platy and moderate, fine, subangular blocky structure; very firm; no roots; many black stains on horizontal ped faces; coarse material more than 2 millimeters in size is about 5 percent, by volume; neutral; gradual; wavy boundary.

IIC1—52 to 70 inches, dark yellowish-brown (10YR 4/4) silt loam that has common, prominent, medium, light-gray (10YR 6/1) mottles; weak, medium, platy structure; firm; many black stains on horizontal faces; a few coarse fragments more than 3 inches in diameter; neutral; gradual, wavy boundary.

IIC2—70 to 77 inches, olive (5Y 5/3) silt loam that has dark-brown (7.5YR 4/4) stains; moderate, medium, platy structure; very firm; few black stains; coarse material more than 2 millimeters is about 5 percent, by volume; mildly alkaline; weakly calcareous.

In undisturbed areas the A1 horizon is darker colored than the Ap horizon and is not more than 5 inches thick. Value of the A1 horizon is 3 and hue is 2 or less. Under the A1 horizon is an A2g horizon that is 4 to 8 inches thick and has a chroma of less than 2 and few to many mottles that have a chroma of 3 or more. The B1g and B21g horizons have primsmatic structure in some places. The lacustrine material ranges from 10 to 28 inches in thickness. The depth to carbonates ranges from 70 to 95 inches. The IIC1 horizon is neutral or mildly alkaline. This sandy strata occur in the B1g, B21g, and B22g horizons in a few areas. The coarse material in the part of the solum that weathered from till is less than 10 percent, by volume.

The Conneaut soils generally are adjacent to the sandy, moderately well drained Claverack and Elnora soils and the poorly drained Swanton soils. Conneaut soils have natural drainage similar to that of the Frenchtown and Sheffield soils, but the Frenchtown and Sheffield soils have a fragipan in the subsoil. Conneaut soils are near the Allis soils but have no shale within 40 inches of the surface and are less clayey than Allis soils throughout.

Conneaut silt loam (Ct).—This nearly level soil occupies areas that are one-half to one mile wide. It is the dominant nearly level soil of the lake plain. Included with this soil in mapping are small areas of the more sandy Claverack and Swanton soils.

Seasonal wetness and slow permeability are major limitations to the use of this soil. The soil can be drained, but low shaly ridges between some areas make drainage difficult. Low knolls and slight depressions caused by tree windthrow occur in wooded areas. (Capability unit IIIw-3; woodland suitability group 2w1)

Elnora Series

This series consists of sandy, nearly level to gently sloping soils that are moderately well drained. Most areas of the Elnora soils in this county are north of U.S. Highway No. 20. These soils formed in fine sand of old beach ridges.

A representative profile of Elnora loamy fine sand has a plow layer of dark-brown loamy fine sand to a depth of 4 inches and brown loamy fine sand to 11 inches. Between depths of 11 and 33 inches, there are subsoil layers of yellowish-brown loamy fine sand. These layers are distinctly mottled with dark brown and faintly mottled with yellow and pale brown. Below a depth of 33 inches are fine sand and loamy fine sand that are grayer as depth increases. Below a depth of 59 inches is loamy fine sand and coarse sand and gravel.

Air and water move rapidly in Elnora sails. Pollution of ground water is possible if Elnora soils are used for disposal of sewage effluent or solid waste. Because of their topographic location, these soils have a seasonally high water table for short periods. The root zone is deep when the water table is low. It is mostly very strongly acid. These soils have a low available moisture capacity, but additional water is available for plants because of capillary movement from the underlying water table. The water table in these soils is commonly at a depth of 6 to 8 feet. Elnora soils are too droughty for shallow-rooted crops but are less droughty than the adjacent well-drained Colonie soils.

A large acreage of Elnora soils is not used for general farming. These soils are mostly used for specialty crops. Irrigation generally is needed for the successful growth of specialty crops. Community development is increasing in some areas of Elnora soils.

Representative profile of Elnora loamy fine sand (T. 14 N., R. 1 W., about 4 miles southwest of the center of the city of Conneaut and 1½ miles west from the intersection of Salsbury Road and State Route 531; *laboratory sample AB-109* in table 10):

Ap1—0 to 4 inches, dark-brown (10YR 4/3) loamy fine sand; weak, fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

Ap2—4 to 11 inches, brown (10YR 5/3) loamy fine sand that has a few spots of strong brown (7.5YR 6/8); very weak, fine and medium, granular structure; friable; many roots; extremely acid; abrupt, wavy boundary.

B21—11 to 20 inches, yellowish-brown (10YR 5/8) loamy fine sand that has common, coarse, distinct, dark-brown (7.5YR 4/4) mottles and few, coarse, faint, yellow (10YR 7/6) mottles; structureless (single grain); friable; common roots; the dark-brown (7.5YR 4/4) mottles occur as irregular masses that are more prominent throughout the horizon; few, medium, soft, dark reddish-brown (5YR 3/2) concretions; extremely acid; clear, wavy boundary.

B22—20 to 26 inches, yellowish-brown (10YR 5/6) loamy fine sand that has few, faint, coarse, pale-brown (10YR 6/3) and strong-brown mottles; structureless (single grain); friable; common roots; few, fine, hard, black concretions; very strongly acid; gradual, wavy boundary.

B23—26 to 33 inches, yellowish-brown (10YR 5/6) loamy fine sand that has few, coarse, faint, pale-brown (10YR 6/3) mottles; structureless (single grain); friable; few roots; very strongly acid; gradual, wavy boundary.

B31—33 to 44 inches, brown (10YR 5/3) fine sand that has common, coarse, faint, light brownish-gray (10YR 6/2) and brownish-yellow (10YR 6/6) mottles and few, fine, distinct, yellowish-red mottles (5YR 4/8); massive parting to single grain under slight pressure; friable; no roots; very strongly acid; gradual, wavy boundary.

B32—44 to 52 inches, grayish-brown (10YR 5/2) loamy fine sand that has common, coarse, prominent, reddish-yellow (7.5YR 6/6) and yellowish-red (5YR 4/8) mottles; massive parting to single grain under slight pressure; very friable; no roots; very strongly acid; abrupt, smooth boundary.

C1—52 to 59 inches, grayish-brown (10YR 5/2) fine sand; structureless (single grain); loose; no roots; strongly acid; abrupt, smooth boundary.

C2—59 to 64 inches, yellowish-brown (10YR 5/4–5/6) loamy fine sand that has few, coarse, faint, light brownish-gray (10YR 6/2) mottles; massive parting to single grain under slight pressure; very friable; no roots; strongly acid; abrupt, smooth boundary.

IIC3—64 to 70 inches, light brownish-yellow (10YR 6/4) very coarse sand and gravel; single grain; loose; no roots; strongly acid.

The Ap horizon is dominantly loamy fine sand, but it ranges to fine sandy loam in some places. The Ap horizon generally is dark brown (10YR 4/3), dark grayish brown (10YR 4/2), or brown (10YR 5/3). It is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2) in some places, but colors have a value of 4 or more when the material is crushed. The upper part of the B horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/6 or 5/8). Hue is 10YR or 7.5YR. In wooded areas, a very dark grayish-brown (10YR 3/2) A1 horizon occurs. It is up to 3 inches thick and contains abundant bleached sand grains.

Under the A1 horizon in wooded areas, a dark-brown (10YR 4/3) B1 horizon, 3 to 6 inches thick, is commonly present. Mottles that have a chroma of 3 or less occur at a depth of 12 to 30 inches. If these mottles occur in the upper part of the solum, they are few. The reaction ranges from extremely acid to strongly acid, and pH increases with depth. The sandy material is neutral at a depth of more than 5 feet in some areas.

Elnora soils are the moderately well drained members of a drainage sequence that includes the well drained Colonie soils and the poorly drained Kingsville soils. Elnora soils are similar to Claverack soils in surface appearance, landscape position, and natural drainage. The soils, however, lack the underlying glacial till that is characteristic of Claverack soils. Elnora soils are less gravelly than the nearby Otisville soils.

Elnora loamy fine sand, 1 to 5 percent slopes (EIB).—This soil mostly occupies undulating areas that generally are north of U. S. Highway No. 20. It commonly is adjacent to higher lying Colonie or Otisville soils, and small areas of these soils are included in mapping.

This Elnora soil is very susceptible to soil blowing, especially in areas where a thick plant cover is lacking. The tilth of this soil is good. Because this soil dries out quickly in spring, it is well suited to specialty crops that are planted early.

The major limitation to the use of this soil for farming is severe droughtiness. Limitations are few for many nonfarm uses. (Capability unit IIIs-1; woodland suitability group 4s1)

Frenchtown Series

The Frenchtown series consists of medium-textured, poorly drained, nearly level soils that formed in silt loam glacial till. These soils have a dense, compact fragipan that occurs at a depth of 18 to 24 inches. Frenchtown soils are in small depressions and small drainageways in the southeastern part of the county near Andover.

A representative profile of a Frenchtown silt loam has a silt loam plow layer that is 7 inches thick, dark grayish brown, and very strongly acid. The upper part of the subsoil has two layers of silty clay loam. The upper layer is light brownish gray, and the lower layer is gray. Both layers are distinctly mottled with yellowish brown and strong brown. They extend to a depth of 20 inches. A thin layer of gray silt loam is between these layers and the fragipan. This gray silty material extends downward into the light olive-brown silt loam fragipan along vertical planes of the prismatic structure. The fragipan occurs at a depth of 22 inches and extends to 40 inches. It is underlain by mildly alkaline silt loam glacial till.

Frenchtown soils have slow to very slow permeability. The fragipan slows the downward movement of water, and it stops the downward penetration of many roots. Few roots penetrate into the interior of the prisms, though some penetrate below the top of fragipan by following gray tongues of silt loam along the structural faces of the fragipan. Within the normal root zone above the fragipan, the available moisture capacity is medium. Frenchtown soils are commonly wet in winter and early in spring and are droughty in summer. They dry out very slowly in spring. Generally, the period when moisture is optimum for tillage is short or none before planting dates occur in the spring. The root zone of Frenchtown soils typically is very strongly or strongly acid. These soils have a moderate capacity for storing and releasing plant nutrients.

Frenchtown soils are suited to general farm crops if drainage is adequate and management is intensive. Where these soils are cultivated, the proportion of forage crops is high.

Representative profile of Frenchtown silt loam (T. 8 N., R. 1 W., about 1 mile north and 1½ miles east of Williamsfield and about 300 yards west of Penn Central RR, Williamsfield Township; *laboratory sample* AB-34 in table 10):

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, medium, granular structure; friable; many roots; very strongly acid; abrupt, smooth boundary.

B21g—7 to 15 inches, light brownish-gray (2.5Y 6/2) light silty clay loam that has common, medium, distinct, yellowish-brown (10YR 5/6-5/8) and strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable; common roots; about 2 percent coarse material consisting of small flat fragments of sandstone; strongly acid; gradual, wavy boundary.

B22g—15 to 20 inches, gray (5Y 5/1) light silty clay loam that has common, medium, distinct, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/8) mottles; weak, medium and coarse, prismatic structure; firm; few roots; about 2 percent coarse material consisting of small flat fragments of sandstone; strongly acid; clear, wavy boundary.

A'2g—20 to 22 inches, gray (5Y 5/1) silt loam that has common, distinct, medium, yellowish-brown (10YR 5/8) and light olive-brown (2.5Y 5/4) mottles; weak, medium and coarse, subangular blocky structure; slightly sticky and slightly plastic; few roots; medium acid; clear, irregular boundary.

B'x—22 to 40 inches, light olive-brown (2.5Y 5/4) silt loam that has common, medium, faint, light yellowish-brown (10YR 6/4) mottles that are more plentiful along ped faces; weak, coarse, prismatic structure that parts under considerable pressure to weak, thick, platy and medium, angular blocky; very firm; few roots along prism faces; on vertical faces, the prisms have thick, patchy, dark-gray (5Y 4/1) clay films; about 5 percent coarse material consisting of flat fragments of sandstone and shale; many, small, black (10YR 2/1) concretions and films; neutral; gradual, wavy boundary.

C—40 to 60 inches, olive-brown (2.5Y 4/4) silt loam that has few, faint, medium, yellowish-brown (10YR 5/4) and brownish-yellow (10YR 6/6) mottles; structureless (massive); firm; no roots; few, thin, gray (5Y 5/1) vertical seams that decrease in thickness and number with depth; 5 to 10 percent coarse material consisting mainly of flat angular fragments of sandstone and shale; mildly alkaline; weakly calcareous.

The solum ranges from 30 to 50 inches in thickness. In most places this thickness is the same as the depth to calcareous material. An A2g horizon that has a chroma of 3 or less is between an A1 horizon and a depth of 10 inches in some uncultivated areas. The dominant hue of the B2g horizons is 2.5Y or 5Y, value is 5 or 6, and chromas are 1 to 3. The B21g and B22g horizons are dominantly silt loam, but they are clay loam, loam, or silty clay loam in some places. The clay content of these horizons ranges from 20 to 30 percent, and the sand content ranges from 14 to 25 percent. The weighted average clay content below a depth of 10 inches and above the fragipan is 25 percent. An A'2 horizon does not occur in all places, and evidence of it may be only the tongues and the coatings on prism faces in the fragipan. In some places the B22g horizon and A'2 horizon have olive brown (2.5Y 4/4) mottles.

The B'x horizon is silt loam, clay loam, or loam, and it typically is 3 to 4 percent lower in clay content than the B2g horizons. The sand content of the B'x horizon ranges from 25 to 35 percent. The depth to this horizon ranges from 18 to 24 inches.

The interior of the prisms in the B'x horizon has dominant hues of 10YR to 2.5Y, values of 4 to 6, and a chroma of 4. The mottles have a hue of 10YR or 7.5YR, value of 5 or 6, and chromas of 6 to 8. The amount of coarse material in the solum ranges from 5 to 10 percent of the volume. The root zone below a depth of 10 inches and above the fragipan ranges from strongly acid to slightly acid. In most places the pH increases markedly in the fragipan. The fragipan ranges from medium acid to neutral.

Frenchtown soils are the poorly drained members of a drainage sequence that includes the moderately well drained Cambridge soils, the somewhat poorly drained Venango soils, and the dark-colored, poorly drained Ilion soils. Frenchtown soils are similar to Sheffield and Conneaut soils in natural drainage but have a greater content of sand. Frenchtown soils have a fragipan, and Conneaut soils do not.

Frenchtown silt loam (Fr).—Ponding generally occurs in depressional areas of this nearly level soil. The organic-matter content in the surface layer typically is low, and tilth is poor in nearly all places. Because of tree windthrow, distinct knolls and depressions occur in wooded areas. A profile of this soil is described as representative for the series.

Included with this soil in mapping are small areas of dark-colored, poorly drained Ilion soils. These included areas commonly occupy depressions and drainageways.

Surface runoff is very slow, and seasonal wetness is the major limitation to use of this soil for farming. Poor natural drainage and slow to very slow permeability are limitations to use for most nonfarm purposes. (Capability unit IIIw–3; woodland suitability group 2w1)

Frenchtown silt loam, sandstone substratum (Fs).—This nearly level soil has a profile similar to that described as representative for the series, except that a sandstone substratum occurs, commonly at a depth of 4 feet. This sandstone and fragments of sandstone in the lower part of the soil interfere with trenching and other excavation. This soil is subject to surface ponding. It is low in organic-matter content and, in almost all places, has poor tilth.

A large acreage of this soil is idle. Seasonal wetness is the major limitation to the use of this soil for farming. Poor natural drainage and slow to very slow permeability are limitations to most nonfarm uses. (Capability unit IIIw–3; woodland suitability group 2wl)

Gravel and Sand Pits

Gravel and sand pits (Gp) consist of areas where gravel or sand has been removed for commercial uses. Some of these pits are still worked. The gravel pits are mostly in areas of Chenango or Otisville soils. The sand pits are generally in areas of Colonie or Elnora soils.

Gravel and sand pits have little potential for uses other than obtaining material for construction. Some local pits can be developed for wildlife areas. The remaining soil material in these pits generally is coarse textured and very droughty. (Capability unit and woodland suitability group not assigned)

Holly Series

The Holly series consists of nearly level, poorly drained soils on the flood plains. These soils formed in loamy alluvium washed from soils that formed mostly in loamy glacial till. Holly soils occupy flood plains along most of the streams in the county.

A representative profile of Holly silt loam in a formerly cultivated area has a very dark gray surface layer 5 inches thick. The dark-colored surface layer is underlain by a layer of mottled, dark grayish-brown silt loam 5 inches thick. The next layer is between depths of 10 to 27 inches and is light olive-gray silty clay loam. Olive-gray loam is between depths of 27 and 50 inches. Mottles are contrasting grayish and brownish colors and indicate natural wetness in this soil. Differences in texture of the subsoil commonly show stratification of the deposited material. Bedrock normally does not occur within 8 to 10 feet of the surface.

These soils have moderately slow permeability. If Holly soils are drained, they have a moderately deep root zone that has a high available moisture capacity. These soils have a seasonal high water table and are subject to flooding.

Most areas of Holly soils are used for pasture and woodland or are idle. Corn and hay are grown in a few areas, particularly where flooding generally is not frequent.

Representative profile of Holly silt loam (T. 9 N., R. 2 W., approximately 4 miles southwest of Andover, Cherry Valley Township):

A1—0 to 5 inches, very dark gray (10YR 3/1) silt loam that has few, medium, distinct, olive (5Y 5/3) mottles; moderate, medium and coarse, granular structure; friable; many roots; medium acid; clear, wavy boundary.

B1g—5 to 10 inches, dark grayish-brown (2.5Y 4/2) silt loam that has common, distinct, yellowish-brown (10YR 5/8) and gray (5Y 6/1) mottles; weak, medium, subangular blocky structure; friable; many roots; clear, wavy boundary.

B2g—10 to 27 inches, light olive-gray (5Y 6/2) silty clay loam that has common, medium, prominent, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; few roots; medium acid; clear, wavy boundary.

Cg—27 to 50 inches, olive-gray (5Y 5/2) loam that has common, medium, prominent, yellowish-brown (10YR 5/6) mottles; structureless (massive); friable; few roots; thin layers of silt; medium acid.

The A1 or the Ap horizon is very dark gray (10YR 3/1), very dark grayish brown (2.5Y 3/2 or 10YR 3/2) or black (10YR 2/1). The B and C horizons are silt loam, silty clay loam, or loam. The weighted average clay content between depths of 10 and 40 inches is 18 to 35 percent. Stratification is apparent in many places. The matrix of the C horizon has hues of 10YR to 5Y, values of 4 to 6, and a chroma of 2 or less. The mottles of the C horizon have hues of 10YR to 2.5Y and a value and chroma of 4 or more. The hue of the mottles is 7.5YR in only a few places. The B and C horizons are medium acid to slightly acid.

The poorly drained Holly soils are members of the drainage sequence that includes the somewhat poorly drained Orrville soils, the moderately well drained Lobdell soils, and the well drained Chagrin soils. Holly soils commonly are adjacent to those soils.

Holly silt loam (Hm).—Where this nearly level soil is adjacent to Platea or Frenchtown soils, the thickness of the alluvium commonly is less than that described as typical. In these areas the alluvium ranges from 18 to 30 inches in thickness to contrasting glacial material. In a few places, shale occurs at a depth of 24 to 36 inches. In a few areas, clayey material is below a depth of 36 inches. Included with this soil in mapping are a few areas of better drained Orrville soil.

Most areas of this Holly soil are long and narrow and are on flood plains along streams. Flood channels commonly cross these areas, particularly along the larger streams.

Use of this soil is seasonally limited by wetness. Flooding is a limitation for most uses. (Capability unit IIIw–7; woodland suitability group 2w1)

Hornell Series

In this series are somewhat poorly drained to moderately well drained, gently sloping to moderately steep soils that are moderately deep to shale. Most areas of Hornell soils occupy narrow ridges on the lake plain. These ridges are oriented in a general northeast-southwest direction.

A representative profile of a Hornell silt loam has a dark grayish-brown silt loam surface layer about 3 inches thick. The uppermost layer in the subsoil is yellowish-brown silt loam about 4 inches thick. Layers lower in the subsoil are much more clayey than the thin surface layer or the uppermost subsoil layer. The lower layers are brownish-yellow silty clay that is very firm when moist and sticky and plastic when wet. The lowest layer in the subsoil is 10 to 20 percent shale fragments. Beneath the subsoil is a 6-inch layer of light brownish-gray shaly silty clay loam. Shale bedrock is at a depth of 26 inches.

Hornell soils are very slowly permeable and are seasonally saturated with water. The underlying shale limits the downward penetration of plant roots. In the moderately deep root zone, the available moisture capacity is low. The upper part of the shale generally is soft, but hard shale occurs at a depth of less than 40 inches in almost all places. Hornell soils have a low capacity for storing and releasing plant nutrients. These soils are extremely acid.

Most areas of Hornell soils are not farmed, partly because of the size and shape of the soil areas. If management is intensive however, the soils that have slopes of less than 12 percent do have satisfactory growth of shallow-rooted crops.

A representative profile of a Hornell silt loam (T. 12 N., R. 5 W., about 2½ miles northwest of Geneva and about one-half mile north of the intersection of Padanarum Road and North Center Road, on the east side of Padanarum Road, Geneva Township; *laboratory sample* AB–119 in table 10):

O1—3 to 2 inches, slightly decomposed leaf litter, dominantly maple leaves; abrupt, smooth boundary.

O2—2 inches to 0, very dark grayish-brown (10YR 3/2) mull.

A1—0 to 3 inches, dark grayish-brown (2.5Y 4/2) silt loam; moderate, fine, granular structure; friable; common roots; extremely acid; abrupt, smooth boundary.

B1—3 to 7 inches, yellowish-brown (10YR 5/4) silt loam; few, faint, coarse, yellowish-brown (10YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; friable; few roots; extremely acid; abrupt, wavy boundary.

B21—7 to 15 inches, brownish-yellow (10YR 6/6) silty clay that has common, fine, distinct, light olive-brown (2.5Y 5/4) mottles; strong, medium and coarse, angular blocky structure; very firm; few roots; peds are coated with yellowish brown (10YR 5/4); 2 percent thin shale fragments; extremely acid; gradual, wavy boundary.

B22—15 to 20 inches, brownish-yellow (10YR 6/6) silty clay that has streaks of light brownish gray (2.5Y 6/2); strong, medium and coarse, angular and subangular blocky structure; very firm; no roots; peds coated with light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/4); the light brownish-gray streaks are more prominent in the lower part of the horizon; 10 to 20 percent thin shale fragments; extremely acid; gradual, wavy boundary.

C—20 to 26 inches, light brownish-gray (2.5Y 6/2) shaly silty clay loam that has many, fine, prominent, yellowish-brown mottles (10YR 5/6–5/8); strong, medium, platy structure; very firm; no roots; contains weathered shale that is less weathered with depth; extremely acid; gradual, wavy boundary.

R—26 to 36 inches, olive (5Y 5/3) shale bedrock that has fractures and cleavage planes coated with dark brown (7.5YR 4/4); extremely acid.

The depth to shale bedrock ranges from 20 to 40 inches. The combined A and B1 horizons range from 6 to 12 inches in thickness. The B1 horizon is yellowish brown (10YR 5/6–5/4), brownish yellow (10YR 6/6), or dark yellowish brown (10YR 4/4) and is silt loam or silty clay loam. The solum ranges from extremely acid to strongly acid. The C horizon ranges from 0 to 15 inches in thickness. The matrix of the C horizon has a hue of 2.5Y or 5Y and a chroma of 3 or less. The mottles in this horizon have a hue of 10YR or 7.5YR and a chroma of 4 or more.

The Hornell soils in this county have brighter colors than the Hornell soils elsewhere. Natural drainage and other characteristics, however, are such that the Hornell soils in Ashtabula County and elsewhere have about the same uses and management.

The Hornell soils are commonly adjacent to the poorly drained Allis soils and are basically similar to them except for natural drainage. The Hornell soils are thinner to shale than the Mahoning soils, which have a Bt horizon that Hornell soils lack. Hornell soils are not less acid as depth increases, but most other soils in the county are.

Hornell silt loam, 2 to 6 percent slopes (HoB).—This soil occupies narrow ridges that are 30 to 50 feet wide and 4 to 6 feet higher than adjacent areas. Some of these ridges are more than one-fourth mile long, but most are shorter. These ridges are on the lake plain, where they are commonly adjacent to or surrounded by poorly drained Conneaut soils. These shale ridges interfere with artificial drainage of the adjacent poorly drained soils. A profile of this soil is described as representative for the series.

Included with this soil in mapping are a few, small, moderately eroded areas on the ridges. In these included areas, the surface layer is shaly silty clay and plants grow poorly.

Most areas of this soil were farmed, but they now are wooded. The size and shape of the soil areas limit use for farming, but the major limitation is seasonal wetness. Very slow permeability and the underlying shale are limitations for most nonfarm uses. (Capability unit IIIw–6; woodland suitability group 2w2)

Hornell silt loam, 6 to 12 percent slopes, moderately eroded (HoC2).—This soil occupies short slopes adjacent to streams in the lake plain and in the western part of the county. The plow layer of this soil is lighter colored and more sticky than it would be if the soil were uneroded.

Included with this soil in mapping are areas where the surface layer is shaly silty clay. These included areas are difficult to till because the silty clay and shale fragments have been mixed into the plow layer. Also included are a few severely eroded areas where raw shale is at the surface. These areas of shale outcrops are at the base of slopes.

This soil is not farmed in most areas. It is used primarily for pasture or as woodland. Short slopes and a very severe erosion hazard are major limitations to the use of this soil for cultivation. Very slow permeability and shale bedrock limit use for most nonfarm purposes. (Capability unit IVe–2; woodland suitability group 2w2)

Hornell silt loam, 12 to 18 percent slope, moderately eroded (HoD2).—This soil is adjacent to drainageways in the western part of the county. It has a more sticky surface layer than Hornell silt loam, 2 to 6 percent slopes, and is more difficult to till. Included with this soil, on short slopes, are areas of shale outcrops.

This soil is poorly suited as cropland. It can be pastured, but a thick plant cover that controls erosion is hard to maintain. Most areas are wooded. Slope, very slow permeability, and bedrock are limitations to use of this soil for most nonfarm purposes. (Capability unit VIe–1; woodland suitability group 2w2)

Ilion Series

Soils of the Ilion series are poorly drained. They have a dark-colored surface layer that is high in organic-matter content. Ilion soils lie in potholes and in depressions of the glacial till plain. They formed in silt loam or loam glacial till of Wisconsin age. Most areas of these soils are in the southeastern part of the county.

A representative profile of Ilion silt loam has a black silt loam plow layer about 8 inches thick. This layer is high in organic-matter content and is slightly acid. The upper part of the subsoil is gray silty clay loam that is mottled with various colors and extends to a depth of 22 inches. The lower part consists of light yellowish-brown silt loam and is about 10 inches thick. The underlying material is light olive-brown silt loam glacial till.

Unless they are drained, Ilion soils have a high water table for long periods. The dark-gray, mottled subsoil indicates prolonged periods of wetness that alternate with periods of dryness. The lower part of the subsoil and the glacial till material are slowly to very slowly permeable to the downward movement of water. Ilion soils generally have a shallow root zone in undrained areas and a moderately deep root zone in drained areas. Seepage from adjacent soils normally allows Ilion soils to supply large amounts of moisture for plant use, but these soils have only a medium available moisture capacity. They have a high capacity for holding and releasing plant nutrients. Ilion soils generally are neutral in most of the root zone.

Most areas of Ilion are not farmed. Drainage is difficult because suitable outlets are hard to establish. General farm crops, however, grow well on these soils if they are adequately drained.

Representative profile of Ilion silt loam (6 miles southeast of Andover and 2 miles east of State Route 7, Williamsfield Township):

A1—0 to 8 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; many roots; slightly acid; clear, wavy boundary.

B21tg—8 to 12 inches, gray (5Y 5/1) silty clay loam that has few, fine and medium, distinct, brownish-yellow (10YR 6/8) mottles; moderate, coarse, angular blocky structure; firm; common roots; few pebbles 2 to 3 centimeters in diameter; neutral; clear, wavy boundary.

B22tg—12 to 22 inches, gray (5Y 5/1) silty clay loam that has common, medium, distinct, light olive-gray (5Y 6/2), olive-yellow (2.5Y 6/6 to 6/8), and brownish-yellow (10YR 6/8) mottles; weak, coarse, prismatic structure that parts to moderate, coarse, angular blocky; firm; gray (5Y 5/1), very patchy, thin clay films on ped faces and in pores; few roots along ped faces; 5 to 10 percent sandstone fragments; neutral; clear, wavy boundary.

B3—22 to 32 inches, light yellowish-brown (2.5Y 6/4) silt loam that has common, medium, distinct, light olive-gray (5Y 6/2) mottles; very weak, coarse, prismatic structure; firm; peds coated with gray (5Y 5/1); few roots; 10 to 15 percent coarse material, primarily sandstone fragments up to 3 inches in size; neutral; clear, wavy boundary.

C—32 to 60 inches, light olive-brown (2.5Y 5/4) silt loam till that has common, medium, distinct, brownish-yellow (10YR 6/8) mottles; structureless (massive); firm; no roots; some gray (5Y 5/1 to 6/1) on vertical surface of peds; 10 to 15 percent coarse material, primarily sandstone fragments up to 3 inches in size; mildly alkaline; weakly calcareous.

The A1 horizon has a hue of 10YR, a value of 3 or less, and a chroma of 1 or 2. This horizon is 6 to 10 inches thick. The B horizon has a dominant hue of 5Y or 2.5Y, a dominant value of 4, 5, or 6, and a chroma of 2 or less. The few to common mottles have a hue of 10YR, 2.5Y, or 5Y and a value of 6 or 8. The clay content of the B horizon ranges from 30 to 35 percent. Depth to calcareous material ranges from 30 to 47 inches. The B horizons range from medium acid to neutral. The C horizon is silt loam or loam.

Ilion soils are the dark-colored, poorly drained members of a drainage sequence that includes the moderately well drained Cambridge soils, the somewhat poorly drained Venango soils, and the poorly drained Frenchtown soils. They also occur in the Pierpont, Platea, and Sheffield sequence as poorly drained members of that group. Ilion soils are the only dark-colored soils on the glacial till plain in Ashtabula County.

Ilion silt loam (Io).—This nearly level soil occupies small depressions within larger areas of Venango or Platea soils. These depressions normally are less than 5 acres in size. The organic-matter content in the surface layer is generally high. This soil is highly susceptible to ponding, but drained areas generally are farmed. Undrained areas ordinarily are farmed around because they dry out slowly.

Slow permeability, wetness, and surface ponding are limitations to the use of this soil. Undrained areas are suited to wetland wildlife. (Capability unit IIIw-4; woodland suitability group 2w1)

Kingsville Series

Soils in the Kingsville series occur on the lake plain and are poorly drained and moderately coarse textured in most places. They occupy low areas adjacent to the sandy Colonie and Elnora soils.

A representative profile of Kingsville soil has a surface layer of black and very dark gray fine sandy loam about 8 inches thick. This is underlain by a subsurface layer of light brownish-gray fine sandy loam about 2 inches thick. Next is the subsoil, mostly gray fine sand that extends to a depth of about 50 inches. Between depths of 10 and 28 inches, there are prominent, yellowish-brown and dark-brown mottles. Mottles are few or none below a depth of 28 inches.

Kingsville soils have a seasonal high water table, and they tend to collect water from adjacent higher lying soils. Even in summer, free water can be reached at a depth of 4 to 8 feet. During winter and spring, the water table commonly is at the surface. Water moves rapidly through Kingsville soils. They can be drained, but the fine sand in these soils flows when it is saturated and plugs tile lines. This fine sand also displaces tile and jointed pipe. Kingsville soils have a moderately deep to deep root zone when the water table is low. In spring, root growth is poor because of the seasonal high water table and poor aeration. Kingsville soils are very strongly acid, and they have a very low capacity for storing and releasing plant nutrients. Drained areas have a low available moisture capacity, but adequate moisture generally is available to plants from seepage and capillary action from the underlying water table.

Drained areas of Kingsville soils can be farmed. Undrained areas are either brushy or are reverting back to woodland.

A representative profile of Kingsville fine sandy loam (T. 14 N., R. 1 W., 1½ miles east of the city of Conneaut; *laboratory sample* AB-115 in table 10):

A11—0 to 5 inches, black (10YR 2/1) fine sandy loam; moderate, medium, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

A12—5 to 8 inches, very dark gray (10YR 3/1) fine sandy loam that has common, medium, distinct, grayish-brown (2.5Y 5/2) mottles and common, very fine, prominent, strong-brown (7.5YR 5/6) mottles; weak, coarse, granular structure; friable; common roots; very strongly acid; abrupt, wavy boundary.

A2—8 to 10 inches, light brownish-gray (2.5Y 6/2) fine sandy loam that has few, fine, distinct, olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/8) mottles; weak, fine and medium, subangular blocky structure; friable; few roots; fillings of very dark gray (10YR 3/1) in root channels; very strongly acid; clear, wavy boundary.

B21g—10 to 14 inches, grayish-brown (2.5Y 5/2) fine sand that has common, coarse, prominent, yellowish-red (5YR 4/6) mottles, medium, faint, gray (5Y 5/1) mottles and fine, distinct, dark-brown (7.5YR 4/4) mottles; massive but with slight pressure parts to single grain; very friable; few roots; strongly acid; clear, wavy boundary.

B22g—14 to 17 inches, gray (5Y 6/1) fine sand that has common, large, prominent, dark-brown (7.5YR 4/4) mottles; structureless (single grain); very friable; few roots; strongly acid; clear, smooth boundary.

B31g—17 to 20 inches, gray (5Y 5/1) fine sand that has common, medium, prominent mottles of dark brown (7.5YR 4/4), light olive brown (2.5Y 5/4), and yellowish brown (10YR 5/6); structureless (single grain); very friable; few roots; medium acid; clear, smooth boundary.

B32g—20 to 28 inches, gray (N 5/0) fine sand that has common, coarse, distinct, dark-brown (7.5YR 4/4) and yellowish-brown (10YR 5/8) mottles and few, distinct, olive-brown (2.5Y 4/4) mottles; structureless (single grain); very friable; few roots; medium acid; diffuse, smooth boundary.

Cg—28 to 50 inches, gray (N 5/0) fine sand; structureless (single grain); loose; flows when saturated; no roots; medium acid.

The A1 horizons are black (10YR 2/1), very dark gray, very dark brown (10YR 2/2), or very dark grayish brown (10YR 3/2). The B horizons have matrix colors in a hue of 10YR, 2.5Y, 5Y, or neutral, a value of 5 or 6, and chromas of 0 to 2. Coarse fragments generally are lacking, but thin gravelly layers occur below a depth of 24 inches in some places. The content of coarse material in the entire profile is not more than 10 percent of the soil volume. Horizons are fine sandy loam or finer above a depth of 10 inches and are loamy fine sand or coarser below a depth of 10 inches. The reaction is strongly acid or very strongly acid in the upper part of solum and is medium acid to slightly acid in the lower part.

Kingsville soils are the poorly drained members of a drainage sequence that includes well drained Colonie soils and moderately well drained Elnora soils. Kingsville soils formed in a thicker layer of sand than did the poorly drained Swanton soils.

Kingsville fine sandy loam (Kf).—This nearly level soil has the profile described as typical for the series. The soil tends to dry out slowly in spring, but drained areas warm up quickly. Trafficability is very poor when this soil is wet. Because tree windthrow has been extensive, many low knolls and shallow depressions are in wooded areas of this soil. Included in mapping are small areas of Swanton soils that have sand at a depth of less than 40 inches.

A high water table is the major limitation to use of this soil for farm or nonfarm purposes. Drained areas are suited to vegetables, small fruits, nursery stocks, and other specialty crops. (Capability unit IIIw–8; woodland suitability group 2w1)

Kingsville silty clay (Kg).—This nearly level soil has a surface layer that commonly is 8 to 12 inches thick. In a few places, this layer is 12 to 18 inches thick. The silty clay surface layer is sticky when wet and is hard to till. It has a narrow range of optimum moisture for tillage, and it compacts easily if it is worked when wet. The underlying sand is similar to that in Kingsville fine sandy loam and flows if saturated.

Most areas of this soil are used for pasture or as woodland. A high water table and difficulty of artificial drainage are the major limitations to the use of this soil for farm or nonfarm purposes. (Capability unit IIIw–8; woodland suitability group 2w1)

Lobdell Series

Soils of the Lobdell series are nearly level, deep, and moderately well drained. They occupy areas on flood plains along the major streams in the county. Lobdell soils formed in sediments that are dominantly silt loam or loam. They are subject to flooding and have a seasonal high water table.

A representative profile of Lobdell silt loam has a dark grayish-brown silt loam surface layer about 9 inches thick. Beneath this are successive layers of silt loam that extend to a depth of 60 inches or more. In descending order, these layers are a dark-brown and yellowish-brown subsoil and gray underlying material. Light brownish-gray mottles occur between depths of 24 and 29 inches. These mottles and gray matrix colors below a depth of 29 inches indicate that this soil is seasonally wet.

Lobdell soils have moderate permeability. Roots can penetrate deeply when the water table recedes late in spring and in summer. Except in periods of flooding, the maximum height of the water table is 1½ to 3 feet below the surface. Lobdell soils have a high available moisture capacity and a high capacity for storing and releasing plant nutrients. These soils are naturally medium acid to slightly acid throughout.

Areas of Lobdell soils that are large enough to farm generally are cultivated. Small areas are used for pasture or as woodland.

A representative profile of Lobdell silt loam (T. 13 N., R. 1 W., 4 miles southwest of Conneaut along Conneaut Creek, within the city limits of Conneaut):

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and coarse, granular structure; friable; many roots; medium acid; clear, smooth boundary.

B21–9 to 14 inches, dark-brown (10YR 4/3) silt loam; very weak, medium, subangular blocky structure; friable; plentiful roots; medium acid; clear, smooth boundary.

B22—14 to 24 inches, yellowish-brown (10YR 5/4) silt loam that has dark grayish-brown (10YR 4/2) organic stains in cracks and very dark grayish-brown (10YR 3/2) stains in root channels; very weak, medium, subangular blocky structure; friable; few roots; medium acid; clear, smooth boundary.

C1g—24 to 29 inches, yellowish-brown (10YR 5/4) silt loam that has common, fine, light-brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; structureless (massive); friable; few roots; medium acid; clear, smooth boundary.

C2g—29 to 60 inches +, gray (5Y 5/1) silt loam that has common, medium, yellowish-brown (10YR 5/8) mottles; structureless (massive); friable; medium acid.

Silt loam and loam are dominant to a depth of 60 inches. In some places layers in the B horizons are fine sandy loam to light silty clay loam. The weighted average clay content at depths of 10 to 40 inches ranges from 18 to 30 percent. The

C horizons range from silt loam to loamy sand and are stratified. The depth to mottles having low chromas ranges from 20 to 30 inches. The reaction, to a depth of 60 inches, is medium acid to slightly acid.

Lobdell soils are the moderately well drained members of a drainage sequence that includes the well drained Chagrin soils, the somewhat poorly drained Orrville soils, and the poorly drained Holly soils. Lobdell soils generally are higher lying and subject to less damaging flooding than the Orrville and Holly soils.

Lobdell silt loam (Lb).—This nearly level soil is the major soil on the flood plains of the Ashtabula River, the Grand River, and Conneaut Creek. Along other streams, it is a minor soil. This soil generally occupies, or is adjacent to, the high bank or natural levee next to the stream.

Included with this soil in mapping are small areas of the more poorly drained Orrville and Holly soils. Also included are a few areas where the surface layer is fine sandy loam.

Flooding is the major limitation to the use of this soil. Flooding normally occurs in winter or early in spring. This soil is widely used for summer crops. (Capability unit IIw-4; woodland suitability group 1o1)

Made Land

Made land (Ma) consists of areas of earth fill, of borrow pits, and of areas where much of the soil surface is covered by streets, homes, factories, or docks. In all of these areas, the original soils have been greatly altered.

This land type generally is not suited to farming. Small areas of borrow pits can be improved and used for pasture. Borrow pits also can be developed for ponds and wildlife areas, but onsite inspection is desirable in local areas. (Capability unit and woodland suitability group not assigned)

Mahoning Series

The Mahoning series is made up of somewhat poorly drained, gently sloping soils that have a moderately fine textured subsoil. In this county these soils have formed partly in acid, shaly till and partly in the underlying material weathered from shale. The depth to weathered shale typically is 5 to 8 feet. These soils are south and west of the Grand River valley.

A representative profile of a Mahoning silt loam has a dark grayish-brown silt loam plow layer about 9 inches thick. A light brownish-gray layer of silt loam is between depths of 9 and 12 inches. The subsoil extends to a depth of 48 inches. The upper layers of the subsoil are grayish-brown and light brownish-gray silty clay loam, the middle layer is mottled yellowish-brown silty clay loam, and the lower layer is mottled light olive-brown silty clay loam. All of the layers in the subsoil have grayish clay films on their structural surface. Light olive-brown shaly silty clay loam occurs at a depth of 48 inches. At a depth of about 90 inches, there are weathered fragments of shale and sandstone.

The upper part of these soils is good material for plant growth. Few roots, however, penetrate below a depth of 24 inches, and most of these are concentrated along vertical structural faces. Water and air movement in these soils is very slow. In the normal, moderately deep root zone, the available moisture capacity is medium. This root zone typically is strongly acid unless altered by liming. The Mahoning soils have a moderate capacity for storing and releasing plant nutrients. They have a seasonal high water table that interferes with early tillage and planting. Unless adequately drained, Mahoning soils dry out very slowly in spring.

A large acreage of Mahoning soil is no longer used for general farming. Areas that are cultivated are used for general farm crops and a high proportion of forage crops.

Representative profile of a Mahoning silt loam, shale substratum (T. 10 N., R. 5 W., about 4½ miles southwest of Rock Creek, Trumbull Township):

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

A3—9 to 12 inches, light brownish-gray (2.5Y 6/2) silt loam that has common, medium, prominent, reddish-yellow (7.5YR 6/8) mottles; weak, medium, subangular blocky structure; friable; many roots; light brownish gray (2.5Y 6/2) ped coatings; strongly acid; gradual, wavy boundary.

B1tg—12 to 16 inches, grayish-brown (2.5Y 5/2) silty clay loam that has common, coarse, prominent, reddish-yellow (5YR-7.5YR 6/8) mottles; weak, coarse, subangular blocky structure; friable; common roots; peds coated with light brownish gray (2.5Y 6/2); very patchy, thin clay films; strongly acid; gradual, wavy boundary.

B21tg—16 to 24 inches, light brownish-gray (2.5Y 6/2) silty clay loam that has common, coarse, prominent, strong-brown (7.5Y 5/6) and yellowish-brownish (10YR 5/8) mottles; very weak, coarse, prismatic structure that parts to weak, medium and thick, platy; firm; common roots; mottles oriented horizontally along platy surfaces; prisms coated with light brownish gray (2.5Y 6/2); patchy, thin clay films; strongly acid; gradual, wavy boundary.

B22tg—24 to 36 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, distinct, gray (5Y 6/1) and reddish-yellow (7.5YR 6/8) mottles; moderate, medium and coarse, prismatic structure that parts to weak, medium and coarse, angular blocky; firm; few roots but only along prism faces; thin, gray (5Y 6/1), clayey coatings on peds; few black coatings; strongly acid; gradual, wavy boundary.

IIB3t—36 to 48 inches, light olive-brown (2.5Y 5/4) silty clay loam; few, faint, medium, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure that parts to very weak, medium, platy; firm; few roots along prism faces; thin, gray (N 6/0), clayey coatings on vertical faces of peds; coatings 1 millimeter or less thick; few black (10YR 2/1) coatings; shale fragments 5 to 10 percent, by volume; medium acid; diffuse, wavy boundary.

IIC—48 to 90 inches, light olive-brown (2.5Y 5/4) shaly silty clay loam that has common, medium, distinct, gray (N 6/0) streaks; very weak, fine to coarse, subangular blocky structure; firm; no roots; 15 percent, by volume, is coarse material consisting mostly of black shale fragments and some fine-grained sandstone fragments; medium acid; diffuse, wavy boundary.

IIR—90 inches +, olive-brown (2.5Y 4/4), thin-bedded, weathered fragments of shale and sandstone.

The B2 horizons range from silty clay loam to silty clay in texture and from 35 to 45 percent in clay content. The matrix colors of the B horizons mostly have a hue of 2.5Y or 5Y, a value of 5 or 6, and a chroma of 2 or 4. Brighter mottles occur in the interior of peds, where mottles have a hue of 10YR, 7.5YR, or 5YR, a value of 5 or 6, and a chroma of 6 or 8. The gray coatings have a hue of 5Y or are neutral. Their values are 5 to 7 and chroma is 1 or less. The upper B horizons are mostly strongly acid. The IIB3 horizon is strongly acid to medium acid. The depth to the IIB3t horizon (lithologic discontinuity) ranges from 24 to 52 inches. The depth to the R horizon ranges from 5 to 8 feet.

The Mahoning soils in this county formed in acid glacial till of shaly silty clay loam texture, but the Mahoning soils elsewhere formed in mildly alkaline glacial till. In this county the lack of carbonates in the C horizon is not enough to affect the use and behavior of these soils.

The Mahoning soils generally are adjacent to Platea, Sheffield, and Hornell soils. Mahoning soils are more clayey than Platea soils, are more clayey and slightly better drained than Sheffield soils, and are much deeper to shale than the steeper Hornell soils. The Mahoning soils in this county are not less acid as depth increases as are most soils in the county and typical Mahoning soils elsewhere.

Mahoning silt loam, shale substratum, 2 to 6 percent slopes (MsB).—This gently sloping soil is in areas where the glacial till is thin over shale. Most areas of this soil are 2 to 20 acres in size. This soil generally is saturated early in spring unless it has been drained. Because the underlying shale is soft, it does not make tilling difficult. The surface layer of this soil is friable silt loam, but this layer contains so much silt that crusting is a serious hazard. The organic-matter content of the surface layer is moderate to low. A profile of this soil is described as representative for the series.

Seasonal wetness is the major limitation to the use of this soil for crops. Very slow permeability and seasonal wetness are the major limitations to the use of this soil for many nonfarm purposes. (Capability unit IIIw-6; woodland suitability group 2w2)

Mahoning silt loam, shale substratum, 2 to 6 percent slopes, moderately eroded (MsB2).—Except for effects caused by erosion, the profile of this soil is similar to that described as representative for the Mahoning series. The present surface, or plow, layer is a mixture of silt loam and silty clay loam from the subsoil. The plow layer is sticky and difficult to till properly. The organic-matter content is generally low. Because water moves into the surface layer of this soil more slowly than into that of the uneroded Mahoning soil, surface runoff is more rapid. This soil has a very narrow range of optimum moisture for tillage, and cloddiness is a severe problem. Included with this soil in mapping are some areas of Hornell soils in which shale is within a depth of 40 inches.

Seasonal wetness is the major limitation to the use of this soil for farming. Erosion control is needed to minimize soil losses. Slow permeability and a seasonal water table are major limitations for most nonfarm uses of this soil. (Capability unit IIIw-6; woodland suitability group 2w2)

Orrville Series

In the Orrville series are deep, somewhat poorly drained, nearly level soils that occupy low areas on stream flood plains. These soils formed in sediments washed from uplands. Orrville soils are highly subject to flooding, particularly during winter and spring.

A representative profile of an Orrville soil has a silt loam surface layer about 8 inches thick. This layer is dark grayish brown in the upper part and dark yellowish brown in the lower part. Beneath the surface layer is the subsoil of pale-olive and light olive-gray silt loam that extends to a depth of 25 inches. The next layer, to a depth of 39 inches, is light olive-gray loam. Between the surface layer and a depth of 39 inches, the soil material is mottled with yellowish brown and strong brown. Gray, friable loam occurs between depths of 39 and 43 inches. Shale bedrock is at a depth of 43 inches.

Orrville soils are dominantly loamy throughout. They have a seasonal high water table that is indicated by grayish colors near the surface. The water table is at about the same level as that of the streams. It generally is low in summer when streams are at low levels. Permeability, or downward movement of water, is moderate in the Orrville soils. These soils have a deep root zone in summer when the water table is low. They can hold large amounts of water available for plants and moderate amounts of plant nutrients. The upper 2 feet of the root zone typically is strongly acid unless altered by liming.

Most areas of Orrville soils are small and brushy and are not used for farming. Some areas are used for pasture.

Representative profile of Orrville silt loam (T. 11 N., R. 3 W., about 2 miles east of Jefferson, south of Netcher Road along Mill Creek, Jefferson Township):

A11—0 to 4 inches, dark grayish-brown (10YR 4/3) silt loam; moderate, very fine, crumb structure; very friable; many roots; strongly acid; clear, irregular boundary.

A12—4 to 8 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, very fine, subangular blocky structure; friable; many roots; strongly acid; clear, wavy boundary.

B1—8 to 14 inches, pale-olive (5Y 6/3) silt loam; many, medium, prominent, light olive-brown (2.5Y 5/4) mottles and few, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, fine, subangular blocky structure; friable; common roots; strongly acid; clear, wavy boundary.

B2—14 to 25 inches, light olive-gray (5Y 6/2) silt loam; many, medium, prominent, yellowish-brown (10YR 5/8) mottles and few, strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable; common roots; strongly acid; gradual, wavy boundary.

C1—25 to 39 inches, light olive-gray (5Y 6/2) loam that has many, medium, prominent, yellowish-brown (10YR 5/8) mottles and few, strong-brown (7.5YR 5/8) mottles; structureless (massive); friable; medium acid; clear, wavy boundary.

C2—39 to 43 inches, gray (5Y 6/1) loam; structureless (massive); friable; medium acid.

R—43 to 50 inches, shale bedrock.

The A horizons are silt loam in most places, but fine sandy loam also occurs. The B horizons typically are silt loam or loam, but sandy loam, clay loam, or light silty clay loam also occurs. The weighted average clay content at a depth of 10 to 40 inches is more than 18 percent and less than 35 percent. The matrix of the B horizons has hues of 10YR to 5Y, values of 4 to 6, and chromas of 1 to 4. Mottles having a high chroma range from few to many and have hues of 7.5YR to 2.5Y, value of 5 or 6, and chromas of 4 to 8. Reaction in the uppermost 40 inches of soil ranges from strongly acid to slightly acid. The profile described as representative generally is less thick to bedrock than Orrville soils elsewhere in the county. Shale bedrock, however, commonly is at a depth of 4 to 5 feet in the immediate vicinity of Geneva and Jefferson and in other areas where the Allis and Hornell soils are nearby.

Orrville soils are the somewhat poorly drained members of a drainage sequence that includes the well drained Chagrin soils, the moderately well drained Lobdell soils, and the poorly drained Holly soils. Orrville soils are similar to the nearby Wallington soils but lack a fragipan characteristic of those soils. Also, the Orrville soils occupy lower positions than Wallington soils.

Orrville fine sandy loam (Or).—The fine sandy loam surface layer of this soil is material recently washed from areas of Colonie or Elnora soils. The underlying soil material typically is loamy as described for the series. This soil occurs along streams in the northern part of the county. It has much better tilth and trafficability than Orrville silt loam. Included with this soil in mapping are wet spots of dark-colored, poorly drained Holly soils.

Seasonal wetness and flooding are major limitations to the use of this soil for any purpose. (Capability unit IIw–1; woodland suitability group 2w1)

Orrville silt loam (Os).—This soil is in small areas on flood plains. It is nearly level or depressional and is subject to ponding during wet periods or after flooding. Because of runoff from adjacent uplands, surface water tends to accumulate on this soil. The soil has poor trafficability when it is wet. It is very susceptible to surface crusting in cultivated areas. A profile of this soil is described as representative for the series. Included in mapping are numerous small areas of dark-colored, poorly drained Holly soils.

Seasonal wetness and flooding are the major limitations to the use of this soil for any purpose. (Capability unit IIw–1; woodland suitability group 2w1)

Otisville Series

The Otisville series consists of well-drained, nearly level to steep soils that are shallow to coarse sand and fine gravel. These soils occupy old beach ridges, former offshore bars, and terrace escarpments. Most of the underlying sand and gravel was derived from sandstone and quartzite. All of the sand and gravel deposits are of Wisconsin glacial age.

A representative profile of an Otisville soil has a thin, dark-brown gravelly sandy loam plow layer about 6 inches thick. Between depths of 6 and 18 inches is a subsoil of brown to strong-brown gravelly coarse sandy loam and very gravelly loamy coarse sand. The next layers, to a depth of 60 inches, are stratified sandy and gravelly material. Below a depth of 12 inches, more than 50 percent of the soil mass is coarse sand or gravel.

Permeability in Otisville soils is rapid. The ground water is likely to be contaminated if these soils are used for disposal of sewage effluent from septic tanks. Very little water is retained in these soils for use by plants. Otisville soils are very droughty but are well suited to irrigation. They have a very low capacity for storing and releasing plant nutrients. These soils have a shallow root zone that commonly is very strongly acid unless altered by liming.

In the northern part of the county, some areas of Otisville soils are irrigated and used for specialty crops, such as sweet corn, melons, strawberries, and nursery stock. Most areas of Otisville soils are used for general farming. Along the beach ridges in the northern part of the county, the urban-rural fringe is expanding and is replacing farming.

Representative profile of Otisville gravelly sandy loam (T. 13 N., R. 2 W., about 4½ miles southwest of Conneaut and 5/8 mile north of the intersection of U.S. Highway No. 20 and Poor Road, Kingsville Township; *laboratory sample* AB–111 in table 10):

Ap—0 to 6 inches, dark-brown (7.5YR 3/2) gravelly sandy loam; weak, medium, granular structure; very friable; many roots; fine gravel makes up about 40 percent, by volume; very strongly acid; abrupt, smooth boundary.

B2—6 to 12 inches, strong-brown (7.5YR 5/6) gravelly coarse sandy loam; weak, medium, subangular blocky structure that parts with slight pressure to weak, medium and fine, granular; friable; common roots; few dark-brown (10YR 4/3) stains on ped faces and sand grains; fine gravel makes up about 40 percent, by volume; very strongly acid; abrupt, wavy boundary.

B3—12 to 18 inches, brown to strong-brown (7.5YR 5/4 to 5/6) very gravelly loamy coarse sand; structureless (single gain); very friable; common roots; about 70 percent fine gravel; very strongly acid; gradual, wavy boundary.

C1—18 to 37 inches, coarse sand and fine gravel that ranges from yellowish brown (10YR 5/6) to dark yellowish brown (10YR 4/4) as depth increases; structureless (single grain); loose; few roots; 80 percent fine gravel; common black stains on pebbles and sand grains; some pebbles and sand grains weakly cemented with black material; strongly acid; diffuse, wavy boundary.

C2—37 to 60 inches, stratified yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) sand and gravel; structureless (single grain); loose; no roots; 80 percent gravel; stratification zones range from 1 to 6 inches in thickness; most fragments larger than sand are sandstone and quartzite; sand is mostly quartzitic; common, very dark grayish-brown (10YR 3/2) and black (10YR 2/1) stains on pebbles; strongly acid.

The solum ranges from 14 to 24 inches in thickness. The A horizon is sandy loam or gravelly sandy loam in most places. The Ap horizon is dark brown (7.5YR 3/2) to very dark grayish brown (10YR 3/2). The gravel content of individual horizons beneath the A horizon ranges from 25 to 80 percent, by volume. The average content of coarse fragments between depths of 10 and 40 inches is more than 50 percent. In wooded areas the A1 horizon is less than 2 inches thick and is very dark brown (10YR 2/2) or very dark grayish brown (10YR 3/2). Under the A1 horizon is a strong-brown (7.5YR 5/6) or dark-brown (7.5YR 4/4) B1 horizon 4 to 7 inches thick. The structure of the B horizon is weak in all areas. The B2 horizon typically is strong brown, but it is yellowish brown, reddish brown, or yellowish red (10YR or 5YR hue) in some places. The reaction ranges from very strongly acid to medium acid throughout the profile.

Otisville soils are more shallow to coarse sand and gravel than Chenango soils. More coarse fragments and pebbles are in Otisville soils than are in the nearby sandy Colonie soils. Otisville soils are better drained than the nearby Red Hook and Atherton soils.

Otisville sandy loam, 1 to 6 percent slopes (OtB).—The profile of this soil is less gravelly in the surface layer and generally throughout than the profile described as representative for the series. This soil has a higher content of coarse sand and less gravel than is typical. The surface layer of this soil is less than 10 percent gravel, by volume, and tilth is excellent. Irrigated areas are used intensively for specialty crops.

Droughtiness is the major limitation to use of this soil for crops or lawns. For many nonfarm uses, limitations other than rapid permeability are few. (Capability unit IVs–1; woodland suitability group 4s1)

Otisville gravelly sandy loam, 1 to 6 percent slopes (OuB).—This Otisville soil is about 20 to 45 percent gravel in the surface or plow layer. This gravel causes excessive wear on tillage implements. The largest areas of this soil are near the towns of Conneaut and Kingsville. This soil occupies areas up to about 20 acres in size. A profile of this soil is described as representative for the series. In the more nearly level areas, there are small inclusions of a soil that is more silty in the surface layer than is typical for Otisville soils.

Irrigated areas are used intensively for specialty crops because this Otisville soil has very good tilth. Because of the higher gravel content, however, this soil is slightly less desirable for specialty crops than Otisville sandy loam.

Very low moisture holding capacity is the major limitation to use of this soil for crops and lawns. For many nonfarm uses, limitations other than slopes of more than 2 percent are few or none. (Capability unit IVs-1; woodland suitability group 4s1)

Otisville gravelly sandy loam, 6 to 12 percent slopes (OuC).—This soil occupies short slopes that are linear in shape. It is more subject to erosion than less sloping Otisville soils. Because of the gravel content of the surface layer, wear on tillage implements is excessive.

Irrigated areas of this soil can be used for specialty crops, but slopes limit crop growth. This soil is used much less for specialty crops than less sloping Otisville soils.

The very low available moisture capacity is the major limitation to use of this soil for crops and lawns. Slopes are a limitation for many nonfarm uses. (Capability unit IVs-1; woodland suitability group 4s1)

Otisville and Chenango soils, 12 to 25 percent slopes (OvE).—These two kinds of soils were mapped as an undifferentiated soil group, because they have similar use and management. The Chenango part of this mapping unit is less gravelly than the Otisville part. Either or both kinds of soils are in the mapped areas. These soils generally occupy slopes that are less than 200 feet long. The soils are on the beach ridges and along Pymatuning and Conneaut Creeks.

These soils are droughty. The Chenango soils, however, have a higher available moisture capacity in the upper part of their profile than do the Otisville soils because Chenango soils are more silty and less gravelly.

The soils in this mapping unit are too steep and too droughty for field crops. Slope and droughtiness are the major limitations to use for farming or most nonfarm uses. (Capability unit VIs-1; woodland suitability group 4s1)

Pierpont Series

Soils in the Pierpont series are moderately well drained and have a fragipan in their subsoil. They formed in silt loam glacial till of Wisconsin age. Most areas of the Pierpont soils are on crests or slopes of hills where surface runoff is medium to rapid. The largest acreage of these soils is in the northern part of the county, south of the beach ridges.

A representative profile of a Pierpont soil has a dark grayish-brown silt loam plow layer that is 7 inches thick. A thin layer of light yellowish-brown silt loam is just below the surface layer. In the upper part of the subsoil are layers, 3 to 5 inches thick, that extend to a depth of 21 inches. These layers are yellowish brown and dark yellowish brown silt loam and light silty clay loam. A dense, compact layer, or fragipan, of dark yellowish-brown light silty clay loam is between depths of 21 and 48 inches. This layer is arranged in weak vertical prisms that effectively slow the downward movement of water and also limit the downward penetration of plant roots. Firm, fairly compact silt loam glacial till is below a depth of 48 inches.

A good root zone for plants extends from the surface to a depth of 20 to 30 inches, which is the top of the fragipan. Few roots penetrate the top of the fragipan. Some roots, however, extend farther downward along the vertical faces of prisms. Because of the fragipan, these soils are slowly permeable. In the normal root zone, the available moisture capacity is medium. The root zone typically is very strongly acid or strongly acid unless altered by liming. Pierpont soils have a moderate capacity for storing and releasing plant nutrients.

If they are intensively managed, Pierpont soils are suited to general farm crops. A large acreage, however, is not farmed. In favorable local areas, these soils are used for fruits, mainly grapes and apples.

Representative profile of a Pierpont silt loam (T. 8 N., R. 3 W., about 3 miles southeast of the village of Colebrook at the intersection of Cream Ridge Road and Troutman Road, Colebrook Township):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.

A2—7 to 10 inches, light yellowish-brown (2.5Y 6/4) silt loam; weak, thick, platy structure that parts to moderate, medium and coarse, granular; friable; many roots; few coarse fragments 2 to 3 millimeters in size; very strongly acid; clear, wavy boundary.

B1—10 to 13 inches, yellowish-brown (10YR 5/6) silt loam that has few, faint, medium, light yellowish-brown (2.5Y 6/4) and pale-brown (10YR 6/3) mottles; weak, fine, subangular blocky structure; friable; common roots; few coarse fragments 2 to 3 millimeters in size; strongly acid; clear, wavy boundary.

B21—13 to 16 inches, yellowish-brown (10YR 5/6) light silty clay loam that has few, medium, faint, strong-brown (7.5YR 5/8), gray (10YR 5/1), and dark yellowish-brown (10YR 4/4) mottles; weak, medium and coarse, subangular blocky structure; friable; common roots; few coarse fragments 2 to 3 millimeters in size; strongly acid; clear, wavy boundary.

B22&A'2—16 to 21 inches, dark yellowish-brown (10YR 4/4) light silty clay loam that has few, medium, distinct, brownish-yellow (10YR 6/8) and strong-brown (7.5YR 5/6) mottles; moderate, medium and coarse, subangular blocky structure; friable; few roots; some peds coated with light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2); few coarse fragments; strongly acid; clear, wavy boundary.

Bxt—21 to 48 inches, dark yellowish-brown (10YR 4/4) light silty clay loam that has common, prominent, medium, yellowish-brown (10YR 5/8) mottles and common, medium, distinct, dark grayish-brown (10YR 4/2) mottles; weak, very coarse, prismatic structure that parts to weak, coarse, subangular blocky; very firm; few roots along prism faces; thick, grayish-brown (10YR 5/2), clayey ped coatings; few large sandstone and shale fragments up to 3 inches or more in size; neutral; clear, wavy boundary.

C—48 to 60 inches, dark yellowish-brown (10YR 4/4) silt loam that has many, medium, faint, dark grayish-brown (10YR 4/2) mottles; weak, coarse, prismatic structure; firm; few roots; few grayish-brown (2.5Y 5/2) clay films in fractures; about 5 percent coarse material that consists of flat fragments of sandstone shale; mildly alkaline; weakly calcareous.

The solum ranges from 40 to 54 inches in thickness. Carbonates commonly are at a depth of less than 48 inches and in some places are at a depth of as little as 30 inches. Reaction is strongly acid to very strongly acid above the fragipan and is neutral or mildly alkaline in the lower part of the pan. Coarse fragments are few.

Undisturbed areas have a dark grayish-brown (10YR 3/2) A1 horizon 1 inch to 5 inches thick. The Ap horizon is grayish brown (2.5Y 5/2 or 10YR 5/2), brown (10YR 5/3 or 4/3), or dark grayish brown (2.5Y 4/2 or 10YR 4/2). The A2 horizon, where present, is light yellowish brown (2.5Y 6/4) or yellowish brown (10YR 5/4). The B2 horizon is yellowish brown (10YR 5/6) or dark yellowish brown (10YR 4/4) mottled with strong brown (7.5YR 5/6 or 5/8), yellowish brown (10YR 5/4, 5/6, 5/8), and pale brown (10YR 6/3). The B2 horizon is silt loam or light silty clay loam that has an average clay content of 24 to 34 percent, by weight. Structure is weak and moderate, fine, medium, and coarse, subangular blocky. The B2 horizon is friable or firm when moist and slightly sticky and plastic when wet.

The top of the fragipan (Bx horizon) is at a depth of 18 to 30 inches. Prisms in the Bx horizon are 5 to 18 inches across and have yellowish-brown (10YR 4/3) or olive-brown (2.5Y 4/4) interiors. The exteriors of prisms are coated by silt and clay films of grayish brown (2.5Y 5/2), olive (5Y 5/3), and gray (5Y 5/1). The clay films are more than one millimeter thick. The Bx horizon is light silty clay loam or clay loam.

The C horizon is dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4). It has few grayish-brown (2.5Y 5/2) clay films in fractures. Texture is silt loam, light silty clay loam, or light clay loam.

The moderately well drained Pierpont soils are members of a drainage sequence that includes the somewhat poorly drained Platea soils, the poorly drained Sheffield soils, and the dark-colored, very poorly drained Ilion soils. Pierpont soils are similar to the moderately well drained Cambridge soils, which have less thick and less abundant clay films in the fragipan than Pierpont soils and a lower clay content in the soil material above the fragipan.

Pierpont silt loam, 2 to 6 percent slopes (PeB).—This soil mostly occupies breaks along the edges of areas of somewhat poorly drained Platea soils. Most areas are 2 to 10 acres in size. This soil has a normal depth of 20 to 30 inches to the fragipan. A profile of this soil is described as representative for the series. Included with the soil in mapping are small areas of the wetter Platea soils.

Because the surface layer of this soil is naturally low in organic-matter content, surface crusting is a major problem in cultivated areas. A moderate erosion hazard is the major limitation to the use of this soil for farming. Slow permeability is a limitation to use for many nonfarm purposes. (Capability unit IIe–2; woodland suitability group 2o1)

Pierpont silt loam, 2 to 6 percent slopes, moderately eroded (PeB2).—This soil is similar to Pierpont silt loam, 2 to 6 percent slopes, except for the effects of erosion. This soil is moderately eroded and typically has a browner, thinner surface layer than the uneroded soil. It also is less deep to the top of the fragipan and contains less organic matter. Seedling survival commonly is lower on this soil than on the uneroded Pierpont silt loam. Because this soil has a lower available moisture capacity, crops show the effects of drought more quickly than on uneroded Pierpont silt loam. Surface crusting is severe in cultivated areas.

A moderate hazard of erosion is the major limitation to use of this soil for farming. Slow permeability is a limitation for most nonfarm uses. (Capability unit IIe–2; woodland suitability group 2o1)

Pierpont silt loam, 6 to 12 percent slopes, moderately eroded (PeC2).—This soil occupies long, narrow areas on convex crests of slopes. Erosion has removed part of the original surface layer, and the present surface layer is browner and thinner than it would be if it were not eroded. It also is stickier because part of the subsoil has been mixed into the surface layer by tillage. This soil has a lower organic-matter content and lower available moisture capacity than uneroded Pierpont soils. Surface crusting is severe in cultivated areas of this soil.

Because surface runoff is rapid, the hazard of erosion is severe. Slow permeability and slope are limitations to use of this soil for many nonfarm purposes. (Capability unit IIIe–2; woodland suitability group 2o1)

Pierpont and Platea soils, 12 to 18 percent slopes, moderately eroded (PoD2).—The soils in this undifferentiated soil group were not mapped separately because they have about the same use and management. The Pierpont part of this mapping unit is moderately well drained. The Platea part is somewhat poorly drained to moderately well drained. Both kinds of soils are fairly similar except for differences in natural drainage. Either or both kinds of soils are in mapped areas. The soils have a silt loam or silty clay loam surface layer; they occupy convex upper slopes and concave areas around the heads of drains. Practically all areas have short, elongated slopes.

Few areas of these soils are farmed. Most areas are used for pasture or as woodland. Some shale crops out in local areas near the base of the slopes.

Slope, erosion, and a very severe erosion hazard are limitations to use of this mapping unit for farming. Slope and slow or very slow permeability are limitations for many nonfarm uses. (Capability unit IVe–1; woodland suitability group 2o1)

Platea Series

The Platea series consists of loamy, nearly level to sloping soils that are somewhat poorly drained. These soils have a dense, compact layer, or fragipan, in the lower part of their subsoil. Platea soils formed in silt loam glacial till of Wisconsin age. They are widespread south of the beach ridges.

A representative profile of a Platea soil has about 21 inches of loamy material above the top of the fragipan. The uppermost 13 inches is mostly light yellowish-brown silt loam. Strong-brown light silty clay loam is between depths of 13 and 21 inches. The fragipan extends to a depth of 44 inches. It is very firm, and it slows the downward movement of water and the downward penetration of plant roots. This fragipan is olive-brown heavy silt loam. Below the fragipan is olive-brown silt loam glacial till.

The uppermost 18 to 24 inches of Platea soils is the normal root zone for plants. Few roots penetrate the top of the dense, compact fragipan, but some roots extend downward along the vertical faces of peds. The root zone has a medium available moisture capacity if the soil is uneroded. It typically is very strongly acid unless altered by liming. Because their permeability is very slow, Platea soils are seasonally saturated above the fragipan. These soils dry slowly in spring, even if they are artificially drained. Artificial drainage is needed for the satisfactory growth of most crops. Platea soils have a moderate capacity for storing and releasing plant nutrients.

The Platea soils are used mainly for general farm crops in which the proportion of forage crops is high. Farming has been abandoned in a large acreage. In favorable local areas, Platea soils are used for fruits, mainly grapes and apples (fig. 13).

Representative profile of a Platea silt loam (T. 11 N., R. 3 W., about 3 miles north and 1 mile west of Jefferson, Jefferson Township; *laboratory sample* AB–39 in table 10):

A11—0 to 1 inch, very dark brown (10YR 2/2) silt loam; moderate, fine, crumb structure; loose; very strongly acid; abrupt, smooth boundary.

A12—1 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, crumb structure; loose; many fine roots; strongly acid; clear, wavy boundary.

Figure 13.— **Concord grapes on a Platea silt loam. Surface is being prepared for a winter cover crop that will protect the soil from erosion.**

A2—3 to 13 inches, light yellowish-brown (2.5Y 6/4) silt loam; few, fine and medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, fine and medium, subangular blocky structure; friable; many fine roots; very few fragments of more than 3 inches in diameter; strongly acid; clear, wavy boundary.

B2—13 to 21 inches, strong-brown (7.5YR 5/8) light silty clay loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) mottles; ped faces coated with light brownish-gray (10YR 6/2) silty material; moderate, medium, subangular blocky structure that parts to weak, fine and medium, subangular blocky; many, fine roots along ped faces; few, patchy clay films in channels and pores cover less than 1 percent of the ped surfaces; firm; very few fragments of more than 3 inches in diameter; strongly acid; abrupt, wavy boundary.

Bx—21 to 44 inches, olive-brown (2.5Y 4/4) heavy silt loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; strong-brown rind around the periphery of peds; ped faces coated with gray (10YR 5/1); weak, very coarse (10 to 16 inches across), prismatic structure that parts under considerable pressure to moderate, angular blocky and platy structure; very firm; brittle; a few fine roots along prism faces; many, thin, black stains and common, fine, black concretions in ped interiors; ped faces have patchy, thin, vesicular silty coating in upper part of horizon; clay films on prism faces more than 1 millimeter thick but are thinner as depth increases; 5 percent coarse fragments; neutral; clear, wavy boundary.

C—44 to 60 inches, olive-brown (2.5Y 4/4) heavy silt loam; very weak, very coarse, prismatic structure but is structureless (massive) at lower depth; firm; faces of plates have patchy clay films but films are less common with depth; few, thin, black, stains; 5 percent coarse fragments consisting of flat angular fragments of sandstone and some shale, igneous, and limestone fragments; calcareous till.

The depth to the fragipan ranges from 18 to 24 inches. The thickness of the solum ranges from 36 to 48 inches in thickness. The B22 horizon is clay loam or silty clay loam, and the fragipan is silt loam, clay loam, or light silty clay loam. The clay content of the B22 horizon ranges from 26 to 37 percent, and its average content is 30 percent. The clay content of the fragipan ranges from 19 to 32 percent, and its average content is 26 percent. In the fragipan the content of sand, including very fine sand, normally ranges from 16 to 24 percent; the average content of sand is 19 percent above the fragipan and 23 percent in the fragipan. The matrix color of the B21 horizon includes light yellowish brown (2.5Y 6/4), olive brown (2.5Y 5/4), yellowish brown (10YR 5/4), and olive brown (2.5Y 4/4). The Bx and C horizons commonly are light olive brown (2.5Y 5/4) or olive brown (2.5Y 4/4). The color of the ped surfaces varies 1 unit in value, chroma, and hue. The upper part of the C horizon is neutral to mildly alkaline. In some places the upper part of the fragipan is medium acid or slightly acid instead of neutral. The interior of the prisms are calcareous at a depth of as little as 20 inches in some areas. The rock fragments are more than 3 inches in size in only a few places and normally make up less than 10 percent of the soil volume.

The somewhat poorly drained Platea soils are members of a drainage sequence of soils that includes the moderately well drained Pierpont soils, the poorly drained Sheffield soils, and the dark-colored, poorly drained Ilion soils. Platea soils have a higher clay content and less sand than Venango soils. In the subsoil Platea soils are less clayey than the Mahoning soils.

Platea silt loam, 0 to 2 percent slopes (PsA).—This soil typically occupies small, nearly level or convex knolls about 2 to 5 acres in size. These knolls generally are surrounded by nearly level, poorly drained Sheffield soils. Excess surface water is a hazard because runoff is slow to ponded. The surface layer generally is thicker than that of other Platea soils. The tilth of this soil is generally poor, particularly in cultivated areas. Surface crusting is fairly common.

A seasonally high water table and very slow permeability are major limitations to the use of this soil for farming or most nonfarm purposes. (Capability unit IIIw–1; woodland suitability group 2w2)

Platea silt loam, 2 to 6 percent slopes (PsB).—This soil lies on knolls and short slopes along drainageways. It also occupies interstream divides. A profile of this soil is described as representative for the series.

Surface runoff is medium to rapid, but excess surface water is not a great hazard. A greater hazard is seasonal saturation of the soil. Unless this soil is drained, water seeps along the top of the fragipan and causes basements to be wet. Surface runoff in cultivated or other disturbed areas may result in excessive losses from erosion.

The major limitation to the use of this soil is seasonal wetness. This soil dries slowly in spring, and generally it has poor tilth. Very slow permeability is a major limitation for many nonfarm uses. (Capability unit IIIw–2; woodland suitability group 2w2)

Platea silt loam, 2 to 6 percent slopes, moderately eroded (PsB2).—This soil is generally browner on the surface than uneroded Platea silt loam. The surface commonly has numerous shale fragments and pebbles. Erosion has lowered the organic-matter content and has decreased the thickness of the root zone, and the available moisture capacity. This soil requires more intensive management than Platea silt loam, 2 to 6 percent slopes. Seedling germination is commonly poor because of crusting. This soil dries slowly in spring because it is saturated early in spring. Seepage along the top of the fragipan causes basements to be wet if this soil is not properly drained. Included in mapping are a few former vineyards that are severely eroded and gullied.

Seasonal wetness is the major limitation to the use of this soil for farming. An erosion hazard also is a limitation. Rapid surface runoff on cultivated or other disturbed areas may cause excessive losses from erosion. Very slow permeability is a major limitation for some nonfarm uses. (Capability unit IIIw–2; woodland suitability group 2w2)

Platea silt loam, 6 to 12 percent slopes (PsC).—This soil has a profile similar to the one described as representative for the series, except that it is about 6 inches shallower to glacial till material. All of the layers in this soil are thinner than are those described in the representative profile. This soil occupies narrow areas along streams and large drainageways. It also occurs on broader hilly areas.

Included in mapping are small areas of moderately well drained Pierpont soils and of poorly drained Sheffield soils. The included areas of Pierpont soils are near the top of the slopes, and those of Sheffield soils occupy small drainageways.

Because surface runoff is rapid, the erosion hazard is severe. This soil is seasonally saturated, and seepage along the top of the fragipan is common.

The severe erosion hazard is the major limitation to the use of this soil for crops. Very slow permeability and seasonal wetness are limitations for many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 2w2)

Platea silt loam, 6 to 12 percent slopes, moderately eroded (PsC2).—This soil has a shallow root zone because it is naturally less deep to the fragipan than less steep Platea soils and because it is eroded. Consequently, its available moisture capacity is lower than that in uneroded Platea soils. The surface layer is brownish and has shale pebbles and fragments. It has low organic-matter content, and seedling mortality is higher than on uneroded Platea soils. Surface runoff is rapid and in large amounts because the soil has a very limited capacity to absorb water. When the soil is saturated, water seeps along the top of the fragipan. Erosion has increased the susceptibility of this soil to crusting. Seedling mortality is high, and more careful management is needed than on less eroded Platea soils.

A severe erosion hazard is the major limitation to the use of this soil for farming. Very slow permeability and seasonal wetness are limitations for many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 2w2)

Platea silt loam, 6 to 12 percent slopes, severely eroded (PsC3).—This soil has lost most of its original surface soil and some of its subsoil through erosion. Locally, gullies are 1 to 3 feet deep. The surface layer of this soil is sticky light silty clay loam in many places. It has a very high organic-matter content and low available moisture capacity.

If this soil is cultivated, the erosion hazard is very severe. Slow permeability and seasonal wetness are major limitations for many nonfarm uses of this soil. (Capability unit IVe–1; woodland suitability group 2w2)

Quarries

Quarries (Qu) consist of abandoned areas, mostly 3 to 4 acres in size, that were mined for massive sandstone. About 60 to 80 years ago, the sandstone was sawed into blocks and used for foundations. None of these quarries are now in operation. These former quarries commonly occupy valley floors, adjacent to streams, and the side slopes of the valleys are steep. Typically, the Chagrin, Lobdell, and similar soils are nearby. The sides of these quarries commonly have vertical sawed walls that are hazardous for recreation, particularly when the pit is filled with water. Little debris is around most of these quarries. Since operations were abandoned, trees have been naturally reestablished and provide cover.

Ponded areas in these old sandstone quarries commonly are not polluted and silted. These areas are well suited to development for wildlife, particularly fish. Recreational development is a possibility if the hazards of rock cliffs and deep water are properly considered and safety measures are taken. (Capability unit and woodland suitability group not assigned)

Red Hook Series

Soils in the Red Hook series are loamy, somewhat poorly drained, and nearly level to gently sloping. They formed in poorly sorted glacial outwash of Wisconsin age that was derived mainly from shale and sandstone. The Red Hook soils occupy areas in the valley of Pymatuning Creek, areas adjacent to Pymatuning Reservoir, and scattered areas in the northern part of the county.

A representative profile of Red Hook silt loam has a very dark grayish-brown and dark grayish-brown silt loam plow layer about 8 inches thick. The subsoil extends to a depth of 36 inches. It is dark yellowish-brown silt loam in the upper part and light brownish-gray loam in the lower part. It is mottled with brownish colors. The underlying material is dark yellowish-brown gravelly sandy loam. This material is about 50 percent fine gravel, and it extends to a depth of 54 inches.

Red Hook soils occupy areas that have a seasonal high water table. Permeability is slow vertically, but individual coarse-textured layers can transmit water horizontally at a rapid rate. Roots easily penetrate the upper 24 inches of soil when the water table is low, but few roots penetrate below a depth of 24 to 30 inches. The root zone is mostly very strongly acid. It has a medium available moisture capacity, but seepage and capillary action above the underlying water table help to provide additional moisture for plants. The Red Hook soils have a moderate to low capacity for releasing and storing plant nutrients.

Drained areas of Red Hook soils normally are used for general farm crops, of which a high proportion is forage crops. A large acreage of these soils is not used for farming.

Representative profile of Red Hook silt loam (T. 9 N., R. 1 W., about 4 miles north-northeast of the town of Andover, 3 miles north of State Route 85, and 240 feet east of Pymatuning Lake Road, Andover Township):

Ap1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; many roots; very strongly acid; abrupt, wavy boundary.

Ap2—2 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; many roots; very strongly acid; abrupt, smooth boundary.

B21—8 to 15 inches, dark yellowish-brown (10YR 4/4) silt loam that has few, medium, distinct, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/8) mottles; weak, fine, subangular blocky structure; friable; many roots; very strongly acid; clear, wavy boundary.

B22—15 to 25 inches, light brownish-gray (10YR 6/2) loam that has common, medium, distinct mottles of yellowish brown (10YR 5/8), grayish brown (10YR 5/2), light brownish gray (2.5Y 6/2), and strong brown (7.5YR 5/8); structureless (massive); firm; few roots; about 5 to 10 percent particles 2 to 5 millimeters in size; very strongly acid; clear, wavy boundary.

B23—25 to 36 inches, light brownish-gray (2.5Y 6/2) loam that has many, medium, prominent mottles of strong brown (7.5YR 5/8), dark yellowish brown (10YR 4/4), and pale brown (10YR 4/3); massive; firm; no roots; about 5 percent particles 2 millimeters or more in size; very strongly acid; clear, irregular boundary.

C—36 to 54 inches, dark yellowish-brown gravelly sandy loam that has few, medium, distinct, pale-brown (10YR 6/3) mottles; massive in upper part but single grain in lower part; loose; no roots; 50 percent fine gravel; streaks of light brownish gray (2.5Y 6/2) extend downward and are surrounded by strong brown (7.5YR 5/8); very strongly acid.

The Ap horizon is silt loam in most areas, but loam occurs in some places. In wooded areas the A1 horizon may be very dark gray (10YR 3/1). Colors in the Ap horizon are very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2). The B21 horizon has weak, coarse, granular structure in some places. The matrix color of the B2 horizons have a hue of 10YR, 2.5Y, or 5Y, values of 4 to 6, and chromas of 2 to 4. Mottles in the B2 horizons have a hue of 10YR or 7.5YR, values of 4 to 6, and chromas of 2 to 6. The B22 and B23 horizons generally are structureless. In some places the colors of the B2 and C horizons are layered and include reddish yellow (5YR 7/8), grayish brown (10YR 5/2), light gray (10YR 7/1), and gray (10YR 6/1). The lower solum is sandy loam and sandy clay loam in some places. Stratification is apparent in many places. The coarse material consists of fine gravel and makes up as much as 10 percent in the upper part of the solum and as much as 50 percent in the lower part. Depth of soil development is 36 inches or more, but depth to free carbonates is 8 to 10 feet. The soil is generally neutral at a depth of 6 feet, but reaction in the upper 3 to 4 feet is strongly acid to very strongly acid.

The somewhat poorly drained Red Hook soils are members of a drainage sequence that includes the well drained Chenango soils, the moderately well drained Braceville soils, and the poorly drained Atherton soils. Red Hook soils contain more sand and gravel than other somewhat poorly drained soils in the county.

Red Hook silt loam, 0 to 4 percent slopes (RhB).—This soil occupies small areas that are mostly 2 to 10 acres in size. It commonly is adjacent to Braceville or Atherton soils, and a few areas are near poorly drained Holly soils. This Red Hook soil stays wet late in spring and drys out slowly, even where it is artificially drained. It has, however, a fairly wide range of optimum moisture for tillage. Included with this soil in mapping are small areas of poorly drained Atherton soils.

Seasonal wetness is the principal limitation to most uses of this soil. (Capability unit IIw–3; woodland suitability group 2w2)

Riverwash

Riverwash (Rw) consists of very cobbly and stony areas in the channels of the major streams. Most of the coarse fragments in Riverwash are limestone and sandstone, but there are a few fragments of granite. Most of these fragments range from 1 to 3 inches in diameter. Included in mapping are a few areas that have a significant content of fine material, but these areas commonly have a droughty root zone.

Most areas are periodically flooded, and this flooding depends on the water level characteristics of the stream. Also most areas are bare of vegetation, but some willow, cattails, marsh grass, and other water-tolerant plants grow in local areas.

Aquatic birds, insects, and amphibious wildlife commonly are present on Riverwash if the areas are not filled by refuse or otherwise polluted. Preserving these areas by cleaning the environment is necessary to support water-tolerant plants and micro-organisms that are food and cover for many kinds of wildlife. During periods of low water, Riverwash provides good sites for stand fishing. (Capability unit and woodland suitability group not assigned)

Sheffield Series

The Sheffield series consists of loamy, poorly drained, nearly level soils. These soils occupy extensive areas on the glacial till plain of Wisconsin age. Some areas of Sheffield soils are above the flood level in the valley of the Grand River. Regardless of topographic position, the Sheffield soils have a dense, compact fragipan in the subsoil.

In a representative profile, the plow layer of a Sheffield soil is dark grayish-brown silt loam 8 inches thick. Below the plow layer, to a depth of 22 inches, are layers of light-gray and light brownish-gray silt loam. The fragipan is between depths of 22 and 41 inches. It is grayish-brown and olive-brown, very firm heavy silt loam and contains grayish coatings. The underlying material is olive-brown silt loam glacial till. About 10 percent of this till is sandstone and shale fragments. Below the plow layer, this soil is mottled throughout with yellowish brown, strong brown, and other colors.

The upper 15 to 26 inches of Sheffield soils is friable and provides a good root zone for plants, but the fragipan slows the movement of water and the penetration of plant roots. Because of the fragipan, for long periods in winter and spring, the Sheffield soils have a perched water table that generally limits root growth to a moderate depth. The root zone has a medium available moisture capacity, but some additional moisture is available to plants in seepage from adjacent areas, and also because roots extend downward along structural faces of the fragipan. Sheffield soils have a moderate capacity for absorbing and releasing plant nutrients. The root zone normally is very strongly acid or strongly acid unless altered by liming.

The Sheffield soils are used mostly for general farming. Feed grains and forage for dairy cows are the main crops.

Representative profile of Sheffield silt loam (T. 11 N., R. 3 W., about 1½ miles east of Jefferson, 320 yards south of State Route 167 on west side of Black Sea Road, Jefferson Township: *laboratory sample* AB-37 in table 10):

Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, medium, granular structure; friable; many fine roots; few coarse fragments larger than 3 inches in diameter; few, black (10YR 2/1), small, soft concretions; very strongly acid; abrupt, smooth boundary.

A2g—8 to 18 inches, light-gray (5Y 7/2) silt loam that has common, fine, distinct, olive-yellow (2.5Y 6/6) and yellowish-brown (10YR 5/8) mottles; weak, fine and medium, subangular blocky structure; friable; few, fine roots; very few fragments larger than 3 inches in diameter; few, black (10YR 2/1), small, soft concretions; very strongly acid; clear, wavy boundary.

B2g—18 to 22 inches, light brownish-gray (2.5Y 6/2) heavy silt loam that has many, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, fine and medium, subangular blocky structure; friable; ped faces coated light brownish gray (2.5Y 6/2) when moist and light gray (5Y 7/2) when dry; few roots; very few fragments larger than 3 inches in diameter; strongly acid; clear, wavy boundary.

Bx1—22 to 26 inches, grayish-brown (2.5Y 5/2) heavy silt loam that has many, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, very coarse, prismatic structure that slightly tends to part to platy; very firm; few fine roots along prism faces; thin, continuous, olive-gray coatings on prisms; ped faces have thin, patchy clay films; common black (10YR 2/1) oxide stains in prism interiors; very few fragments larger than 3 inches in diameter; medium acid; gradual, smooth boundary.

Bx2—26 to 41 inches, olive-brown (2.5Y 4/4) heavy silt loam that has common, medium, distinct, yellowish-brown (10YR 5/6) and gray (5Y 5/1) mottles; moderate, very coarse, prismatic structure that tends to part to platy; very firm; few, fine roots on prism faces; thin, continuous, gray (5Y 5/1) coatings on prisms; prism faces coated with thick, patchy clay films more than 1 millimeter thick in upper part but thinner in lower part; less than 5 percent coarse fragments; neutral; gradual boundary.

C—41 to 60 inches, olive-brown (2.5Y 4/4) heavy silt loam that has common to many, medium, distinct, yellowish-brown (10YR 5/8), light olive-brown (2.5Y 5/6), and gray (5Y 5/1) mottles; massive but breaks into angular chunks; firm; fractures have thin clay films that are fewer as depth increases; 10 percent coarse fragments consisting mainly of flat angular fragments of sandstone; some shale, igneous, and a few limestone fragments; mildly alkaline; calcareous.

The depth to carbonates ranges from 30 inches to 45 inches. An O1 horizon, ½ to 1 inch thick, occurs in wooded areas and consists of undecomposed leaf litter. It is underlain by a very dark gray or black, matted O2 horizon that is ½ inch to 1½ inches thick. The A1 horizon is 1 inch to 3 inches thick and, in most places, is very dark gray (10YR 3/1). The A2g horizon has a hue of 5Y, 2.5Y, or less commonly, 10YR, values of 5 to 7, and chromas of 1 to 3. Mottles of high chroma and concretions are common.

The B1g horizon generally is the finest textured horizon in the solum, but there is evidence of degradation and few clay films. The B2g horizon has hues of 5Y, 2.5Y, and 10YR; values of 5 to 7, and a chroma of 2 or less. Mottles are common to many and of higher chroma than those of the matrix. The range of texture in the B2g horizon includes heavy silt loam and light silty clay loam; clay content ranges from 26 to 34 percent. The content of sand coarser than very fine sand is less than 15 percent. The B2g horizon generally is friable but is firm in some places. The top of the fragipan, or Bx horizon, is at a depth ranging from 15 to 26 inches. The dominant chroma of the prism interiors is 4, but chromas of 2 and 3 also occur. Value is 4 or 5, and hue is 10YR or 2.5Y.

Mottles of low chroma, 2 or less, occur throughout the fragipan. The prism faces are coated with clay films 1 to 5 millimeters thick. These clay films have chromas of 0 to 2, values of 4 to 6, and a hue of 10YR or yellower. The prisms range from 5 to 18 inches across and part to a weak, thick, platy structure and a coarse, angular blocky structure. The fragipan typically is silt loam, but its texture ranges to light silty clay loam. The fragipan ranges from 12 to 24 inches in thickness.

The Sheffield soils are strongly acid above the fragipan, but the pH increases sharply to neutral in the fragipan. The percentage of base saturation is moderately low in the upper part of the solum, but base saturation increases with depth to more than 75 percent in the fragipan. In slightly depressional areas, the solum is somewhat thicker and less acid and the fragipan is less strongly developed. The amount of coarse material in the solum is variable, but it is more than 10 percent, by volume, in only a few places. Typically coarse material makes up 2 to 5 percent of the solum.

Sheffield soils are the poorly drained members of a drainage sequence that includes the moderately well drained Pierpont soils, the somewhat poorly drained Wallington and Platea soils, and the darker colored, poorly drained Ilion soils. Sheffield soils are similar to Conneaut soils, except that Conneaut soils lack a fragipan. Sheffield soils are more silty and less sandy than Frenchtown soils but otherwise are similar. They contain less clay in the B horizons than the nearby Mahoning and Canadice soils.

Sheffield silt loam (Sf).—The surface layer of this nearly level soil generally is low in organic-matter content and is subject to surface crusting. The soil dries slowly in the spring and locally is subject to ponding. It occupies large areas throughout the county south of the beach ridges. A profile of this soil is described as representative for the series. Included with this soil in mapping are a few small areas of somewhat poorly drained Platea soils.

Seasonal wetness and very slow permeability are the principal limitations to use of this soil. (Capability unit IIIw–3; woodland suitability group 2w1)

Sheffield silt loam, stratified substratum (Sh).—This nearly level soil occupies areas 5 to 15 acres in size in the valley of the Grand River. This soil has a profile similar to that described as representative for the Sheffield series, except that the substratum is stratified silt, sand, and clay instead of glacial till. The water table is seasonally high, and the soil dries out slowly in spring. Included with this soil in mapping are a few areas of somewhat poorly drained Platea soils and poorly drained Canadice soils.

Seasonal wetness and very slow permeability are the main limitations to use of this soil. This soil is much softer and more unstable for buildings than Sheffield silt loam, which formed on glacial till. (Capability unit IIIw–3; woodland suitability group 2w1)

Steep Land, Loamy

Steep land, loamy (Sm) is a land type occupying slopes ranging from 18 to 50 percent. The soil material is loamy and mostly well drained. In most areas the surface layer is 2 to 3 inches of dark-colored silt loam. Next is material that is mostly friable and loamy compared to the immediately underlying till. The till at greater depths is massive, firm, and dominantly of brownish and grayish colors. It is mildly alkaline and calcareous in most places. Most areas of this land type are linear in shape and commonly are 10 to 40 acres in size.

The root zone is moderately deep to deep, and the available moisture capacity is mostly medium. The erosion hazard is severe. Some bare areas are gullied and cause local siltation. The lower slopes of some areas are shaly.

This land type is suited to trees. It is well suited to nature trails and to habitat for woodland wildlife. Its landscape views have esthetic value. The steep slopes are the dominant limitation for most uses. (Capability unit VIIe–1; woodland suitability group 2r1)

Steep Land, Silty and Clayey

Steep land, silty and clayey (Sn) is a land type that occupies slopes ranging from 18 to 50 percent. The soil material is silty and clayey and is mostly of lacustrine origin. Most areas are well drained.

Most areas of this land type are long, narrow, and winding. These areas are commonly on escarpments along the edges of terraces, and on escarpments that formed where lacustrine parts of the lake plain were downcut. Most areas range from 5 to 15 acres in size.

The topmost layer of this land type is dark-colored silt loam. It is 2 to 3 inches thick over laminated silt and clay that are structureless (massive) and medium acid. The silty and clayey layers are mostly brownish and grayish.

The root zone is moderately deep to deep and has a medium available moisture capacity. The erosion hazard is severe. Some bare areas are gullied and cause local siltation. Steep land, silty and clayey, is unstable and subject to slippage when wet. It is hazardous to use this land type for construction.

This land type is suited to trees. It is well suited to habitat for woodland wildlife and to recreation facilities. Steep slopes and soil slippage are the dominant limitations to use. (Capability unit VIIe–1; woodland suitability group 2r1)

Swanton Series, Silty Subsoil Variant

The Swanton series, silty subsoil variant, consists of deep, poorly drained soils that are nearly level and occur on the lake plain in the northern part of the county. The uppermost 18 to 40 inches of these soils formed in material that contains more sand than the lower part. The lower part formed in loamy material that weathered from glacial till.

A representative profile of a Swanton soil in a wooded area has about 3 inches of partly decomposed leaf litter on the surface. The upper 4 inches of mineral material is black fine sandy loam. Beneath this layer is fine sandy loam that is gray in the upper part and light brownish gray in the lower part. The upper part of the subsoil is light brownish-gray and yellowish-brown fine sandy loam between depths of 11 and 21 inches. Below this layer the subsoil is dark grayish-brown very gravelly loamy fine sand to a depth of 27 inches and is light olive-brown silt loam to a depth of 58 inches. This lowermost subsoil layer formed in weathered glacial till. Massive, calcareous glacial till is at a depth of 58 inches.

The Swanton soils, silty subsoil variant, have a very slow permeability in the lower layers. Permeability in the upper layers of fine sandy loam is rapid. These soils lie on the lake plain in areas that have a seasonal high water table for long periods. Large amounts of water are available to crops through seepage and capillary action above the underlying water table, but the Swanton soils have only a medium available moisture capacity. Their root zone is mostly shallow until the water table recedes in summer. Swanton soils have a low to moderate capacity for storing and releasing plant nutrients. They are strongly acid or very strongly acid in the normal root zone, but in some places the upper part is less acid because of liming.

In most areas of these soils, farming has been abandoned. Artificial drainage is difficult because the sandy upper part of these soils tends to flow when it is saturated. Drained areas commonly are used for specialty crops. Because of tree windthrow, low knolls and depressions occur in many wooded areas of Swanton soil.

Representative profile of Swanton fine sandy loam, silty subsoil variant, in the city of Conneaut (T. 14 N., R. 1 W., about 2 miles northeast of the center of the city and one-half mile north of U.S. Highway No. 20 on State Line Road; *laboratory sample* AB–114 in table 10):

O1—3 to 2 inches, slightly decomposed leaf litter; abrupt, smooth boundary.

O2—2 inches to 0, dark reddish-brown (5YR 2/2) decomposed leaf litter; somewhat greasy mor; weak, thin, platy structure that parts to weak, fine, granular; very friable; many roots; abrupt, smooth boundary.

A11—0 to 4 inches, black (5YR 2/1) fine sandy loam; moderate, medium, granular structure; very friable; many roots; strongly acid; abrupt, wavy boundary.

A12g—4 to 6 inches, gray (5Y 5/1) fine sandy loam that has many, fine, faint, very dark gray (5Y 3/1) mottles; moderate, medium and coarse, granular structure;

friable; many roots; very strongly acid; abrupt, wavy, smooth boundary.

A2g—6 to 11 inches, light brownish-gray (2.5Y 6/2) fine sandy loam that has many, medium, prominent mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); weak, medium, subangular blocky structure; friable; common roots; some peds have thin, silty, dark-gray (10YR 4/1) coatings; very strongly acid; clear, smooth boundary.

B21g—11 to 16 inches, light brownish-gray (2.5Y 6/2) fine sandy loam that has many, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common roots; light brownish gray is continuous around the ped exteriors and occurs in the interiors; strongly acid; clear, smooth boundary.

B22g—16 to 21 inches, yellowish-brown (10YR 5/6) fine sandy loam that has many, medium, prominent, light brownish-gray (2.5Y 6/2) mottles and many, medium, faint, strong-brown (7.5YR 5/6) mottles; and common, medium, distinct, dark-brown (7.5YR 4/2) mottles; very weak, medium and coarse, subangular blocky structure; friable; few roots; strongly acid; abrupt, smooth boundary.

B31g—21 to 27 inches, dark grayish-brown (10YR 4/2) very gravelly loamy fine sand that has many, medium, distinct, light brownish-gray (2.5Y 6/2) mottles; structureless (massive parting to single grain under slight pressure); friable; very few roots; this horizon is stratified and is 70 percent coarse material consisting of rounded and subrounded fine gravel; common, flat fragments that have subrounded edges and are up to 6 inches in diameter; strongly acid; abrupt, smooth boundary.

IIB32g—27 to 58 inches, light olive-brown (2.5Y 5/4) silt loam that has common, medium, distinct, yellowish-brown (10YR 5/6) mottles, few, medium, distinct, strong-brown (7.5YR 5/6) mottles, and few, medium, prominent, gray (N 5/0) mottles; structureless (massive); firm; about 5 percent coarse material consisting mostly of small angular fragments of sandstone; the color change to lower horizon is diffuse; slightly acid in upper part but is neutral as depth increases; clear, wavy boundary.

IICg—58 to 70 inches, gray (N 5/0) silt loam that has common, coarse, prominent, yellowish-brown (10YR 5/6) mottles; massive; firm; about 5 percent coarse material consisting mostly of small, flat, angular fragments of sandstone; mildly alkaline; calcareous.

The solum ranges from 36 to 60 inches in thickness. The depth to the IIB32g horizon (lithologic discontinuity) ranges from 18 to 42 inches. The gravelly B31g horizon is immediately above the discontinuity but is not present in all places. The total gravel content in all other horizons is less than 10 percent. The mottles having chroma of 2 or less in the B horizons range from 20 to 40 percent. The peds in the B horizons are coated with colors that have a chroma of 2 or less. The base hue of the IIB3 horizon is 2.5Y, 10YR, or 5Y.

The Swanton soils in this county differ from normal Swanton soils in the Northeastern States by having a silt loam glacial till substratum instead of a clayey lacustrine substratum. For this reason, the Swanton series in this county is named a silty subsoil variant. Except for some engineering uses, this subsoil does not greatly alter usefulness and behavior of the soils. The glacial till substratum is more stable than lacustrine clays.

These Swanton soils are similar in surface appearance to Kingsville soils and occupy similar landscapes. The Kingsville soils, however, formed in deep fine sands. Swanton soils are the poorly drained members of a drainage sequence that includes moderately well drained Claverack soils. They are more poorly drained than nearby Elnora soils, and they have more sand and less clay than the nearby Allis soils.

Swanton fine sandy loam, silty subsoil variant (Sw).—This nearly level soil occupies areas 5 to 50 acres in size. The fine sandy loam surface layer of this soil generally has good tilth. Included in mapping are a few areas in which the sandy upper part of the soil is as thin as 12 inches. Adjacent to Allis soils, mapped areas of this soil are underlain by shale within a depth of 40 inches. The sandy upper part has very poor trafficability when it is saturated. Seasonal wetness, very slow permeability, and poor natural drainage are limitations to the use of this soil for farm or nonfarm purposes. (Capability unit IIIw–8; woodland suitability group 2w1)

Venango Series

In this series are nearly level to sloping, somewhat poorly drained soils that formed in loamy glacial till. These soils occupy areas in the southeastern corner of the county. They have dense, compact layers, or a fragipan, in the subsoil.

A representative profile of a Venango soil has a dark grayish-brown silt loam plow layer and a thin, pale-brown silt loam layer beneath the plow layer. The combined thickness of the two layers is 13 inches. The upper part of the subsoil, to a depth of 21 inches, is yellowish-brown silt loam and loam that is mottled with light brownish gray and strong brown. Silty coatings of light brownish gray occur between depths of 17 and 21 inches. The fragipan begins at a depth of 21 inches and extends to 46 inches. It is mostly extremely firm, olive-brown silt loam. Below a depth of 46 inches is light olive-brown silt loam glacial till.

Because of the fragipan, Venango soils have very slow permeability and a moderately deep root zone. The fragipan also causes a perched seasonal high water table for long periods in winter and spring. Unless rains are timely, Venango soils are commonly too wet in spring and too dry in summer for optimum plant growth. The normal root zone has a medium available moisture capacity. Above the fragipan, Venango soils typically are strongly acid to extremely acid unless they have been limed. They have a moderate capacity for storing and releasing plant nutrients. In wooded areas tree windthrow is common because of the restricted root zone.

If they are adequately drained, Venango soils are suited to general farm crops. Cultivated areas are used for general farm crops, of which a high proportion is forage crops. A large acreage of Venango soils is no longer farmed.

Representative profile of Venango silt loam (T. 9 N., R. 1 W., about 2½ miles southeast of Andover and one-half mile northeast of the Pymatuning Lake Road and Marvin Road, Andover Township; *laboratory sample* AB–S11 in table 10):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; very few fragments more than 2 inches in diameter; very strongly acid; clear, wavy boundary.

A2—9 to 13 inches, pale-brown (10YR 6/3) silt loam; few, fine, faint, light yellowish-brown (10YR 6/4) mottles; weak, fine and medium, subangular blocky structure; friable; very few fragments more than 5 centimeters in diameter; very strongly acid; clear, wavy boundary.

B21–13 to 17 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, light brownish-gray (10YR 6/2) and strong-brown (7.5YR 5/8) mottles; light brownish-gray (10YR 6/2) silty coatings on ped surfaces; weak, medium, subangular blocky structure; firm; 4 percent, by volume, is fragments 1 to 5 centimeters in diameter; strongly acid; clear, smooth boundary.

B22&A'2—17 to 21 inches, yellowish-brown (10YR 5/4) loam; few, medium, distinct, strong-brown (7.5YR 5/8) mottles; ped faces coated with pale-brown (10YR 6/3) and light brownish-gray (2.5Y 6/2) silty material; weak, medium and coarse, subangular blocky structure; firm; 4 percent, by volume, is fragments 1 to 5 centimeters in diameter; very strongly acid; abrupt, irregular boundary.

B'x1—21 to 41 inches, olive-brown (2.5Y 4/4) loam that has a strong-brown (7.5YR 5/8), thick rind around the periphery of the peds; ped faces coated light brownish gray (2.5Y 6/2); coatings are up to 7 millimeters thick and have about the same texture as the interiors; weak, very coarse (6 to 12 inches), prismatic structure that parts under considerable pressure to weak, thick, platy and weak, angular blocky; very firm; brittle; common, thin, black stains in ped interiors; few, patchy, gray (5Y 5/1) clay films, more than 1 millimeter thick, coat the vertical prism faces; 4 percent, by volume, is fragments 1 to 5 centimeters in diameter; very strongly acid; gradual, smooth boundary.

B'x2—41 to 46 inches, olive-brown (2.5Y 4/4) loam; prism faces coated with light brownish gray (2.5Y 6/2); coatings thinner than in horizon above; weak, very coarse (6 to 12 inches), prismatic structure to massive; very firm; brittle; a few, thin, gray (5Y 5/1) clay films on vertical prism faces; 4 percent, by volume, is fragments 1 to 5 centimeters in diameter; strongly acid; clear, wavy boundary.

C—46 to 75 inches, light olive-brown (2.5Y 5/4) loam; massive; firm; few gray (5Y 5/1) clay films in fractures; few, thin, black stains; about 10 percent of volume is coarse fragments consisting mostly of sandstone but some shale and igneous material; neutral or weakly calcareous.

The solum ranges from 36 to 60 inches in thickness. In forested areas, an O1 horizon is present and is ½ to 1 inch thick. This horizon consists mostly of undecomposed leaf litter. Under this layer is a dark-brown (10YR 4/3), matted, somewhat greasy O2 horizon ½ inch to 2 inches thick. The A1 horizon normally is very dark grayish brown (10YR 3/2) and is 1 to 3 inches thick. The color of the A2 horizon is pale brown (10YR 6/3), light yellowish brown (10YR 6/4), or light olive brown (2.5Y 5/4).

The B2 horizons show evidence of degradation and few or no clay films. The matrix of the B2 horizon is yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4), and mottles have a chroma of 2. Peds are covered with silt coatings that have a value of 5 or 6, a chroma of 2 or 3, and a hue of 10YR or yellower. The B2 horizons are loam in most places, but in some places the lower part of the B2 horizon is light clay loam or light silty clay loam.

The fragipan occurs at a depth of about 16 to 24 inches. Its matrix is dark yellowish brown (10YR 4/4), olive brown (2.5Y 4/4), or yellowish brown (10YR 5/4 to 5/6). The faces of prisms are coated with light brownish gray (2.5Y 6/2) and gray (5Y 5/1) silt and clay films. The clay films are more than 1 millimeter thick. The fragipan is loam or silt loam. The weighted average clay content of the B2 horizons ranges from 18 to 25 percent. In these horizons the content of pebbles and sand coarser than very fine sand ranges from 15 to 50 percent.

The Venango soils have a strongly acid to extremely acid solum above the pan. Reaction is strongly acid to very strongly acid in the upper part of the fragipan and is strongly acid to medium acid in the lower part. The base saturation is commonly elss than 35 percent above the pan but is more than 35 percent in the lower part of the pan. The depth to calcareous material is quite variable within short distances but generally is more than 48 inches. The upper part of the C horizon is neutral instead of calcareous in some places. The size of rock fragments and the amount of coarse material is somewhat variable but is more than 20 percent, by volume, in only a few places.

Venango soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Cambridge soils and the poorly drained Frenchtown soils. Dark-colored, very poorly drained Ilion soils are in nearby lower areas. The Venango soils are similar to Platea soils except that they are higher in sand content and less silty than those soils. Venango soils are also similar to the Wallington soils on the lake plain but formed in glacial till material, whereas the Wallington soils formed in old lake deposits.

Venango silt loam, 0 to 2 percent slopes (VeA).—This soil occupies irregularly shaped areas 2 to 10 acres in size. The profile of this soil is 2 to 4 inches thicker above the fragipan than that described as representative for the Venango series. The soil is generally adjacent to poorly drained Frenchtown soils, and small spots of Frenchtown soils are included with this soil in mapping. Surface runoff is very slow, and the soil dries out less quickly than more sloping Venango soils. This soil has a low organic-matter content in the surface layer. As a result, surface crusting is a problem.

Seasonal wetness is the major limitation to the use of this soil for farming. Seasonal wetness and very slow permeability are limitations for many nonfarm uses. (Capability unit IIIw–1; woodland suitability group 2w2)

Venango silt loam, 2 to 6 percent slopes (VeB).—This soil occupies upland areas 2 to 35 acres in size. It is commonly adjacent to, but higher than, poorly drained Frenchtown soils. This soil has better surface drainage and dries more quickly in spring than Venango soils that have slopes of 0 to 2 percent. It is subject to surface crusting if farmed, and it has poor trafficability when wet. A profile of this soil is described as representative for the series.

Included with this soil in mapping are small areas of Frenchtown soils along drainageways. Also included, where slopes are more than 4 percent, are areas of moderately well drained Cambridge soils.

Seasonal wetness is the major limitation to the use of this soil for farming. Erosion also is a hazard, particularly when the soil is saturated. Seasonal wetness and very slow permeability are limitations for many nonfarm uses. (Capability unit IIIw–2; woodland suitability group 2w2)

Venango silt loam, 2 to 6 percent slopes, moderately eroded (VeB2).—This soil generally has a thinner root zone, lower available moisture capacity, and more surface runoff than uneroded Venango silt loam, 2 to 6 percent slopes. The present plow layer is a mixture of the original surface layer and the upper part of the subsoil. The plow layer is browner than typical because it has lost organic matter. Plants are affected by drought more quickly on this eroded soil than on uneroded Venango soils.

The fragipan causes seasonal wetness, which is a limitation to use of this soil for farming. Erosion is a hazard if the soil is cultivated and not protected. Seasonal wetness, very slow permeability, and slopes are limitations for many nonfarm uses. (Capability unit IIIw–2; woodland suitability group 2w2)

Venango silt loam, 6 to 12 percent slopes (VeC).—This soil occupies short slopes along streams and large drainageways. It generally dries more quickly in spring than less sloping Venango soils. It is subject to some wetness and seepage on the lower part of the slope where it is adjacent to poorly drained Frenchtown or Holly soils. Included with this soil in mapping are areas of moderately well drained Cambridge soils.

Because surface runoff is rapid and in large amounts, the erosion hazard is a greater limitation to use of this soil for farming than is a seasonally high water table. Very slow permeability and slope are major limitations to many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 2w2)

Venango silt loam, 6 to 12 percent slopes, moderately eroded (VeC2).—Erosion has removed 25 to 75 percent of the original surface layer from this soil. As a result, the present plow layer includes part of the underlying soil, and it is browner than typical. This soil occupies slopes adjacent to drainageways. Small rills and gullies are present locally. Erosion has reduced the organic-matter content, the available moisture capacity, and the root depth. This eroded soil requires larger amounts of fertilizer and more intensive management than uneroded Venango soils.

Because surface runoff is rapid, the erosion hazard is severe in cultivated areas. Very slow permeability and slope are major limitations for many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 2w2)

Venango silt loam, sandstone substratum, 0 to 2 percent slopes (VgA).—The profile of this Venango soil has a sandstone substratum below a depth of 40 inches rather than glacial till as does the profile described as representative for the series. This soil is in the southwestern part of the county. Areas of this soil commonly occupy knolls 2 to 5 acres in size.

This soil has a seasonally high water table, but internal drainage through fractured sandstone causes this soil to dry more quickly in spring than Venango silt loam, 2 to 6 percent slopes. Sandstone fragments up to boulder size occur in the subsoil, and these cause some problems in trenching and excavating. Fractured sandstone fragments normally are within a 40-inch depth. Solid sandstone is below 40 inches.

Surface runoff is slow, and seasonal wetness is the major limitation to use for farming. Seasonal wetness, very slow permeability, and limited depth to sandstone are limitations for many nonfarm uses. (Capability unit IIIw–1; woodland suitability group 2w2)

Venango silt loam, sandstone substratum, 2 to 6 percent slopes (VgB).—This soil has a sandstone substratum rather than glacial till as does Venango silt loam, 2 to 6 percent slopes. It occupies small areas in the southwestern part of the county. It lies on knolls surrounded by Frenchtown and Platea soils and in areas adjacent to drainageways.

This soil has a seasonal high water table during winter and spring. Internal drainage through the underlying sandstone causes this soil to dry more quickly in spring than Venango soils that are underlain with till. Surface runoff is rapid and causes a severe erosion hazard. Fractured sandstone fragments normally occur within a depth of 40 inches, but solid sandstone is below a depth of 40 inches. This sandstone causes some problems in ditching and excavating.

Seasonal wetness is the major limitation to the use of this soil for farming. Very slow permeability and limited depth to sandstone are limitations for many nonfarm uses. (Capability unit IIIw–2; woodland suitability group 2w2)

Wallington Series

Soils of the Wallington series are deep, somewhat poorly drained, and nearly level to gently sloping. They formed in stratified loamy material that was deposited on the bottom of an old glacial lake in the valley of the Grand River. Wallington soils have a dense, compact fragipan in the subsoil.

A representative profile of a Wallington soil in a wooded area is covered with a thin, very dark brown leaf mantle. The surface layer is about 3 inches of black silt loam. A thin subsurface layer of dark-brown silt loam is between the surface layer and the top of the subsoil at a depth of 7 inches. To a depth of 17 inches, the subsoil is friable, yellowish-brown silt loam. To this depth the soil is friable. Below a depth of 17 inches, the subsoil is dense and compact and extends to a depth of 50 inches. This dense material is mostly olive-brown silt loam. Light brownish-gray mottles are present below a depth of 12 inches. These mottles indicate seasonal saturation and a fluctuating water table. Below a depth of 50 inches, stratified silt loam, sandy loam, and loamy sand occur.

The permeability of Wallington soils is slow or very slow through the fragipan. The fragipan causes a perched high water table during winter and spring. The root zone in these soils depends on the depth to the fragipan, which ranges from shallow to moderately deep. Within the root zone, there normally is a low to medium available moisture capacity. Wallington soils have a moderate capacity for storing and releasing plant nutrients. They normally are very strongly acid to extremely acid above the fragipan.

Most areas of Wallington soils are not used for farming. Many of these areas are brushy or wooded. Wallington soils must be drained and intensively managed if crops are to be grown. With intensive management, they can produce general farm crops and moisture-tolerant grasses and legumes.

Representative profile of a Wallington silt loam (T. 10 N., R. 4 W., about 2½ miles northwest of Rock Creek and 100 feet north of Twisted Tree Campsite in Beaumont Boy Scout Camp, Morgan Township):

O1—1½ inches to 1 inch, mantle of undecomposed leaf litter; abrupt, smooth boundary.

O2—1 inch to 0, very dark brown (10YR 2/2), matted, somewhat greasy mor; abrupt, smooth boundary.

A1—0 to 3 inches, black (10YR 2/1) silt loam; moderate, fine and medium, granular structure; very friable; many roots; extremely acid; abrupt, wavy boundary.

A2—3 to 7 inches, dark-brown (10YR 4/3) silt loam that has few, fine, faint, pale-brown (10YR 6/3) mottles; weak, medium, granular structure; friable; common roots; extremely acid; clear, wavy boundary.

B2—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam that has few, medium, distinct, pale-brown (10YR 6/3) mottles; weak, medium, subangular blocky structure; friable; common roots; very strongly acid; clear, wavy boundary.

B&A'2—12 to 17 inches, yellowish-brown (10YR 5/4) silt loam that has many, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; firm; few roots; peds coated with light brownish gray (10YR 6/2); somewhat vesicular; very strongly acid; abrupt, irregular boundary.

B'x1—17 to 36 inches, light olive-brown (2.5Y 5/6) silt loam that has many, medium, distinct mottles of yellowish brown (10YR 5/4), strong brown (7.5YR 5/8) and light brownish gray (10YR 6/2); weak, very coarse (6 to 10 inches across), prismatic structure; weak, thin and medium, platy secondary structure; very firm; few roots along prism faces; strong brown (7.5YR 5/8) occurs as a fringe around the ped periphery under a coating of light olive gray (5Y 6/2); fine (2 millimeters), black (10YR 3/1) concretions and black stains; strongly acid; gradual boundary.

B'x2—36 to 50 inches, olive-brown (2.5Y 4/4) silt loam that has many, medium, distinct, light brownish-gray (2.5Y 6/2) and strong-brown (7.5YR 5/8) mottles; very weak, very coarse (8 to 14 inches across), prismatic structure; weak, thin and medium, platy secondary structure; very firm; no roots; strong brown (7.5YR 5/8) occurs as a fringe around the ped periphery under a coating of olive gray (5Y 5/2); strongly acid; diffuse, wavy boundary.

C—50 to 70 inches, olive-brown (2.5Y 4/4), stratified silt loam, sandy loam, and loamy sand; horizontal streaks of light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6); weak, thin and medium, platy structure; firm; no roots; strongly acid in upper part, grading to neutral as depth increases.

The solum of Wallington soils ranges from 45 to 60 inches in thickness. Depth to the fragipan ranges from 15 to 30 inches. An Ap horizon, if present, is commonly brown (10YR 4/3) or dark grayish brown (10YR 4/2). The A2 horizon is brown (10YR 4/3), dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4 to 5/8), or strong brown (7.5YR 5/8). In some places pale-brown (10YR 6/3) and light brownish-gray (10YR 6/2) mottles occur in the A2 horizon. The dominant colors in the upper B horizons are generally shades of yellowish brown (10YR 5/4 to 5/8). Major colors in the fragipan are yellowish brown (10YR 5/4), dark yellowish brown (10YR 4/4), olive brown (2.5Y 4/4), or light olive brown (2.5Y 5/4 to 5/6). Mottles and ped coatings vary 1 unit in value, hue, or chroma. The dominant texture of the B and C horizons includes silt loam, loam, or very fine sandy loam, but a few individual horizons are silty clay loam, sandy clay loam, or clay loam. Stratification generally is apparent. Depth to carbonates ranges from 60 to 100 inches. The reaction ranges from extremely acid in the upper part of the solum to strongly acid in the lower part. The C horizon is strongly acid in the upper part but is neutral as depth increases.

Wallington soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Williamson soils and the poorly drained Sheffield soils. Wallington soils are less clayey than Caneadea soils and have a fragipan that the Caneadea soils lack. They are similar to Venango soils, except that Venango soils formed in loamy glacial till and Wallington soils have a neutral, medium-textured, stratified substratum.

Wallington silt loam, 0 to 2 percent slopes (WaA).—This Wallington soil occupies irregularly shaped areas. It generally has a low organic-matter content in the surface layer. Consequently, it is subject to surface crusting.

This soil dries slowly in spring. When it is wet, it has very poor trafficability. Some areas of this soil have a higher clay content than is typical for the series, but this does not significantly alter its use or behavior.

A seasonal high water table is the major limitation to use of this soil for farming. Low natural fertility and very strong acidity also are serious limitations to use for farming. Very slow permeability and seasonal wetness are limitations to use for many nonfarm purposes. This soil is soft and unstable when it is saturated. (Capability unit IIIw-1; woodland suitability group 2w2)

Wallington silt loam, 2 to 6 percent slopes (WaB).—This soil occupies short slopes adjacent to drainageways. Because it is gently sloping, it tends to dry out more quickly than the nearly level Wallington soil. Surface runoff from this soil is medium to rapid, and erosion is a hazard to cultivated areas. A profile of this soil is described as representative for the series. Some areas of this soil have a slightly higher clay content than typical for the series, but this does not alter its use or behavior.

Seasonal wetness is the major limitation to use of this soil for farming. Very slow permeability and seasonal wetness are limitations for many nonfarm uses. This soil is soft and unstable when it is saturated. (Capability unit IIIw-2; woodland suitability group 2w2)

Willette Series

The Willette series consists of black, mucky, level soils that are very poorly drained. The muck layers are 12 to 41 inches thick over a clayey substratum. Willette soils formed in an accumulation of partly decomposed, saturated vegetative materials mixed with variable amounts of mineral material. They occupy low-lying bogs and swamps and are commonly adjacent to soils on flood plains.

A representative profile of a Willette soil has a surface layer of black muck that consists mostly of partly decomposed organic material. Black silty muck is between depths of 8 and 24 inches. This layer is friable and smooth to the touch if it is moist, but it is loose and powderlike when dry. The layers beneath a depth of 24 inches are gray and greenish-gray silty clay, and they extend to a depth of 50 inches. The lower part of this clayey material is calcareous.

If undrained, these soils have a continuously high water table. If drained for farming, Willette soils have a moderately deep root zone. Available moisture capacity is high. The muck layers have moderately rapid permeability, and the clayey substratum has very slow permeability.

Areas of Willette soils are mostly wet and swampy and are not used. They would be suited to cultivated crops if they were drained and intensively managed.

A representative profile of Willette muck (T. 8 N., R. 4 W., about 3 miles southeast of Orwell, Orwell Township):

1—0 to 8 inches, black (10YR 2/1) muck; moderate, medium, granular structure; very friable; many roots; strongly acid; diffuse boundary.

2—8 to 24 inches, black (10YR 2/1) silty muck; moderate, medium, granular structure; very friable; many roots; many reddish-brown (5YR 4/4) wood fragments; strongly acid; abrupt, wavy boundary.

IIC1—24 to 36 inches, gray (N 5/0) silty clay; structureless (massive); sticky and plastic when wet; few roots; slightly acid; clear, wavy boundary.

IIC2—36 to 50 inches +, greenish-gray (5GY 5/1) silty clay; structureless (massive); nonsticky and plastic; few roots; mildly alkaline; calcareous.

The hue of the organic material ranges from 5YR to 10YR, and chroma and value are 2 or less. The muck layers range from 12 to 42 inches in thickness. The content of woody fragments is variable. The IIC horizons are variable and include medium-textured and moderately fine textured till, or medium-textured to fine-textured lacustrine sediments. Carbonates occur within 1 to 2 feet below the organic horizons in some places.

The Willette soils are similar to Carlisle soils but have a total thickness of muck that is less than that in Carlisle soils. Willette soils are adjacent to Holly soils on the flood plains. They differ from Holly soils by having a higher content of organic matter and finer textured material within a depth of 40 inches.

Willette muck (We).—Most areas of this soil are rounded in shape and range from 3 to 6 acres in size. Most areas occur in scattered depressions in the valley of Pymatuning Creek and in a few lagoons next to Lake Erie. In some areas this soil is subject to flooding. Included in mapping are a few areas where the substratum is sandy.

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In undrained areas, this soil is subject to ponding for long periods. Severe wetness limits most uses. Willette muck is unstable if used for building sites. (Capability unit IIIw–5; woodland suitability group not assigned)

Williamson Series

Soils in the Williamson series are loamy and moderately well drained. They formed in stratified loamy materials in the valley of the Grand River. Most areas of these soils are in Morgan Township. A distinct fragipan, or dense compact layer, is at a depth of 15 to 24 inches.

A representative profile of a Williamson soil in a wooded area has a thin, dark-brown layer of leaf litter. The surface layer of the mineral material is thin, very dark brown silt loam. The next layer, to a depth of 5 inches, is yellowish-brown silt loam. The upper layers in the subsoil are yellowish-brown silt loam to a depth of 22 inches. A lower subsoil layer of yellowish-brown loam extends to a depth of 40 inches. This layer is the uppermost part of the fragipan. The lowermost layer of the fragipan, to a depth of 52 inches, is yellowish-brown fine sandy loam. The fragipan is very firm or extremely firm and is mottled with pale olive and strong brown. At a depth of 52 inches is a substratum of stratified sandy loam, silt loam, and loamy sand.

Williamson soils are slowly permeable or very slowly permeable. The fragipan restricts downward movement of water and the penetration of plant roots. As a result, these soils have a perched seasonal high water table. Roots normally penetrate only to the top of the fragipan. Below this, they are confined to widely separated vertical cracks along structural faces. The normal root zone is mostly moderately deep. Within this root zone the available moisture capacity is medium to low. Reaction in the upper layers is very strongly acid to extremely acid unless the soils have been limed. Williamson soils have a moderate capacity for storing and releasing plant nutrients. All areas of the Williamson soils have soft, compressible layers above the pan when the soil is saturated.

Most areas of Williamson soils are brushy or wooded. Few areas are used for farming, but if management is intensive, these soils are suited to the commonly grown field crops.

Representative profile of Williamson silt loam (T. 10 N., R. 4 W., about 2 miles north-northeast of East Trumbull, Morgan Township):

O1—1½ inches to 1 inch, mantle of undecomposed leaf litter; abrupt, smooth boundary.

O2—1 inch to 0, very dark brown (10YR 2/2), motted, somewhat greasy mor; abrupt, smooth boundary.

A1—0 to 1 inch, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

A2—1 inch to 5 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, granular structure; friable; common roots; few fine pores; extremely acid; clear, wavy boundary.

B21—5 to 9 inches, yellowish-brown (10YR 5/8) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; few fine pores; very strongly acid; clear, wavy boundary.

B22—9 to 16 inches, yellowish-brown (10YR 5/4) silt loam; weak, coarse, subangular blocky structure; firm; few roots; few fine pores; very strongly acid; gradual, wavy boundary.

B&A'2—16 to 22 inches, yellowish-brown (10YR 5/4) silt loam that has common, distinct, medium, light olive-gray (5Y 6/2) mottles; weak, coarse, subangular blocky structure; very firm but shatters under pressure; few roots; many fine pores; very strongly acid; abrupt, irregular boundary.

B'x1—22 to 40 inches, yellowish-brown (10YR 5/6) loam mottled with strong brown (7.5YR 5/8) and pale olive (5Y 6/3); very weak, very coarse (6 to 14 inches across), prismatic structure; secondary structure weak, thin and medium, platy; extremely firm; few roots along prism faces; strong brown (7.5YR 5/8) occurs as a thick fringe around the ped periphery under a coating of pale olive (5Y 6/3); common, very thin, black films on secondary structural units; few, fine, black concretions; strongly acid; diffuse, wavy boundary.

B'x2—40 to 52 inches, yellowish-brown (10YR 5/4) fine sandy loam mottled with strong brown (7.5YR 5/8) and pale olive (5Y 6/3); very weak, very coarse (8 to 14 inches across), prismatic structure; weak, thin and medium, platy secondary structure; very firm; no roots; strong brown (7.5YR 5/8) occurs as a thin fringe around the ped periphery under a thin shiny and pitted coating of pale olive (5Y 6/3); few, very thin, black films on secondary structural units; strongly acid; diffuse, wavy boundary.

C—52 to 70 inches, olive-brown (2.5Y 4/4) stratified sandy loam, silt loam, and loamy sand that have horizontal streaks of strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) and thin, vertical streaks of gray (10YR 5/1); weak, thin and medium, platy structure; firm; no roots; medium acid in upper part, but is neutral as depth increases.

The solum ranges from 44 to 60 inches in thickness. Depth to the fragipan ranges from 15 to 24 inches. The A2 horizon is dark yellowish brown (10YR 4/4) or strong brown (7.5YR 5/8) in some places. The uppermost B horizon normally is yellowish brown (10YR 5/4 to 5/8). The grayish colors of the B and A'2 horizon may vary a unit in value, hue, or chroma. These colors are both mottles and streaks or patches of degraded material. The ped interiors of the Bx horizon are strong brown (7.5YR 5/8), dark yellowish brown (10YR 4/4), olive brown (2.5Y 4/4), or light olive brown (2.5Y 5/4). The B and C horizons are silt loam, loam, or very fine sandy loam.

Thin zones of moderately fine textured or moderately coarse textured sediments occur in the lower part of the solum in some places. Depth to carbonates ranges from 60 to 120 inches. The reaction ranges from extremely acid in the upper part of the solum to neutral in the C horizon.

These soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Wallington soils and the poorly drained Sheffield soils. Williamson soils are similar to Cambridge soils but have less clay in the upper B horizons. The Williamson soils formed in loamy lacustrine materials, and Cambridge soils formed in glacial till material.

Williamson silt loam, 0 to 2 percent slopes (WIA).—This soil generally has a greater depth to the top of the fragipan than other Williamson soils. It generally is low in organic-matter content, and it is subject to surface crusting.

Included with this soil in mapping are small areas of soils that have up to 12 inches of deposited material on the surface. This material is loam and fine sandy loam. Also included, just west of Rock Creek, are about 40 acres that are underlain by gravel having a high silt content. This area is slightly better drained than are areas of a typical Williamson soil. Some small spots of the wetter Wallington soils also are included in mapped areas. Also included are areas of a soil that has a higher clay content than typical, but this does not affect use and behavior.

Seasonal wetness is the principal limitation to the use of this soil for farming. Slow or very slow permeability and seasonal wetness are limitations to many nonfarm uses. (Capability unit IIw–2; woodland suitability group 1o1)

Williamson silt loam, 2 to 6 percent slopes (WlB).—This soil generally occupies short slopes, where surface runoff is medium to rapid. The surface layer is generally low in organic-matter content, and as a result, surface crusting is likely in cultivated areas. A profile of this soil is described as representative for the series.

Included with this soil in mapping are a few areas that have a loam or fine sandy loam surface layer and few areas of wetter Wallington soils. The included areas of Wallington soils are in the more nearly level parts of the mapped areas. Also included are areas of a soil that has higher clay content than typical, but this does not affect use and behavior.

An erosion hazard is caused by slope and medium to rapid surface runoff. Slow or very slow permeability and seasonal wetness are limitations for many nonfarm uses. (Capability unit IIe–2; woodland suitability group 1o1)

Williamson silt loam, 6 to 12 percent slopes, moderately eroded (WlC2).—Erosion has removed 25 to 75 percent of the original surface layer, and the present plow layer is mostly yellowish-brown material from the upper part of the subsoil. This soil generally has a shallower depth to the top of the fragipan than uneroded Williamson soils. As a result, the soil tends to be droughty because it has only a low available moisture capacity. The lower moisture capacity results in more rapid and larger amounts of surface runoff than on uneroded Williamson soils. Included with this soil in mapping are areas of a soil that has higher clay content than typical, but this does not affect use and behavior.

A severe erosion hazard is a limitation to use of this soil for cultivated crops. A seasonally high water table, slow or very slow permeability, and slope are limitations to use for many nonfarm purposes. This soil is soft and subject to slippage when it is saturated, particularly on the higher slopes. (Capability unit IIIe–2; woodland suitability group 1o1)

Williamson silt loam, 12 to 18 percent slopes, moderately eroded (WlD2).—This soil has a shallow depth to the top of the fragipan. Surface runoff is very rapid because this soil has a low available moisture capacity. Included in mapping are areas of a soil that has higher clay content than typical, but this does not affect use and behavior.

A very severe erosion hazard is a serious limitation to use of this soil for cultivated crops. Moderately steep slopes, slow or very slow permeability, and seasonal wetness are limitations for many nonfarm purposes. The limited depth to the fragipan and instability of this soil when it is saturated cause serious problems in construction. (Capability unit IVe–1; woodland suitability group 1r1)

Formation and Classification of the Soils

In this section the factors of soil formation and the processes affecting soil formation are discussed. Emphasis is placed on the formation of the soils in Ashtabula County. Then the system of soil classification currently used by the Soil Conservation Service and others is discussed, and the soil series in the county are classified in this system and in an older system.

Factors of Soil Formation

The characteristics of a soil at any given place depend on the interrelationships of (1) the physical and mineralogical composition of the parent material, (2) the climate under which the parent material accumulated and weathered, (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 that the processes of soil formation acted on the parent material and developed soil. Many different kinds of soils formed because the factors vary from place to place.

Parent material

In Ashtabula County, the factors most responsible for differences in the soils are parent material and relief. The main kinds of parent material are (1) Wisconsin-age glacial till of silt loam and loam texture, (2) sandy and gravelly beach deposits on ridges, (3) silty, sandy, and clayey materials deposited in glacial lakes, (4) residual shale, (5) sandy and gravelly glacial outwash material, and (6) recent alluvium. The major areas of each kind of parent material generally coincides with the soil associations in the county. These associations are shown on the general soil map at the back of this survey. The associations and the parent materials that generally coincide with them are as follows:

1. Venango-Frenchtown-Cambridge, loam glacial till.
2. Platea-Sheffield, silt loam glacial till.
3. Sheffield-Platea, silt loam glacial till.
4. Platea-Pierpont, silt loam glacial till.
5. Chenango-Red Hook-Atherton, sandy and gravelly glacial outwash.
6. Canadice-Caneadea, clayey deposits in glacial lakes.
7. Elnora-Colonie-Kingsville, sandy and gravelly beach deposits on ridges.
8. Otisville-Chenango, sandy and gravelly beach deposits.
9. Conneaut-Swanton-Claverack, silty and sandy materials deposits in glacial lakes.

Also, all soil associations in the county have recent deposits of local alluvium along streams. Residual shale occurs in several associations as part of Hornell and Mahoning soils, and residual sandstone occurs in one association as part of the Frenchtown soils.

Parent material has contributed to basic characteristics of the soils. The Colonie, Kingsville, and Elnora soils, for example, are sandy because they formed on beach sands. The Caneadea and Canadice soils are relatively clayey because they formed in moderately fine textured to fine textured sediments. Venango soils and Platea soils have different amounts of silt and sand because they formed on glacial till of different texture. All of the parent materials in the county contain relatively small amounts of plant nutrients. For this reason, few of the soils in the county have high natural fertility.

Relief

Relief, or topography, tends to modify the effects of climate within short horizontal distances. Hillsides, for example, are generally drier than adjacent depressions because water tends to run off the hillsides and collect in the depressions. The presence or absence of a seasonal high water table is largely determined by relief. Practically all of the nearly level soils in the county have a seasonal high water table of some duration. Kingsville, Ilion, and Atherton soils collect seepage water from adjacent soils. A perched seasonal water table occurs in nearly level Sheffield, Platea, Frenchtown, Braceville, Wallington, Venango, and Williamson soils. Sloping or steep soils tend to be thinner than nearly level soils in the same series. This thinning is caused by rapid surface runoff and erosion. Drainage sequences of soils that formed in similar parent materials are largely the result of differences in relief. Examples of this are the Chenango, Braceville, Red Hook, and Atherton soils. The Chenango soils are well drained and generally are higher topographically than the other soils in the sequence. The poorly drained Atherton soils are generally lower than the Chenango, the moderately well drained Braceville, and the somewhat poorly drained Red Hook soils.

Climate

Climate is an active soil-forming factor that influences both parent materials and plant and animal life in and on the soil. The climate in Ashtabula County is relatively uniform throughout except where it is modified locally by relief. The soils in the county have properties characteristic of a humid temperate climate. Most of the soils have been leached of bases to the extent that they are strongly acid or extremely acid. Many of the soils have properties that result from seasonal saturation or a fluctuating water table. In effect, this is microclimate acting on the soil. Mottles and gray colors indicate reduction and resegregation of iron caused by a water table that fluctuates because the soils are wet in winter and dry in summer. All except the well-drained soils in the county have gray colors or gray mottles and mottles of yellowish brown, pale yellow, or other colors. The prevailing climate has caused the soils in the county to have moderately developed horizons, yellowish hues and gray mottles and coatings, and acid reaction.

Plant and animal life

The plant life in the county has dominantly been hardwood trees. These native trees have a low content of bases in their leaves. In undisturbed areas practically all of the soils in the county have a thin surface layer of accumulated organic matter, and an upper part of the soil largely deficient in bases. Thick organic deposits, such as those in Carlisle and Willette soils, occur in depressions where the water table is high for long periods. The soils in these swampy areas formed under wetland trees, shrubs, and sedges.

Other living organisms, such as earthworms, fungi, bacteria, rodents, and insects, have contributed to organic residues and to the mixing of materials. These effects are not to be minimized, but relatively little is known of their magnitude or consequence. In Ashtabula County the mixing of soil materials caused by tree windthrow is of some consequence, particularly on the poorly drained soils. Wooded areas of all the poorly drained soils show a pronounced microrelief of low knolls and depressions. In these areas the trees grow mostly on the knolls. .

Man has had and will continue to have effects on the soils in the county. He has drained much of the acreage in the native forest. Man has fertilized and limed large areas of soils and thereby has altered the natural chemistry of the soils. Cultivation of the soils and construction in many areas have caused soil mixing and losses through erosion. The long term effects of these practices on each soil is still to be evaluated, but regardless of the ultimate effect, it is certain that such practices will continue.

Time

Time is required for interaction of the other factors and for the processes of soil formation to develop different kinds of soils. Most soils in the county have had sufficient time for development of characteristics such as structure, horizons, and leached bases and carbonates. The extent or degree that properties developed in the different soils is modified by the interactions of the other soil-forming factors. As a result of this interaction, the expressions of development are different, though most of the soils are roughly similar in geologic age.

Processes of Soil Formation

Soil formation is both concurrent with and subsequent to geomorphological processes. Individual soils are the products of various physical, chemical, and biochemical processes that have prevailed or are currently active in the soils. The following processes are known to occur in the formation of soils: (1) accumulation and decomposition of organic matter on the surface and in the soil; (2) formation of new compounds and complexes by decomposition, recombination, precipitation, oxidation, hydration, or reduction of the original compound; (3) translocation downwards, upwards, or laterally of soluble, suspendable, or volatile materials; (4) losses because of leaching, volatilization, or erosion.

All of the soils in the county have an observable horizon of accumulated organic matter unless the horizon has been destroyed by cultivation. The depth to which calcium carbonate has been leached in most of the soils is moderate or deep. The interiors of peds in soil material having prismatic structure in the fragipan of soils, such as the Platea, may be more calcareous than the outside of the peds. Where this occurs, the fragipan is impervious enough to prevent leaching. The Cambridge, Mahoning and similar soils have horizons of clay accumulation in the subsoil. This fine-textured clay has moved downward and accumulated on ped faces and in pores. Gray colors and mottles in all of the somewhat poorly drained and poorly drained soils is evidence of alteration by reduction and oxidation. Other processes active in the county are a cycle of base exchange between soil and plants, physical mixing by plants and animals, and seasonal changes in the weather.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow classes that are used in detailed soil surveys so that the knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes of more general categories to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*15*) and revised later (*14*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*11, 17*). Therefore, readers interested in developments of the system should search the latest literature available.

Under the current system of classification, six categories are recognized. Beginning with the broadest and most inclusive, these are the order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. These properties are chosen so that the soils of similar genesis, or mode of origin, are grouped together. Most of the classes of the current system are briefly defined in the following paragraphs. The family, subgroup, and order for each soil series in the county, under the current classification, are shown in table 9. This table also shows the great soil groups of the 1938 classification.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The soil properties used to differentiate the soil orders

TABLE 9.—*Soil series classified according to the current system of classification and the 1938 system with later revisions*

Series	Current Classification			Great soil groups of the 1938 classification
	Family	Subgroup	Order	
Allis	Fine, illitic, acid, mesic	Aeric Haplaquepts	Inceptisols	Low-Humic Gley soils.
Atherton	Fine-loamy, mixed, nonacid, mesic.	Aeric Haplaquepts	Inceptisols	Low-Humic Gley soils.
Braceville	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols	Sols Bruns Acides.
Cambridge	Fine-loamy, mixed, mesic	Ochreptic Fragiudalfs	Alfisols	Sols Bruns Acides.
Canadice	Fine, illitic, mesic	Typic Ochraqualfs	Alfisols	Low-Humic Gley soils.
Canadice, mucky variant.	Fine, mixed, nonacid, mesic	Histic Humaquepts	Inceptisols	Humic Gley soils.
Caneadea	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols	Gray-Brown Podzolic soils.
Carlisle [1]	Euic, mesic	Typic Medisaprists	Histosols	Organic soils.
Chagrin	Fine-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Chenango	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Claverack, moderately shallow variant.	Fine-loamy, mixed, mesic	Aquic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Claverack, silty subsoil variant.	Sandy over loamy, mixed, mesic	Aquic Eutrochrepts	Inceptisols	Sols Bruns Acides.
Colonie	Mixed, mesic	Alfic Udipsamments	Entisols	Regosols.
Conneaut	Fine-silty, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols	Low-Humic Gley soils.
Elnora	Mixed, mesic	Aquic Udipsamments	Entisols	Regosols.
Frenchtown	Fine-loamy, mixed, mesic	Typic Fragiaqualfs	Alfisols	Low-Humic Gley soils.
Holly	Fine-loamy, mixed, nonacid, mesic	Typic Fluvaquents	Entisols	Alluvial soils.
Hornell [2]	Fine, illitic, acid, mesic	Aeric Haplaquepts	Inceptisols	Sols Bruns Acides
Ilion	Fine-loamy, mixed, mesic	Mollic Ochraqualfs	Alfisols	Humic Gley soils.
Kingsville	Mixed, mesic	Mollic Psammaquents	Entisols	Humic Gley soils.
Lobdell	Fine-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisols	Alluvial soils.
Mahoning	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols	Gray-Brown Podzolic soils.
Orrville	Fine-loamy, mixed, nonacid, mesic.	Aeric Fluvaquents	Entisols	Alluvial soils.
Otisville	Sandy-skeletal, mixed, mesic	Typic Udorthents	Entisols	Regosols.
Pierpont	Fine-silty, mixed, mesic	Aqueptic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils.
Platea	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Gray-Brown Podzolic soils.
Red Hook	Coarse-loamy, mixed, acid, mesic	Aeric Haplaquepts	Inceptisols	Sols Bruns Acides.
Sheffield	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols	Low-Humic Gley soils.
Swanton, silty subsoil variant.	Coarse-loamy, mixed, nonacid, mesic.	Aeric Haplaquepts	Inceptisols	Low-Humic Gley soils.
Venango	Fine-loamy, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Sols Bruns Acides.
Wallington	Coarse-silty, mixed, mesic	Aeric Fragiaquepts	Inceptisols	Sols Bruns Acides.
Willette	Clayey, euic, mesic	Terric Medisaprists	Histosols	Organic soils.
Williamson	Coarse-silty, mixed, mesic	Typic Fragiochrepts	Inceptisols	Sols Bruns Acides.

[1] The muck layer of the Carlisle soils in this county is slightly thinner than is defined for the series. This difference, however, does not affect the use or behavior of the soils.

[2] The Hornell soils in this county have brighter colors than defined for the series. This minor difference, however, does not affect the use or behavior of the soils.

are those that tend to give broad climatic groupings of the soils. Two exceptions are the Entisols and Histosols, which occur in many different climates. Four soil orders are represented in Ashtabula County. They are Entisols, Inceptisols, Alfisols, and Histosols.

Entisols are soils in which the soil materials have been only slightly altered by the soil-forming processes. The only developed soil horizon is a weakly expressed A1 horizon in which some organic matter has accumulated.

Inceptisols are mineral soils in which genetic properties have started to develop in one or more horizons. Horizons are more strongly developed than in the Entisols but less strongly developed than in Mollisols, Alfisols, and Ultisols. Inceptisols lack horizons of clay accumulation that are characteristic of the Alfisols.

Alfisols are mineral soils that have horizons of illuviated clay. These soils have a base saturation of more than 35 percent in their lower subsoil.

Histosols are organic soils that are saturated with water for long periods unless they have been drained. They contain an organic horizon that has a minimum thickness of 16 inches and a minimum content of organic matter of 20 percent.

SUBORDER: Each order is divided into suborders, primarily on the basis of soil characteristics that produce classes having greatest genetic similarity. The soil properties used to separate suborders are those that mainly indicate the presence or absence of a seasonal water table or other differences resulting from climate or vegetation.

GREAT GROUP: Suborders are separated into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make the separation are those in which clay, iron, or humus has accumulated or those that have pans that interefere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is shown in table 9 as the last word in the name of the subgroup.

SUBGROUP: Great groups are subdivided into subgroups, one representing the central, or typic, segment of a group and others, called intergrades, that have one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of the subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Fragiochrepts.

FAMILY: Families are established on the basis of soil properties that are important to the growth of plants or to the behavior of the soils where used for engineering. Among the properties considered are texture, reaction, soil temperature, mineralogy, permeability, thickness of horizon, and consistence. Because Ashtabula County is south of the boundary between the frigid (cool) and mesic (middle) soil temperature zones, all of the soils are placed in mesic families. The tentative placement of the soils in families is given in table 9.

SERIES: A definition of the soil series is given in the section, "How This Survey Was Made," near the front of this publication. Some of the soils in the county do not fit the series that have been recognized, but recognition of a new series would not serve a useful purpose. Soils of this kind are named for the series they strongly resemble because they differ from those series in ways too small to affect their use or management. These soils are called taxadjuncts to the series for which they are named. Carlisle and Hornell soils are taxadjuncts in this survey area. Remarks at the end of these series, in the section "Descriptions of the Soils" tell how they differ from the typical soils elsewhere.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at State, National, and regional levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication have been established earlier. The Elnora series, however, had tentative status when the survey was sent to the printer.

The placement of any of the soils in the new classification system, particularly at the subgroup and family level, is subject to revision as more knowledge is gained about each soil, or as the classification system is revised.

Laboratory Data

Laboratory data are given for 12 soil series in Ashtabula County in table 10. The profiles of these soils are described, in the section "Descriptions of the Soils," as representative profiles for the series. The data in table 10 were obtained at Ohio State University, Columbus, Ohio. Soil series were selected that would add to the knowledge of the soils in Ohio. Several of these soils occur mainly in Ashtabula County and have only small acreages in adjacent counties.

Unpublished mechanical analysis data are available for the following soil series represented in Ashtabula County: Chenango, Williamson, Allis, Pierpont, Chagrin, Orrville, Lobdell, and Colonie. These data are on file in Columbus, Ohio at the Agronomy Department, Ohio State University; the Ohio Department of Natural Resources, Division of Lands and Soil; and the State office of the Soil Conservation Service.

The following paragraphs outline some of the procedures used to obtain the data in table 10.

Particle-size distribution was obtained by the pipette method described by Steele and Bradfield (*12*), but the soil sample weighed 10 grams and sodium hexametaphosphate was used as the dispersing agent. The organic-matter content was determined by wet-oxidation procedures (*8*). Exchangeable calcium (Ca) and magnesium (Mg), were determined by the EDTA method (*3*). Potassium (K) was determined by flame photometry. Exchangeable hydrogen (H), which also includes titratable aluminum (Al), was determined by triethanolamine method (*8*). The cation-exchange capacities are the sum of the exchangeable cations. The calcium carbonate equivalent was determined titrimetrically by the procedure of Hutchison and MacLennan (*9*). All pH measurements were made by using a 1:1 soil-water ratio. Moisture retention was determined by using Uhland core samples. Iron (Fe) was determined by dithionite extractions.

Clay Mineralogy [6]

Clay mineralogy for the Canadice, Caneadea, and Platea soils has been determined by the Agronomy Department, OARDC, Columbus, Ohio. The Canadice and Caneadea soils were sampled outside of Ashtabula County, but the results apply to these soils in this county. X-ray diffractograms were obtained from each sample by using a Norelco full-wave generator, Norelco electronic circuit panel Model 12206, and a Bristol strip chart recorder. Each sample was analyzed from 2° (2-theta) to 32° (2-theta).

The profiles of Caneadea and Canadice soils that were sampled have similar clay mineralogy throughout their profiles. The profiles of both kinds of soil show a great increase in illite and a decrease in vermiculite as depth increases. The profile of the Caneadea soil appears to be somewhat more strongly weathered than that of Canadice soil because a larger amount of interstratified minerals and less illite are in the Ap horizon. The surface horizon of the Caneadea soil shows evidence of moderate quantities of interlayer hydroxyaluminum between the 14-Angstrom components as indicated by a distinct 12-Angstrom peak when the soil material is heated to 400 or 550° C. Other horizons in both Caneadea and Canadice soils suggest the presence of small amounts of interlayer aluminum. These two profiles are classified as illitic, because the illitic component is very pronounced and has sharp, intense peaks.

In the surface horizons of the soils in the Platea series, the interlayer aluminum components are well ordered and crystallized. Platea soils contain a chloritelike mineral that is thermally stable to 550° C. This mineral is not like most chlorite minerals, because it has a gibbsite layer (Al_2OH_6) instead of a brucite layer (Mg_3OH_6) between the 10-Angstrom components. This gibbsite layer is important to the interpretation of these soils from the standpoint of extractable aluminum and the lime requirement. About 50 percent of the cation exchange capacity is aluminum. The dominant clay in Platea soils is illite. This clay ranges from 20 to 30 percent in surface horizons to 50 to 60 percent in the lower part of the B horizon and in the C horizon. The content of vermiculite decreases with depth.

General Facts About the County

This section describes the climate; transportation and other development; and physiography, geology, relief, and drainage in Ashtabula County. It also describes farming.

Climate [7]

Situated in the northeastern corner of Ohio, on the western slope of the Appalachian Mountains, Ashtabula County has a climate that may roughly be classified as continental, though adjacent Lake Erie has some effects. The Grand River flows northward, in a broad valley, to within 8 miles of the lake shore, where it turns sharply westward and continues into adjoining Lake County. The terrain in the valley is gently rolling in most places, but it ranges to nearly level or even level in some places. The valley rises gradually toward the east and the west. The average elevation on the river bottom is almost 800 feet, but elevation on hilltops is between 1,000 and 1,100 feet.

Lake Erie, on the northern boundary of the county, has a moderating effect on climate throughout the county, but the effect lessens as distance from the lake shore increases. Because the valley of the Grand River extends north and south, the effect of the lake is more pronounced than it would be if this valley extended east and west. The effect of the lake is most pronounced in a narrow belt between the lake shore and an escarpment that parallels the shore and is about 4 miles inland.

A summary of temperature and precipitation at Geneva and Dorset is given in table 11. In this table the average monthly highest maximum and lowest minimum temperatures are not actual temperatures recorded during the period of record, but they are temperatures likely to occur in typical years.

Table 12 gives probabilities of selected freezing temperatures or lower than these temperatures occurring at Geneva and Dorset on specified dates. The Geneva station is located about 3 miles southwest of Geneva and is near the top of an escarpment at an elevation of 860 feet. The climatic data at this station are representative of the temperature of the coastal plain. The data at Dorset is representative of the interior of the county.

The data in tables 11 and 12 show that there are two distinct climates in Ashtabula County, but each climate blends gradually into the other as distance from Lake Erie increases. The transition is most abrupt in a zone a few miles wide at the crest of the escarpment between Ashtabula and Jefferson. The effect of Lake Erie is most moderating during the cold periods, and because of this effect, the growing season is lengthened a few days on each end. The warming effect, however, is confined to times when winds blow from a northerly direction. Jefferson is too far from the lake for its temperature to be much affected by the lake. During warm periods, one effect of the lake reverses because water is cooler than land. The combination of lake influence and topographic features produces a large variation in precipitation.

Lake Erie affects the weather primarily by moderating the temperature. The high temperature during the day is lowered in summer, and low temperature is raised in winter when winds are blowing across the warmer water. When winds are from a southerly direction, the lake has no effect on the weather. In the interior of the county, daytime temperatures are higher in summer and night temperatures are 2 to 5 degrees lower than those near the lakeshore. This contrast is most noticeable when comparing climate records for Geneva and Dorset, where instruments are located on level farmland.

Annual precipitation ranges from about 35 inches on the shore line to more than 42 inches at higher elevations along the west-central part of the county. The average is about 37 inches on the coastal strip and is 39 or 40 inches within the valley of the Grand River. This difference in precipitation is caused mostly by a difference in elevation. When moisture-bearing winds are forced to rise over hills, the amount of rainfall or snowfall increases in rough proportion to the distance the moisture rises.

[6] Adapted from unpublished material prepared by DR. L. P. WILDING, Agronomy Department, Ohio State University.

[7] By MARVIN E. MILLER, State climatologist for Ohio, National Weather Service, U.S. Department of Commerce.

TABLE 10.—

[Analyses made at Ohio Research and Development Center, Ohio State University,

Soil sample number location	Depth	Particle-size distribution: Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.05 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)	USDA textural class
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
Allis silt loam:	0–7	2. 8	2. 8	4. 8	9. 0	9. 0	48. 4	23. 2	Silt loam
Laboratory sample AB–112.	7–10	1. 2	3. 6	8. 3	14. 3	9. 2	41. 4	22. 0	Silt loam
Location: T. 13 N., R. 1 W.,	10–14	1. 0	1. 2	2. 4	4. 1	2. 9	52. 2	36. 2	Silty clay loam
3½ miles southwest from the	14–20	. 3	. 6	. 4	. 7	. 8	55. 6	41. 6	Silty clay
center of the city of Con-	20–27	1. 1	1. 6	. 6	1. 0	1. 1	50. 4	44. 2	Silty clay
neaut and 400 yards north-	27–33	6. 3	5. 9	1. 9	2. 3	1. 8	50. 1	31. 7	Silty clay loam
east of the junction of Keefus									
Road and Under Ridge Road.									
Cambridge silt loam:	0–1	. 2	. 9	. 7	4. 2	7. 0	71. 6	15. 4	Silt loam
Laboratory sample AB–35.	3–5	. 2	. 9	. 9	6. 0	9. 4	67. 2	15. 4	Silt loam
Location: T. 10 N., R. 1 W.,	5–8	. 3	. 8	. 8	5. 4	8. 9	70. 4	13. 4	Silt loam
in Richmond township,	8–17	. 3	. 9	. 9	5. 5	8. 6	69. 0	14. 8	Silt loam
about 6 miles northwest of	17–19	. 4	. 9	. 9	5. 5	11. 3	64. 7	16. 3	Silt loam
Andover, 500 yards east of	19–24	1. 5	2. 3	2. 0	11. 1	16. 9	55. 4	13. 0	Silt loam
Pymatuning Lake Road.	24–32	1. 5	3. 0	2. 0	8. 5	8. 8	54. 7	21. 5	Silt loam
	32–48	2. 0	3. 2	2. 8	7. 7	8. 6	53. 4	22. 3	Silt loam
	48–66	1. 9	4. 3	2. 3	9. 5	9. 5	52. 1	20. 4	Silt loam
	66–80	4. 2	4. 6	2. 1	7. 7	7. 4	52. 6	21. 4	Silt loam
Claverack loamy fine sand, silty	0–3	1. 1	2. 4	3. 2	54. 6	8. 8	23. 4	6. 5	Fine sandy loam
subsoil variant:	3–6	1. 0	1. 1	1. 3	62. 8	9. 4	19. 7	4. 7	Loamy fine sand
Laboratory sample AB–108.	6–11	. 3	1. 0	1. 3	67. 2	7. 9	17. 3	5. 0	Loamy fine sand
Location: T. 14 N., T. 1 W.,	11–16	. 3	. 7	1. 3	67. 8	7. 2	16. 7	6. 0	Loamy fine sand
about one-half mile north of	16–24	. 1	. 6	1. 9	70. 1	7. 6	13. 2	6. 5	Loamy fine sand
U.S. Highway No. 20 in city	24–33	. 4	. 6	2. 2	73. 3	5. 1	12. 2	6. 2	Loamy fine sand
of Conneaut.	33–37	1. 3	3. 0	1. 9	6. 1	5. 0	58. 0	24. 7	Silt loam
	37–46	1. 5	3. 2	1. 9	4. 2	5. 1	59. 7	24. 4	Silt loam
	46–54	1. 4	3. 1	1. 9	4. 1	5. 1	61. 0	23. 4	Silt loam
	54–70	1. 5	3. 2	2. 7	4. 2	4. 4	60. 5	23. 5	Silt loam
	[1] 73–83	1. 7	3. 3	1. 9	4. 7	5. 3	58. 4	24. 7	Silt loam
Elnora loamy fine sand, silty sub-	0–4	. 6	1. 5	1. 8	65. 4	9. 6	13. 6	7. 5	Loamy fine sand
soil variant:	4–11	. 6	1. 3	1. 7	65. 0	9. 5	14. 5	7. 4	Loamy fine sand
Laboratory sample AB–109.	11–20	. 1	. 7	. 9	69. 1	8. 2	9. 8	11. 2	Fine sandy loam
Location: T. 14 N., R. 1 W.,	20–26	0	. 1	. 2	79. 7	7. 8	8. 0	4. 2	Fine sand
about 4 miles southwest of	26–33	0	. 1	. 2	78. 2	8. 1	8. 7	4. 7	Loamy fine sand
city of Conneaut, 1½ miles	33–44	0	. 1	. 2	81. 9	8. 2	6. 2	3. 4	Fine sand
west of the intersection of	44–52	. 4	. 5	. 2	71. 2	12. 9	8. 7	6. 1	Loamy fine sand
Salsbury Road and State	52–59	0	. 1	. 3	83. 2	11. 7	1. 5	3. 2	Fine sand
Route 531.	59–64	. 6	. 5	. 2	71. 3	13. 9	3. 3	10. 2	Loamy fine sand
	64–70	4. 1	22. 5	16. 9	43. 7	6. 1	. 2	6. 5	Sand
Frenchtown silt loam:	0–7	2. 8	1. 2	1. 9	4. 9	6. 7	63. 6	18. 9	Silt loam
Laboratory sample AB–34.	7–15	1. 0	1. 7	1. 5	4. 5	5. 7	55. 2	30. 4	Silty clay loam
Location: T. 8 N., R. 1 W.,	15–20	1. 3	2. 9	2. 6	8. 7	9. 5	51. 5	23. 5	Silt loam
in Williamsfield Township,	20–22	2. 4	2. 6	1. 9	6. 3	6. 1	53. 8	26. 9	Silt loam
about 1 mile north and 1½	22–40	3. 8	4. 2	3. 6	11. 0	10. 9	52. 3	14. 4	Silt loam
miles east of Williamsfield	40–60	4. 1	5. 7	4. 1	13. 0	10. 1	48. 3	14. 7	Loam
and about 300 yards west of									
Penn Central Railroad.									
Hornell silt loam:	2–0	2. 7	2. 3	1. 4	3. 1	3. 5	64. 5	22. 5	Silt loam
Laboratory sample AB–119.	0–3	3. 2	2. 5	1. 7	3. 6	3. 4	61. 4	24. 4	Silt loam
Location: T. 12 N., R. 5 W.,	3–7	2. 2	2. 1	1. 3	3. 0	3. 1	55. 4	32. 9	Silty clay loam
in Geneva Township, about	7–15	1. 5	1. 3	. 6	. 9	1. 1	48. 0	46. 6	Silty clay
2½ miles northwest of	15–20	2. 3	2. 2	. 6	. 7	. 7	50. 4	43. 1	Silty clay
Geneva, about one-half mile	20–26	6. 1	6. 1	1. 6	1. 6	1. 2	46. 5	36. 9	Silty clay loam
north of the intersection of									
Padanaram Road and North									
Center Road on east side of									
Padanaram Road.									

See footnotes at end of table.

Laboratory data

Columbus, Ohio. Absence of figure indicates determination was not made]

Moisture held at tensions of—		Bulk density	Reaction	Organic-matter content	Free iron (Fe)	Exchangeable cations				Sum of cations	Base saturation	Ca-Mg ratio	$CaCO_3$ equivalent
⅓-bar	15 bars					Ca	Mg	H	K				
Percent	*Percent*	*gm./cc.*	*pH*	*Percent*	*Percent*	*meq./100 gm.*	*meq./100 gm.*	*meq./100 mg.*	*meq./100 gm.*	*meq./100 gm.*	*Percent*		*Percent*
---	---	---	5. 6	3. 6	---	5. 6	2. 0	11. 2	0. 28	19. 1	42	2. 8	---
---	---	---	5. 3	. 5	---	2. 5	1. 6	6. 8	. 18	11. 1	39	1. 5	---
---	---	---	5. 0	. 4	---	3. 9	3. 0	9. 3	. 22	16. 4	43	1. 3	---
---	---	---	4. 9	---	---	3. 9	3. 9	9. 9	. 23	17. 9	45	1. 0	---
---	---	---	4. 7	---	---	4. 0	4. 5	9. 6	. 23	18. 3	48	. 9	---
---	---	---	4. 7	---	---	3. 3	3. 6	7. 4	. 24	14. 5	49	. 9	---
---	---	---	4. 6	20. 7	---	2. 6	. 7	34. 8	. 34	38. 4	9	---	---
---	---	---	4. 6	6. 8	---	---	---	27. 8	. 10	27. 9	3	---	---
---	---	1. 01	4. 8	5. 8	---	---	---	26. 4	. 02	26. 4	---	---	---
---	---	1. 12	5. 0	2. 5	---	---	---	18. 8	. 02	18. 8	---	---	---
---	---	1. 45	5. 2	---	---	---	---	11. 6	---	11. 6	---	---	---
---	---	---	5. 2	---	---	. 7	. 2	6. 8	. 03	7. 7	12	---	---
---	---	1. 68	6. 6	---	---	---	1. 8	3. 6	. 13	---	---	3. 9	---
---	---	1. 52	7. 8	---	---	---	---	---	---	---	---	---	1. 6
---	---	1. 63	8. 0	---	---	---	---	---	---	---	---	---	5. 5
---	---	---	8. 1	---	---	---	---	---	---	---	---	---	6. 5
---	---	---	4. 0	7. 3	1. 67	. 2	. 2	21. 4	. 29	22. 1	3	---	---
---	---	---	4. 2	4. 0	1. 88	. 2	. 2	15. 5	. 16	16. 1	4	---	---
---	---	---	4. 6	2. 5	1. 73	. 2	. 2	12. 0	. 13	12. 5	4	---	---
---	---	---	4. 9	---	1. 71	. 3	. 2	8. 3	. 15	9. 0	8	---	---
---	---	---	5. 2	---	1. 88	. 7	. 3	3. 2	. 15	4. 4	27	---	---
---	---	---	5. 5	---	1. 69	1. 7	. 6	1. 8	. 09	4. 2	57	---	---
---	---	---	6. 2	---	4. 96	6. 9	2. 2	2. 9	. 12	12. 1	76	3. 1	---
---	---	---	6. 6	---	2. 58	5. 7	2. 0	1. 7	. 18	9. 6	---	2. 8	---
---	---	---	7. 2	---	2. 56	5. 7	1. 9	1. 3	. 17	9. 1	86	3. 0	---
---	---	---	7. 6	---	2. 62	---	---	---	---	---	---	---	2. 0
---	---	---	7. 3	---	. 42	---	---	---	---	---	---	---	5. 4
20. 4	4. 1	1. 27	4. 6	1. 5	. 90	. 2	. 2	6. 2	. 22	6. 8	9	---	---
16. 7	3. 7	1. 31	4. 4	1. 1	. 96	. 2	. 2	5. 6	. 15	6. 2	10	---	---
12. 9	4. 6	1. 34	4. 3	. 1	1. 56	. 2	. 2	3. 7	. 12	4. 2	12	---	---
10. 9	2. 3	1. 38	4. 8	---	. 88	. 4	. 3	1. 9	. 11	2. 7	30	---	---
11. 1	2. 2	1. 39	5. 0	---	. 86	. 5	. 3	1. 7	. 13	2. 6	35	---	---
13. 9	2. 2	1. 47	4. 7	---	. 74	. 2	. 2	2. 2	. 13	2. 7	19	---	---
---	---	---	4. 8	---	1. 84	. 8	. 3	3. 0	. 21	4. 3	30	---	---
---	---	---	5. 2	---	1. 04	. 9	. 4	1. 3	. 26	2. 9	55	---	---
---	---	---	5. 1	---	2. 00	2. 0	. 6	3. 4	. 22	6. 2	45	---	---
---	---	---	5. 4	---	1. 10	1. 5	. 6	1. 9	. 13	4. 1	54	---	---
---	---	---	4. 7	5. 9	---	1. 7	. 3	19. 2	. 32	21. 5	11	---	---
---	---	---	5. 0	. 5	---	4. 1	1. 3	13. 2	. 28	---	---	3. 1	---
---	---	---	6. 2	. 3	---	8. 4	3. 1	4. 1	. 20	---	---	2. 7	---
---	---	---	7. 3	. 3	---	13. 0	4. 2	2. 0	. 22	---	---	3. 1	---
---	---	---	7. 5	. 3	---	6. 5	1. 8	1. 6	. 09	---	---	3. 6	1. 5
---	---	---	7. 9	---	---	---	---	---	---	---	---	---	5. 4
---	---	---	3. 9	15. 6	---	3. 8	2. 3	37. 7	. 51	---	---	1. 6	---
---	---	---	3. 9	14. 6	---	2. 0	1. 1	35. 3	. 40	---	---	1. 8	---
---	---	---	4. 1	2. 1	---	. 3	. 6	21. 0	. 20	22. 1	5	---	---
---	---	---	4. 2	1. 0	---	. 3	. 6	20. 6	. 23	21. 7	5	---	---
---	---	---	4. 2	. 5	---	. 3	. 7	18. 8	. 23	20. 0	6	---	---
---	---	---	4. 2	---	---	. 4	. 8	15. 5	. 26	17. 0	9	---	---

TABLE 10.—

Soil sample number location	Depth	Particle-size distribution							USDA textural class
		Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.05 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)	
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
Kingsville fine sandy loam:	0–5	0. 3	0. 8	4. 5	52. 2	13. 1	23. 5	5. 6	Fine sandy loam
Laboratory sample AB–115.	5–8	. 2	. 7	3. 8	57. 6	7. 2	22. 8	7. 7	Fine sandy loam
Location: T. 14 N., R. 1 W.,	8–10	. 2	1. 1	4. 3	64. 1	5. 8	19. 6	4. 9	Loamy fine sand
1½ miles east of city of	10–14	. 1	. 7	4. 4	79. 8	6. 2	6. 3	2. 5	Fine sand
Conneaut.	14–17	. 6	1. 8	4. 3	77. 2	6. 2	6. 3	3. 6	Fine sand
	17–20	13. 9	13. 6	11. 0	44. 4	5. 1	9. 4	2. 6	Sand
	20–28	3. 2	6. 1	11. 6	74. 4	2. 2	1. 7	. 8	Fine sand
	28–39	6. 7	14. 6	17. 1	57. 4	2. 3	1. 4	. 5	Fine sand
	39–50	. 5	1. 1	3. 7	91. 2	2. 9	. 1	. 5	Fine sand
Otisville gravelly loam:	0–1	19. 0	18. 3	8. 1	18. 0	9. 0	21. 6	6. 0	Coarse sandy loam
Laboratory sample AB–111.	1–6	29. 5	17. 5	5. 0	7. 1	7. 1	24. 5	9. 3	Coarse sandy loam
Location: T. 13 N., R. 2 W.,	6–12	37. 0	20. 1	4. 7	5. 2	4. 4	19. 8	8. 9	Coarse sandy loam
in Kingsville Township,	12–18	45. 7	34. 2	4. 4	2. 8	1. 9	5. 1	5. 9	Loamy coarse sand
about 4½ miles southwest	18–27	54. 5	37. 2	2. 1	1. 3	. 1	0	4. 8	Coarse sand
of Conneaut, ⅝ mile north	27–37	64. 0	27. 8	1. 8	1. 3	. 7	. 4	4. 0	Coarse sand
of intersection of U.S.	37–60	28. 5	33. 2	17. 5	10. 7	2. 7	3. 6	3. 8	Coarse sand
Highway No. 20 and Poor									
Road.									
Platea silt loam:	0–½	. 4	1. 3	1. 3	7. 8	8. 5	65. 9	14. 8	Silt loam
Laboratory sample AB–39.	½–2½	2. 1	1. 2	1. 2	5. 7	6. 6	62. 9	20. 5	Silt loam
Location; T. 11 N., R. 3 W., in	2½–13	1. 2	2. 0	1. 7	9. 2	9. 9	54. 4	21. 6	Silt loam
Jefferson Township, about	13–21	2. 1	3. 0	1. 8	8. 5	7. 8	47. 3	29. 5	Clay loam
3 miles north and 1 mile	21–44	2. 2	3. 5	1. 8	8. 4	7. 6	51. 5	25. 0	Silt loam
west of Jefferson.	44–60	2. 5	3. 4	2. 1	8. 9	6. 6	51. 8	24. 7	Silt loam
	60–90	1. 9	3. 2	2. 0	8. 6	7. 8	55. 3	21. 2	Silt loam
Sheffield silt loam:	0–8	3. 0	2. 3	1. 3	5. 8	6. 4	60. 0	21. 2	Silt loam
Laboratory sample AB–37.	8–18	2. 0	1. 7	1. 0	4. 2	5. 3	58. 2	27. 6	Silty clay loam
Location: T. 11 N , R. 3 W.,	18–22	1. 5	1. 9	1. 4	7. 8	9. 1	58. 8	19. 5	Silt loam
in Jefferson Township about	22–26	2. 6	3. 0	1. 8	6. 6	6. 2	54. 4	25. 4	Silt loam
1½ miles east of Jefferson,	26–41	2. 6	3. 4	1. 9	7. 7	6. 8	55. 5	22. 1	Silt loam
320 yards south of State	41–60	2. 4	3. 0	1. 5	6. 7	6. 2	54. 2	26. 0	Silt loam
Route 167 on west side of	[1] 60–84	8. 7	6. 4	2. 1	5. 9	5. 9	56. 9	14. 1	Silt loam
Black Sea Road.	[1] 84–96	7. 4	6. 0	2. 4	8. 3	8. 4	58. 8	8. 7	Silt loam
Swanton fine sandy loam:	0–4	. 8	6. 8	5. 8	36. 8	17. 8	23. 0	9. 0	Fine sandy loam
Laboratory sample AB–114.	4–6	. 1	. 6	. 3	41. 1	14. 1	23. 6	20. 2	Sandy clay loam
Location: T. 14 N., R. 1 W.,	6–11	0	. 5	. 4	49. 4	12. 7	18. 1	18. 9	Fine sandy loam
in city of Conneaut, about	11–16	0	. 1	. 1	53. 1	18. 1	13. 7	14. 9	Fine sandy loam
2 miles northeast of the	16–21	0	. 3	. 2	55. 1	20. 0	14. 0	10. 4	Fine sandy loam
center of the city and one-half mile north of U.S.	21–27	7. 4	8. 3	3. 6	53. 4	9. 5	11. 2	6. 6	Loamy fine sand
Highway 20 on State Line	27–36	2. 6	5. 2	3. 3	7. 0	6. 2	60. 5	15. 2	Silt loam
Road.	36–45	2. 7	4. 8	3. 0	6. 1	6. 2	60. 8	16. 4	Silt loam
	45–54	3. 2	4. 6	2. 8	7. 4	6. 5	58. 1	17. 4	Silt loam
	54–58	2. 9	4. 7	2. 8	5. 6	5. 5	61. 2	17. 3	Silt loam
	58–62	4. 0	5. 6	3. 2	6. 3	5. 6	59. 1	16. 2	Silt loam
Venango silt loam:[2]	0–7	1. 6	2. 8	4. 5	3. 2	9. 5	59. 0	19. 4	Silt loam
Laboratory sample AB–S11.	7–10	1. 7	2. 9	3. 1	4. 3	8. 8	61. 0	18. 2	Silt loam
Location: T. 9 N., R. 1 W.,	10–13	3. 7	5. 0	4. 4	6. 8	12. 0	54. 1	14. 0	Silt loam
in Andover Township,	13–17	2. 7	4. 8	4. 8	6. 5	12. 0	50. 4	18. 8	Silt loam
about 2½ miles southeast of	17–22	2. 7	3. 8	3. 8	5. 4	11. 2	47. 1	26. 0	Loam
Andover and one-half mile	22–32	4. 1	4. 7	4. 7	6. 1	11. 1	46. 7	22. 6	Loam
northeast of the Pymatuning	32–41	4. 5	5. 5	4. 8	6. 1	10. 7	47. 6	20. 8	Loam
Lake Road and Marvin	41–48	4. 9	5. 8	5. 1	6. 6	11. 1	48. 0	18. 3	Loam
Road.	48–75	4. 0	6. 1	6. 2	8. 0	12. 4	46. 5	16. 8	Loam
	75–87	2. 6	3. 3	3. 3	6. 0	11. 7	57. 2	15. 9	Silt loam
	95–99	1. 3	2. 5	8. 2	28. 0	21. 8	26. 0	12. 2	Sandy loam

[1] Layer sampled but not described for representative profile.
[2] Data for this profile of Venango silt loam was obtained in 1960. The representative profile described in the section "Descriptions

Laboratory data—Continued

Moisture held at tensions of—		Bulk density	Reaction	Organic-matter content	Free iron (Fe)	Exchangeable cations				Sum of cations	Base saturation	Ca-Mg ratio	$CaCO_3$ equivalent
⅓-bar	15 bar					Ca	Mg	H	K				
Percent	*Percent*	*gm./cc.*	*pH*	*Percent*	*Percent*	*meq./100 gm.*	*meq./100 gm.*	*meq./100 mg.*	*meq./100 gm.*	*meq./100 gm.*	*Percent*		*Percent*
			5. 2	7. 2		06. 0	1. 8	11. 1	0. 26			3. 3	
			5. 0	2. 9		3. 2	1. 3	7. 8	. 15			2. 4	
			5. 0	1. 0		1. 3	. 5	3. 4	. 09	5. 3	36		
			5. 2	. 3		1. 2	. 6	2. 0	. 08	3. 9	49		
			5. 3			1. 7	. 7	1. 8	. 08	4. 3	58		
			5. 8			2. 3	. 8	1. 4	. 10	4. 6	70		
			5. 7			1. 3	. 6	. 9	. 10	2. 9	69		
			5. 8			1. 5	. 4	. 4	. 10	2. 4	83		
			5. 8			1. 1	. 6	. 2	. 10	2. 0	90		
			4. 2	8. 5	1. 34	. 3	. 3	14. 9	. 22	15. 7	5		
			4. 4	1. 2	1. 54	. 2	. 1	7. 5	. 13	7. 0	5		
			4. 4	. 1	1. 54	. 2	. 2	5. 4	. 15	6. 0	10		
			4. 7		1. 38	. 7	. 3	3. 8	. 15	5. 0	24		
			4. 9		1. 34	. 9	. 3	2. 6	. 12	3. 9	33		
			5. 3		1. 16	1. 1	. 4	2. 6	. 10	4. 2	38		
			5. 1		1. 30	1. 1	. 4	2. 4	. 11	4. 0	40		
			4. 9	8. 7									
			5. 4	11. 0		7. 0	. 9	17. 6	. 37	25. 9	32		
		1. 49	5. 2	1. 2		7. 1	. 1	10. 4	. 08	11. 7	11		
		1. 64	5. 0	. 5		1. 4	. 4	10. 4	. 13	12. 3	15		
		1. 75	6. 8	. 4		6. 9	2. 1	2. 9	. 13			3. 3	
		1. 80	8. 0										6. 3
			8. 0										6. 5
		1. 02	4. 6	4. 4		. 5		18. 8	. 20	19. 5	4		
		1. 41	5. 0			1. 7	. 3	10. 8	. 11	12. 9	16		
		1. 45	5. 2			2. 2	. 6	6. 4	. 09	9. 3	31		
		1. 60	5. 7			7. 9	2. 4	5. 1	. 19			3. 2	
		1. 66	6. 9			8. 4	2. 3	2. 4	. 13			3. 6	
		1. 75	8. 0										6. 2
			8. 1										3. 0
			7. 9										3. 6
			4. 2	15. 8		2. 9	. 7	33. 5	. 46	37. 6	11		
			4. 2	3. 6		2. 0	. 5	17. 2	. 17	19. 9	14		
			4. 3	. 7		1. 3	. 4	8. 2	. 14	10. 0	18		
			4. 4	. 3		1. 3	. 4	6. 0	. 10	7. 8	23		
			4. 6			1. 8	. 5	4. 0	. 08	6. 4	38		
			5. 4			3. 2	1. 0	1. 8	. 06			3. 2	
			6. 2			5. 2	2. 0	2. 6	. 11			2. 6	
			6. 5			5. 4	2. 1	2. 2	. 13			2. 6	
			6. 5			4. 8	2. 0	1. 8	. 12			2. 4	
			5. 3			7. 3	1. 9	1. 8	. 15			3. 8	
			7. 2										3. 8
34. 3	13. 2	1. 22	4. 3	5. 4		1. 4	. 4	18. 8	. 26	20. 9	10		
			4. 6	1. 9		1. 8	. 4	14. 6	. 16	17. 0	14		
			4. 9	. 6		2. 3	. 3	6. 0	. 11	8. 7	31		
28. 8	11. 9	1. 61	5. 1	. 6				8. 1	. 14				
28. 7	16. 3	1. 65	4. 8			3. 5	. 8	8. 7	. 16				
25. 5	14. 2	1. 69	4. 6			2. 4	1. 0	8. 6	. 13			2. 4	
25. 0	15. 2	1. 75	4. 7					7. 1	. 13				
25. 5	14. 2	1. 77	5. 3					4. 2	. 09				
			6. 5			5. 1	1. 6	2. 3	. 06			2. 9	
			7. 8										2. 7
			8. 0										3. 9

of the Soils" was observed in 1966 in the immediate vicinity of this profile. Thus, there are discrepancies in the depths given in this table and those given for the representative profile.

TABLE 11.—*Temperature and precipitation*

AT GENEVA [1] (ELEVATION 860)

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average monthly highest maximum	Temperature: Average monthly lowest minimum	Precipitation: Average monthly total	Precipitation: One year in 10 will have— Less than—	Precipitation: One year in 10 will have— More than—	Precipitation: Average monthly snowfall	Precipitation: Average number of days with 1.0 inch or more of snow
	° F.	° F.	° F.	° F.	Inches	Inches	Inches	Inches	
January	35	20	55	0	2. 73	1. 07	4. 74	16. 2	6
February	36	20	57	1	2. 32	1. 15	3. 68	10. 7	5
March	44	27	68	10	3. 07	1. 51	4. 88	10. 3	4
April	57	37	78	22	3. 91	2. 06	6. 03	2. 3	1
May	68	47	83	33	3. 88	1. 81	6. 30	0	0
June	76	57	89	42	3. 66	1. 98	5. 58	0	0
July	80	61	89	49	3. 14	1. 55	4. 98	0	0
August	79	60	89	48	3. 45	1. 47	5. 79	0	0
September	73	54	88	38	3. 11	1. 38	5. 18	0	0
October	64	45	80	32	3. 16	. 80	6. 18	. 8	0
November	50	34	71	17	3. 73	2. 37	5. 24	11. 0	3
December	37	24	58	6	2. 91	1. 87	4. 06	21. 0	7
Year	58	40	[2] 91	[2] −2	39. 07	[3] 32. 01	[3] 46. 62	72. 3	26

AT DORSET [4] (ELEVATION 970)

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average monthly highest maximum	Temperature: Average monthly lowest minimum	Precipitation: Average monthly total	Precipitation: One year in 10 will have— Less than—	Precipitation: One year in 10 will have— More than—	Precipitation: Average monthly snowfall	Precipitation: Average number of days with 1.0 inch or more of snow
January	30	14	52	−9	2. 79	1. 00	4. 98	16. 5	5
February	33	15	55	−4	2. 25	. 94	3. 81	11. 7	6
March	41	24	67	6	2. 62	1. 22	4. 26	12. 0	5
April	55	35	78	17	3. 59	1. 82	5. 64	4. 5	2
May	68	45	84	28	2. 99	1. 89	4. 21	0	0
June	76	53	88	36	4. 00	1. 94	6. 39	0	0
July	81	57	90	43	3. 57	2. 47	4. 77	0	0
August	79	56	88	43	3. 50	. 92	6. 76	0	0
September	74	50	88	33	3. 25	1. 86	4. 82	0	0
October	62	39	78	25	3. 10	1. 08	5. 58	. 9	0
November	49	31	68	16	3. 82	2. 15	5. 71	7. 5	2
December	34	19	59	−3	2. 56	1. 39	3. 88	17. 7	7
Year	57	36	[2] 91	[2] −12	[3] 38. 04	[3] 29. 96	[3] 46. 67	70. 8	27

[1] Period of record 1944–66.
[2] Based on records of extremes for year. Extremes may occur in months other than January and July.
[3] Probabilities based on annual totals, not sum of all monthly values.
[4] Period of record 1957–66.

The most spectacular effect of Lake Erie on precipitation is seen in winter snowfall. Most of Ashtabula County is in the snow belt of Ohio. Air masses passing over the open water of Lake Erie pick up both moisture and heat. Then as the air is forced to rise over the ridge that parallels the lake, the excess moisture falls in the form of snow. The instability of the warmed air creates turbulence, which produces heavy snow squalls. Many of these squalls extend over the interior of the county, though elevation is higher than near the lake. On the average, however, annual snowfall in the interior valley is about 30 inches less than that along the crest of the ridge in the west-central part of the county. The county as a whole receives more than twice as much snow as the State does.

Soil moisture goes through a seasonal cycle each year that is almost independent of the amount of precipitation the soil receives. After soil moisture has fallen to its lowest content early in October, the moisture supply is gradually replenished during the cold season, when the water received exceeds that lost by evaporation. By the end of March, soil moisture is restored to or is more than field capacity and ground water reserves are increased. After the end of March and through the growing season, the level of soil moisture depends on the balance between the water received from rainfall and that lost by evaporation and transportation.

In fields of small grains and other cultivated crops and in meadows and pastures, the amount of water used by plants increases rapidly in April and May. As a result, available moisture may be almost depleted by the end of June if spring rainfall is seriously deficient. Fields of row crops that are planted in spring lose comparatively little water until the latter part of June, when these plants start to grow rapidly. Since water needs of all crops reach a maximum in July and August, and rainfall is almost always insufficient to meet those needs, there is a progressive drying of all soils. Available moisture generally reaches its lowest point about the end of September. This is the end of the annual moisture cycle, which starts over again in October.

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

GENEVA

Probability	Dates for given probability and temperature				
	16 ° F. or lower	20 ° F. or lower	24 ° F. or lower	28 ° F. or lower	32 ° F. or lower
Spring:					
1 year in 10 later than	April 2	April 8	April 17	April 28	May 13
2 years in 10 later than	March 28	April 3	April 12	April 24	May 9
5 years in 10 later than	March 15	March 24	April 2	April 16	April 30
Fall:					
1 year in 10 earlier than	November 19	November 14	November 6	October 31	October 16
2 years in 10 earlier than	November 23	November 18	November 10	November 3	October 20
5 years in 10 earlier than	December 3	November 27	November 20	November 11	October 30

DORSET

Probability	16 ° F. or lower	20 ° F. or lower	24 ° F. or lower	28 ° F. or lower	32 ° F. or lower
Spring:					
1 year in 10 later than	April 11	April 10	April 28	May 15	June 4
2 years in 10 later than	April 7	April 8	April 24	May 10	May 30
5 years in 10 later than	March 29	April 2	April 12	April 29	May 19
Fall:					
1 year in 10 earlier than	November 10	November 4	October 22	October 5	September 13
2 years in 10 earlier than	November 15	November 9	October 28	October 11	September 18
5 years in 10 earlier than	November 28	November 20	November 10	October 25	September 29

Except during the coldest weather in winter, when the soils are bare, the temperature in the topsoil generally does not fall much below freezing, though it may be completely frozen. At a depth of 4 inches, temperatures below 20° F. are very unusual, even in the coldest weather. When snow lies on the ground, its insulating properties cause soil temperatures underneath to rise because of the upward transfer of heat. Frost ordinarily does not penetrate to a depth of more than 10 to 15 inches, and in milder winters it may not penetrate to 8 inches. Although frost may have penetrated to a depth of 2 feet, a spell of mild weather that lasts 10 days or 2 weeks is sufficient to thaw the ground completely. During March and April the topsoil warms up practically as fast as the air itself, though there may be a lag of 1 day at a depth of 4 inches, and a lag of 3 days at a depth of 12 inches. Because of this rapid warming of the topsoil, spring planting is not delayed unless excess water is in the cold soil.

In an average year, 90 days are clear, 118 are partly cloudy, and 157 are cloudy. The proportion of clear days is higher in summer than in winter, which is dominantly cloudy. The strongest winds come in winter and average 12 miles per hour. Average velocity is about 8 miles per hour in summer. Most frequently winds are from the south in summer. Thunderstorms occur about 33 times a year, mostly in summer. Each day the relative humidity fluctuates with the temperature, but in the opposite direction. When it rains, snows, or is foggy, relative humidity is more than 90 percent, but on hot summer days, it may drop to 20 percent or below, especially when winds are southerly. Tornadoes may be expected to strike somewhere in the county about once in 5 years, though they are less severe than those in the States to the west and south.

Transportation and Other Development

Ashtabula County is made up of both rural and urban-fringe areas that have modern transportation and communication systems. Electricity and telephones are available to both rural and urban areas. A network of State and Federal highways link all parts of the county with adjoining areas. Insterstate Highway No. 90 crosses the northern part of the county and links the county with major farm and commercial markets to the east and west. State Routes 11 and 7 provide access to southern markets. The lake ports of Ashtabula and Conneaut link the county with other lake ports and with seaports. These ports link with both foreign and domestic markets. Railroads also link the county with major eastern and midwestern markets and with southern markets.

The population of the county is densest in the four northern townships. Plymouth and Jefferson Townships have large urban and rural nonfarm populations. The rural nonfarm population is increasing, especially in the northwestern part of the county. The farming population is concentrated in the southeastern and south-central parts of the county.

Major industries are concentrated around the cities of the lake plain, though small industries operate in all of the towns and villages. Schools and churches are located in each of the townships, and the rural townships have consolidated school districts. The major hospital is in the city of Ashtabula.

Recreational facilities are scattered throughout the county. Pymatuning State Park is the major recreational area.

Physiography, Geology, Relief, and Drainage

Two physiographic provinces occur in Ashtabula County (*4*). The lake plain, not more than 5 miles wide, is in the northern part of the county in the Eastern Lake section of the Central Lowlands Province of the United States. The rest of the county lies in the glaciated part of the Appalachian Plateau Province. The Portage Escarpment separates these two provinces (*13*).

The bedrock underlying the soils of Ashtabula County is dominantly shale and sandstone of the Devonian and Mississippian systems. Most of the county is underlain by shale of the Ohio formation. Outcrops of bedrock generally are on escarpments along the streams. In a few soils, a part of the solum formed from residuum of bedrock or has been influenced by the bedrock. A part of the solum of the Allis and Hornell soils on the lake plain formed from weathered shale. The Claverack and Swanton soils that have a shale substratum have also had part of their subsoil formed in shale. The lower part of the solum was influenced by the underlying shale in the Mahoning soils that have a shale substratum. The Venango soils and the Cambridge soil that has a sandstone substratum are in Windsor and Hartsgrove Townships and in the southern part of Trumbull Township. They have had a part of their solum influenced by the Berea sandstone.

All of the surficial glacial deposits of Ashtabula County are of Wisconsin Age. Kent till (*6*, *19*) lies in the southeastern corner of the county and is of early Cary age. It is the oldest till in the county. Kent till is in about the same areas as the Venango-Frenchtown-Cambridge soil association. The valley of Pymatuning Creek is adjacent to Kent till and contains glacial outwash (*6*) that has an areal extent similar to that of the Chenango-Red Hook-Atherton soil association. The Defiance moraine lies across the southeastern corner of the county along the southeastern boundary of the Platea-Sheffield soil association. The Portage Escarpment moraine (*7*) roughly parallels the Lake Erie shore line and is 5 to 6 miles inland. The Platea-Pierpont soil association is roughly in the eastern half of this moraine. The glacial drift between the Portage Escarpment moraine and Defiance moraine is called Hiram till (*19*). All of the Sheffield-Platea soil association and a major part of the Platea-Sheffield soil association occur within the Hiram till area. The most extensive lacustrine deposits occur in the valley of the Grand River, and a few deposits are on the plateau. These deposits are roughly in the same areas as the Canadice-Caneadea soil association.

The lake plain north of the Portage Escarpment moraine consists of wave-washed till, glacial beach deposits, and lacustrine deposits. The major beach deposits of glacial lakes Warren and Whittlesey (*19*) correspond to the areas of the Otisville-Chenango and Elnora-Colonie-Kingsville soil associations. The Conneaut-Swanton-Claverack soil association contains Ashtabula till (*19*) and lacustrine and beach deposits of the higher stages of what is now Lake Erie.

A major part of the county is level or gently undulating. Steep areas are along the streams. The two morainic areas and the Venango-Frenchtown-Cambridge soil association are more rolling than the rest of the county. Elevation above sea level ranges from 573 feet at the Lake Erie shore line to slightly over 1,180 feet at Owens Hill in Andover Township. The dominant elevation mostly ranges from 950 to 1,100 feet in the plateau region.

Roughly the southeast one-quarter of the county drains into the Ohio River through Mosquito Creek, Pymatuning Creek, and the tributaries of the Shenango River. Major streams in the county that flow into Lake Erie include Conneaut Creek, the Ashtabula River, and the Grand River.

Farming

In 1964, according to the U.S. Census of Agriculture, the land in farms in Ashtabula County was 214, 424 acres, or 47.5 percent of the total land. This acreage is almost 12 percent less than the acreage in farms in 1959. From 1959 to 1964, the total number of farms has decreased from 2,295 to 1,737, but the acreage per farm increased from 105.9 to 123.4 acres.

The Conservation Needs Inventory in 1967, sponsored by State and Federal agencies, indicates that of the total rural land, 36 percent was cropland, 6 percent pasture, 30 percent woodland, and 28 percent other rural uses. Since the climate and soils of the county are more favorable for meadow crops than for grain crops, cash-grain farmers are few. The main crop is hay, though oats, corn, and wheat also are grown. Dairying is the major source of farm income, and poultry is second. Raising poultry and sheep is adapted to part-time farming. Part-time farming is increasing as urban-fringe development continues, especially in the northern half of the county, and brings about changes in the economic structure of the area. On the lake plain, where urban-fringe development has practically eliminated general farms, fruit and truck farms, and nurseries are prevalent, especially on the sandy and gravelly soils that are well adapted to these kind of farms.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage. See Natural soil drainage.

Eluviation. The movement of material from one place to another within the soil, in either true solution or collodial suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur in the lower part of the subsoil, 15 to 40 inches below the surface.

Glacial drift. Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial outwash. Cross-bedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

Glacial till. Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders that were transported and deposited by glacial ice.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit. Material deposited in lake water and exposed by lowering of the water level or elevation of the land..

Microclimate. Local climatic conditions, brought about by the changes in the general climate resulting from local differences in elevation and exposure.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation of partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a 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 have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower part of the A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil series or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline.	9.1 and higher

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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